EXHIBIT 1002

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	10/11/2022	11470138	9401-00254	3720

70560 7590 09/21/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

DAVID F. BRUECK, SARATOGA SPRINGS, UT;
MARK B. HURST, CEDAR HILLS, UT;
R. DREW MAJOR, OREM, UT;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

DISH Technologies L.L.C., Englewood, CO

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

70560 7590 09/14/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

EXAMINER	
PATEL, CHIRAG R	

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
09/14/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@kwlaw.co
ipdept@dish.com
uspto@dockettrak.com

Corrected ***Notice of Allowability***	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the printer rush on September 6, 2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 11/17/20.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.
PE2E Search	12/15/2021	C.P.
Google Patents / Scholar	12/15/2021	C.P.
Reviewed the Carmel '473 patent	01/25/2022	C.P.

Webgroup CZ a.s. Ex. 1002, Page 5 of 1406

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H04N	H04N21/2662, H04N21/8456,	05/13/2022	C.P.
H04L	H04L65/607,H04L65/608, H04L67/02	05/13/2022	C.P.

Webgroup CZ a.s. Ex. 1002, Page 6 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	70	F	2022-05-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
H04L	/	65	/	80	I	2013-01-01
H04L	/	65	/	61	I	2022-05-01
H04L	/	65	/	65	I	2022-05-01
H04L	/	65	/	1101	I	2022-05-01
H04L	/	67	/	60	I	2022-05-01
H04L	/	67	/	568	I	2022-05-01
H04L	/	67	/	02	I	2013-01-01
H04L	/	65	/	1069	I	2013-01-01
H04N	/	21	/	2662	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	12 September 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220912

Webgroup CZ a.s. Ex. 1002, Page 7 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	12 September 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220912

Webgroup CZ a.s. Ex. 1002, Page 8 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22										
	5		14		23										
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	12 September 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220912

Webgroup CZ a.s. Ex. 1002, Page 9 of 1406

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021	12/15/2021	01/25/2022	03/04/2022	05/13/2022	09/12/2022		
	1	✓	=	=	=	=	=	=		
	2	✓	=	=	=	=	=	=		
	3	✓	=	=	=	=	=	=		
	4	✓	=	=	=	=	=	=		
	5	✓	=	=	=	=	=	=		
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	27	✓	=	=	=	=	=	=		
	28	✓	=	=	=	=	=	=		
	29	✓	=	=	=	=	=	=		
	30	✓	=	=	=	=	=	=		

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ Examiner's Signature | Initials

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	9401-00254
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

KW LAW LLP (Dish Technologies L.L.C.)

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UNITED STATES

FILING FEE RECEIVED

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Patel, Chirag R.
Attorney Docket Number	066.0141X1C9

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7577750	B2	2009-08-18	Shen et al.	
	2	6195680	B1	2001-02-27	Goldszmidt et al.	
	3	6449719	B1	2002-09-10	Baker	
	4	7369610	B2	2008-05-06	Xu et al.	
	5	7408984	B2	2008-08-05	Lu et al.	
	6	7523181	B2	2009-04-21	Swildens et al.	
	7	6976090	B2	2005-12-13	Ben-Shaul et al.	
	8	7240100	B1	2007-07-03	Wein et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	9	6850965	B2	2005-02-01	Allen	
	10	7334044	B1	2008-02-19	Allen	
	11	7760801	B2	2010-07-20	Ghanbari et al.	
	12	7099954	B2	2006-08-29	Li et al.	
	13	6760772	B2	2004-07-06	Zou et al.	
	14	7054911	B1	2006-05-30	Lango et al.	
	15	7797439	B2	2010-09-14	Cherkasova et al.	
	16	7477688	B1	2009-01-13	Zhang et al.	
	17	7054774	B2	2006-05-30	Batterberry et al.	
	18	5168356		1992-12-01	Acampora et al.	
	19	7818444	B2	2010-10-19	Brueck et al.	

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	20	7599307	B2	2009-10-06	Seckni et al.	
	21	7093001	B2	2006-08-15	Yang et al.	
	22	6874015	B2	2005-03-29	Kaminsky et al.	
	23	6845107	B1	2005-01-18	Kitazawa et al.	
	24	6185736	B1	2001-02-06	Ueno	
	25	5768527 ~~5768527~~		1998-06-16	Zhu et al.	
	26	7274740	B2	2007-09-25	van Beek et al.	
	27	7546355	B2	2009-06-09	Kalnitsky	
	28	7174385	B2	2007-02-06	Li	
	29	7376747	B2	2008-05-20	Hartop	
	30	7719985	B2	2010-05-18	Lee et al.	

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	Attorney Docket Number	066.0141X1C9

	31	7349358	B2	2008-03-25	Hennessey et al.	
	32	7194549	B1	2007-03-20	Lee et al.	
	33	6374289	B2	2002-04-16	Delaney et al.	
	34	7325073	B2	2008-01-29	Shao et al.	
	35	7609652	B2	2009-10-27	Kellerer et al.	
	36	6795863	B1	2004-09-21	Doty, Jr.	
	37	7817985	B2	2010-10-19	Moon	
	38	7788395	B2	2010-08-31	Bowra et al.	
	39	7536469	B2	2009-05-19	Chou et al.	
	40	7412531	B2	2008-08-12	Lango et al.	
	41	7295520	B2	2007-11-13	Lee et al.	

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	42	7054365	B2	2006-05-30	Kim et al.	
	43	6122660		2000-09-19	Baransky et al.	
	44	7391717	B2	2008-06-24	Kiemets et al.	
	45	7260640	B1	2007-08-21	Kramer et al.	
	46	7310678	B2	2007-12-18	Gunaseelan et al.	
	47	6618752	B1	2003-09-09	Moore et al.	
	48	6721723	B1	2004-04-13	Gibson et al.	
	49	6859839	B1	2005-02-22	Zahorjan et al.	
	50	7779135	B2	2010-08-17	Hudson et al.	
	51	7593333	B2	2009-09-22	Li et al.	
	52	5953506		1999-09-14	Kalra et al.	

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	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	53	6091775		2000-07-18	Hibi et al.	
	54	6091777		2000-07-18	Guetz et al.	
	55	6195680		2001-02-27	Goldszmidt et al.	
	56	6366614		2002-04-02	Pian et al.	
	57	6389473		2002-05-14	Carmel et al.	
	58	6486803	B1	2002-11-26	Luby et al.	
	59	6490627		2002-12-03	Kalra et al.	
	60	6510553		2003-01-21	Hazra	
	61	6574591		2003-06-03	Kleiman et al.	
	62	6604118		2003-08-05	Klleiman et al.	
	63	6731600		2004-05-04	Patel et al.	

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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	64	5732183		2004-05-04	Graham	
	65	6968387		2005-11-22	Lanphear	
	66	7075986		2006-07-11	Girod et al.	
	67	7096271		2006-08-22	Omoigui et al.	
	68	7349976		2008-03-25	Glaser et al.	
	69	7408984	B2	2008-08-05	Lu et al.	
	70	4535355		1985-08-13	Arn et al.	
	71	8036265	B1	2011-10-11	Reynolds et al.	
	72	5687095		1997-11-11	Haskell et al.	
	73	7116894	B1	2006-10-03	Chatterton	
	74	7328243	B2	2008-02-05	Yaeger et al.	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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	Attorney Docket Number	066.0141X1C9

	75	7330908	B2	2008-02-12	Jungek	
	76	7653735	B2	2010-01-26	Mandato et al.	
	77	8612624	B2	2013-12-17	Brueck et al.	
	78	8868772	B2	2014-10-21	Major et al.	
	79	8402156	B2	2013-03-19	Brueck et al.	
	80	8370514	B2	2013-02-05	Hurst et al.	
	81	8880721	B2	2014-11-04	Hurst et al.	

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	1	20020161898	A1	2002-10-31	Hartop et al.	
	2	20050055425		2005-03-00	Lango et al.	

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	3	20050015509		2005-01-00	Sitaraman	
	4	20020131496		2002-09-00	Vasudevan et al.	
	5	20040083283	A1	2004-04-29	Sundaram et al.	
	6	20080219151	A1	2008-09-11	Ma et al.	
	7	20020152318	A1	2002-10-17	Menon et al.	
	8	20060080718	A1	2006-04-13	Gray et al.	
	9	20050120107	A1	2005-06-02	Kagan et al.	
	10	20040103444	A1	2004-05-27	Weinberg et al.	
	11	20050188051	A1	2005-08-25	Sneh	
	12	20030154239	A1	2003-08-14	Davis et al.	
	13	20040030547	A1	2004-02-12	Leaning et al.	

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	14	20040117427	A1	2004-06-17	Allen et al.	
	15	20030014684	A1	2003-01-16	Kashyap	
	16	20060206246	A1	2006-09-14	Walker	
	17	20050076136	A1	2005-04-07	Cho et al.	
	18	20030018966	A1	2003-01-23	Cook et al.	
	19	20040030599	A1	2004-02-12	Sie et al.	
	20	20050262257	A1	2005-11-24	Major et al.	
	21	20050033855	A1	2005-02-10	Moradi et al.	
	22	20010047423	A1	2001-11-29	Shao et al.	
	23	20030140159	A1	2003-07-24	Campbell et al.	
	24	20020176418	A1	2002-11-28	Hunt et al.	

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	25	20020169926	A1	2002-11-14	Pinckney, III, et al.	
	26	20020178330	A1	2002-11-28	Schlowsky-Fischer et al.	
	27	20050084166	A1	2005-04-21	Bonch et al.	
	28	20020091840	A1	2002-07-11	Pulier et al.	
	29	20080281803	A1	2008-11-13	Gentric	
	30	20060168295 ~~20061068295~~	A1	2006-07-27	Batterberry et al.	
	31	20060165166	A1	2006-07-27	Chou et al.	
	32	20020097750	A1	2002-07-25	Gunaseelan et al.	
	33	20020152317	A1	2002-10-17	Wang et al.	
	34	20030021166	A1	2003-01-30	Soloff	
	35	20040168052	A1	2004-08-26	Clisham et al.	

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	36	20050066063	A1	2005-03-24	Grigorovitch et al.	
	37	20050204046	A1	2005-09-15	Watanabe	
	38	20060059223	A1	2006-03-16	Klemets et al.	
	39	20060168290	A1	2006-07-27	Doron	
	40	20040260701	A1	2004-12-23	Lehikoinen et al.	
	41	20090055471	A1	2009-02-26	Kozat et al.	
	42	20080222235	A1	2008-09-11	Hurst et al.	
	43	20050185578	A1	2005-08-25	Padmanabham et al.	
	44	20070280255	A1	2007-12-06	Tsang et al.	
	45	20080037527	A1	2008-02-14	Chan et al.	
	46	20080205291	A1	2008-08-28	Li et al.	

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	47	20070094405	A1	2007-04-26	Zhang	
	48	20080184688	A1	2006-08-17	Ganguly et al.	
	49	20080263180	A1	2008-10-23	Hurst et al.	
	50	20080133766	A1	2008-06-05	Luo	
	51	20070079325	A1	2007-04-05	de Heer	
	52	20070067480	A1	2007-03-22	Beek et al.	
	53	20070030833	A1	2007-02-08	Pirzada et al.	
	54	20090055547	A1	2009-02-26	Hudson et al.	
	55	20090210549	A1	2009-08-20	Hudson et al.	
	56	20100098103	A1	2010-04-22	Xiong et al.	
	57	20090043906	A1	2009-02-12	Hurst et al.	

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	58	20020161911	A1	2002-10-31	Pinckney, III et al.	
	59	20060236219	A1	2006-10-19	Grigorovitch et al.	
	60	20080046939	A1	2008-02-21	Lu et al.	
	61	20060130118	A1	2006-06-15	Damm	
	62	20070204310	A1	2007-08-30	Hua et al.	
	63	20030065803	A1	2003-04-03	Heuvelman	
	64	20040049780	A1	2004-03-11	Gee	
	65	20060133809	A1	2006-06-22	Chow et al.	
	66	20020144276	A1	2002-10-03	Radford et al.	
	67	20020073167	A1	2002-06-13	Powell et al.	
	68	20020174434	A1	2002-11-21	Lee et al.	

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	69	20020188745		2002-12-12	Hughes et al.	
	70	20030005455	A1	2003-01-02	Bowers	
	71	20030067872	A1	2003-04-10	Harrell et al.	
	72	20030081582		2003-05-01	Jain et al.	
	73	20030107994		2003-06-12	Jacobs et al.	
	74	20030135631		2003-07-17	Li et al.	
	75	20030151753		2003-08-14	Li et al.	
	76	20030152036		2003-08-14	Quigg Brown et al.	
	77	20030204519	A1	2003-10-30	Sirivara et al.	
	78	20040003101	A1	2004-01-01	Roth et al.	
	79	20040030797	A1	2004-02-12	Akinlar et al.	

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	80	20040031054	A1	2004-02-12	Dankworth et al.	
	81	20040054551	A1	2004-03-18	Ausubel et al.	
	82	20040071209		2004-04-15	Burg et al.	
	83	20040093420		2004-05-13	Gamble	
	84	20040143672	A1	2004-07-22	Padmanabham et al.	
	85	20040170392		2004-09-02	Lu et al.	
	86	20050108414		2005-05-19	Taylor et al.	
	87	20050123058		2005-06-09	Greenbaum et al.	
	88	20070024705		2007-02-01	Richter et al.	
	89	20080028428		2008-01-31	Jeong et al.	
	90	20080056373		2008-03-06	Newlin et al.	

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	Attorney Docket Number	066.0141X1C9

	91	20080162713		2008-07-03	Bowra et al.	
	92	20080195744		2008-08-14	Bowra et al.	
	93	20020029274	A1	2002-03-07	Allen	
	94	20060075446	A1	2006-04-06	Klemets et al.	
	95	20080104647	A1	2008-05-01	Hannuksela	
	96	20040220926	A1	2004-11-04	Lamkin et al.	
	97	20010013128	A1	2001-08-09	Hagai et al.	
	98	20030204602	A1	2003-10-30	Hudson et al.	
	99	20040010613	A1	2004-01-15	Apostolopoulos et al.	

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	Attorney Docket Number	066.0141X1C9

	1	2011004225	JP	A	2011-01-06	Hodoshima		
	2	2001067264	WO	A1	2001-09-13	Streamcenter, Inc.		
	3	200192752	JP		2001-04-06	Hitachi Information Systems Ltd.		
	4	2006010113	WO	A2	2006-01-26	Network Foundation Technologies, LLC		
	5	2004025405	WO	A2	2004-03-25	Thomson Licensing S.A.		
	6	2466482	CA	A1	2003-05-22	MusicMatch Inc.		
	7	2000-201343	JP		2000-07-18	Toshiba Corp.		
	8	0919952	EP	A1	1999-06-02	Mattavelli et al.		
	9	1670256	EP	A2	2006-06-14	Klements et al.		
	10	1777969	EP		2007-04-25	British Telcom		
	11	1298931	EP	A2	2003-04-02	Oplayo Oy		

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	12	1202487	EP	A2	2002-05-02	Toshiba KK		
	13	1395014	EP	A1	2004-03-03	Matsushita Electric Ind. Co. Ltd.		
	14	2367219	GB	A	2002-03-27	Vintage Global		

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	1	FUJISAWA, HIROSHI ET AL. "Implementaton of Efficient Access Mechanism for Multiple Mirror-Servers" IPSJ SIG Technical Report, vol. 2004, no. 9 (2004-DPS-116), January 30, 2004, Information Processing Society of Japan, pp. 37-42.	☒
	2	LIU, JIANGCHUAN ET AL. "Adaptive Video Multicast Over the Internet" IEEE Computer Society, 2003.	☒
	3	"The meaning of performance factor---English-Japanese Weblio Dictionary", [online], February 24, 2012, [searched on February 24, 2012], the Internet <URL:http://ejje.weblio.jp/content/performance+factor>.	☒
	4	TSURU, ET AL. "Recent evolution of the Internet measurement and inference techniques", IEICE Technical Report, Vol. 103, No. 123, pp. 37-42, June 12, 2003.	☒
	5	REJAIE, REZA ET AL. "Architectural Considerations for Playback of Quality Adaptive Video OVer the Internet" University of Southern California, Information Sciences Institute, 1998.	☒
	6	ROY, SUMIT ET AL. "A System Architecture for Managing Mobile Streaming Media Services" Streaming Media Systems Group, Hewlett-Packard Laboratories, 2003.	☒

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	7	XU, DONGYAN ET AL. "On Peer-to-Peer Media Streaming" Department of Computer Sciences, Purdue University, 2002.	☒
	8	KOZAMERINK, FRANC "Media Streaming Over the Internet - An Over of Delivery Technologies" EBU Technical Review, October 2002.	☒
	9	LIENHART, RAINER ET AL. "Challenges in Distributed Video Management and Delivery" Intel Corporation, EECS Dept., UC Berkeley, 2000-2002.	☒
	10	ZHANG, XINYAN ET AL. "CoolStreaming/DONet: A Data-Driven Overlay Network for Peer-to-Peer Live Media Streaming" IEEE 2005.	☒
	11	GUO, YANG "DirectStream: A Directory-Based Peer-to-Peer Video Streaming Service" LexisNexis, Elsevier B.V. 2007	☒

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	47	20070094405	A1	2007-04-26	Zhang	
Change(s) applied to document, /J.T./ 1/7/2022	48	20080184688	A1	~~2008-08-17~~ 08/2008	~~Ganguly et al.~~ Daly et al.	
	49	20080263180	A1	2008-10-23	Hurst et al.	
	50	20080133766	A1	2008-06-05	Luo	
	51	20070079325	A1	2007-04-05	de Heer	
	52	20070067480	A1	2007-03-22	Beek et al.	
	53	20070030833	A1	2007-02-08	Pirzada et al.	
	54	20090055547	A1	2009-02-26	Hudson et al.	
	55	20090210549	A1	2009-08-20	Hudson et al.	
	56	20100098103	A1	2010-04-22	Xiong et al.	
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PATENT NUMBER (if known)	APPLICATION NUMBER
	16/876,579

Completed by (check one):

☐ Applicant/Inventor — /Brett A. Carlson/ (Signature)

☑ Attorney or agent of record — 67,812 (Reg. No.) — Brett A. Carlson (Typed or printed name)

☐ Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) (Form PTO/SB/96) is enclosed or was filed on _____ (Date)

480-241-8219 (Requester's telephone number)

August 17, 2022 (Date)

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. If the assignee is a juristic entity, this form must be signed by a patent practitioner (attorney or agent) of record. Submit multiple forms if more than one signature is required (see below*).

☐ *Total of _____ PTO/SB/47 forms are submitted

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0016. Public burden for this form is estimated to average 5 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing this form, please call 1-800-PTO-9199 and then select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects this information under authority of 5 CFR 1.290. The information in this system of records is used to manage all records of applicant including name, citizenship, residence, post office address and other information with respect to inventors and their legal representatives pertaining to the applicant's activities in connection with the invention for which a patent is sought. This information is protected from disclosure to third parties in accordance with the Privacy Act.

However, routine uses of this information may include disclosure to the following: to law enforcement and investigation in the event that the system of records indicates a violation or potential violation of law; to a Federal, state, local, or international agency, in response to its request; to an agency, organization, or individual for the purpose of performing audit or oversight operations as authorized by law; to non-federal personnel under contract to the agency; to a court for adjudication and litigation; to the Department of Justice for Freedom of Information Act (FOIA) assistance; to members of congress working on behalf of an individual; to the Office of Personnel Management (OPM) for personnel research purposes; to National Archives and Records Administration for inspection of records; and to the Office of Management and Budget (OMB)for legislative coordination and clearance. Failure to provide any part of the requested information may result in an inability to process requests for access and information. The applicable Privacy Act System of Records Notice for this information is COMMERCE/PAT-TM-7 Patent Application Files, available at Federal Register / Vol. 78, No. 61 / Friday, March 29, 2013 /Notices 19243. https://www.govinfo.gov/content/pkg/FR-2013-03-29pdf/2013-07341.pdf

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson/Blake Scheffey
Attorney Docket Number:	9401-00254

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1200**

Electronic Acknowledgement Receipt	
EFS ID:	46429817
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Blake Scheffey
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	9401-00254
Receipt Date:	17-AUG-2022
Filing Date:	18-MAY-2020
Time Stamp:	13:43:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1200
RAM confirmation Number	E20228GD44213440
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	9401-00254_IFT.pdf	303775 3cbf4deced5da871212c1e1592cc1a211b0b90b2	no	1
Warnings:					
Information:					
2	Maintenance Fee Address Change	9401-00254_FeeAddress.pdf	246557 295cb1758814ce22fd4704852890865cfc186357	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37990 09999a17d99be05c46baacd877b1f21fdd55dacf	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	588322		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70560 7590 05/20/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	08/22/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, CHIRAG R	2454	709-219000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 KW Law, LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: DISH Technologies L.L.C.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Englewood, CO

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the ~~required fee(s)~~, any deficiency, or credit any overpayment to Deposit Account No. 602406

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Brett A. Carlson/ Date August 17, 2022

Typed or printed name Brett A. Carlson Registration No. 39,928

Webgroup CZ a.s. Ex. 1002, Page 42 of 1406

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70560 7590 05/20/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 05/20/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	08/22/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70560 7590 05/20/2022

KW LAW LLP (Dish Technologies L.L.C.)
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Phoenix, AZ 85014

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Certificate of Mailing or Transmission

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	08/22/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, CHIRAG R	2454	709-219000

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❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Webgroup CZ a.s. Ex. 1002, Page 44 of 1406

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

70560 7590 05/20/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

EXAMINER	
PATEL, CHIRAG R	
ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 05/20/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the amendment filed on April 5, 2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 4/5/22, 4/20/22.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance: Please refer to the notice of allowances mailed on January 5, 2022 and February 2, 2022.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197

(toll free).

/Chirag R Patel/
Primary Examiner, Art Unit 2454

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021	12/15/2021	01/25/2022	03/04/2022	05/13/2022			
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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	70	F	2022-05-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	13 May 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220513

Webgroup CZ a.s. Ex. 1002, Page 51 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	13 May 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220513

Webgroup CZ a.s. Ex. 1002, Page 52 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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	2		11		20		29								
	3		12		21		30								
	4		13		22										
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	8		17		26										
	9		18		27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	13 May 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220513

Webgroup CZ a.s. Ex. 1002, Page 53 of 1406

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.
PE2E Search	12/15/2021	C.P.
Google Patents / Scholar	12/15/2021	C.P.
Reviewed the Carmel '473 patent	01/25/2022	C.P.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
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H04L	H04L65/607,H04L65/608, H04L67/02	05/13/2022	C.P.

PE2E SEARCH - Search History (Prior Art)

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L27	17	(("5267334") or ("5404446") or ("5841432") or ("5389473") or ("6172672") or ("20020156912") or ("20030055995") or ("20030233464") or ("20020131496") or ("20030135863")).PN.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/02/01 04:57 PM
L28	211	("20010013128"|"20010047423"|"20020029274"|"20020073167"|"20020091840"|"20020097750"|"20020131496"|"20020144276"|"20020152317"|"20020152318"|"20020156912"|"20020161898"|"20020161908"|"20020161911"|"20020169926"|"20020174434"|"20020176418"|"20020178330"|"20020188745"|"20030005455"|"20030014684"|"20030018966"|"20030021166"|"20030021282"|"20030055995"|"20030065803"|"20030067872"|"20030081582"|"20030093790"|"20030107994"|"20030135631"|"20030135863"|"20030140159"|"20030151753"|"20030152036"|"20030154239"|"20030195977"|"20030204519"|"20030204602"|"20030233464"|"20030236904"|"20040003101"|"20040010613"|"20040030547"|"20040030599"|"20040030797"|"20040031054"|"20040049780"|"20040054551"|"20040071209"|"20040083283"|"2	(US-PGPUB; USPAT)	OR	ON	ON	2021/02/01 04:58 PM

		0040093420"|"2004010 3444"|"20040117427"|" 20040143672"|"200401 68052"|"20040170392"| "20040179032"|"20040 199655"|"20040220926 "|"20040221088"|"2004 0260701"|"2004026795 6"|"20050015509"|"200 50033855"|"200500554 25"|"20050066063"|"20 050076136"|"20050084 166"|"20050108414"|"2 0050120107"|"2005012 3058"|"20050185578"|" 20050188051"|"200502 04046"|"20050251832"| "20050262257"|"20060 010003"|"20060059223 "|"20060075446"|"2006 0080718"|"2006013011 8"|"20060133809"|"200 60165166"|"200601682 90"|"20060206246"|"20 060236219"|"20060277 564"|"20061068295"|"2 0070024705"|"2007003 0833"|"20070067480"|" 20070079325"|"200700 94405"|"20070204310"| "20070280255"|"20080 028428"|"20080037527 "|"20080046939"|"2008 0056373"|"2008010464 7"|"20080120330"|"200 80120342"|"200801337 66"|"20080162713"|"20 080184688"|"20080195 744"|"20080205291"|"2 0080219151"|"2008022 2235"|"20080263180"|" 20080281803"|"200900 43906"|"20090055471"| "20090055547"|"20090 210549"|"20100098103 "|"20100262711"|"2011 0307545"|"2015005849 6"|"4535355"|"5168356" |"5267334"|"5404446"|" 5687095"|"5732183"|"5 7685627"|"5841432"|"5 953506"|"6091775"|"60 91777"|"6122660"|"617 2672"|"6185736"|"6195 680"|"6366614"|"63742 89"|"6389473"|"644971 9"|"6486803"|"6490627" |"6510553"|"6574591"|"					

		6604118"|"6618752"|"6708213"|"6721723"|"6731600"|"6757796"|"6760772"|"6795863"|"6845107"|"6850965"|"6859839"|"6874015"|"6968387"|"6976090"|"7054365"|"7054774"|"7054911"|"7075986"|"7093001"|"7096271"|"7099954"|"7116894"|"7174385"|"7194549"|"7240100"|"7260640"|"7274740"|"7295520"|"7310678"|"7325073"|"7328243"|"7330908"|"7334044"|"7349358"|"7349976"|"7369610"|"7376747"|"7391717"|"7408984"|"7412531"|"7477688"|"7523181"|"7536469"|"7546355"|"7558869"|"7577750"|"7593333"|"7599307"|"7609652"|"7653735"|"7707303"|"7719985"|"7760801"|"7779135"|"7788395"|"7797439"|"7817985"|"7818444"|"7925781"|"8036265"|"8370514"|"8402156"|"8521836"|"8612624"|"8683066"|"8686066"|"8868772"|"8880721"|"9344496"|"9462074").PN.					
L29	0	(L25 L26 L27 L28) and streamlet with "same" near2 duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/02/01 05:05 PM
L30	7	(L25 L26 L27 L28) and streamlet with duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/02/01 05:06 PM
L31	46	(("8521836") or ("7558869") or ("7707303") or ("7925781") or ("8880721") or ("9344496") or ("8683066") or ("8686066") or ("6708213") or ("6757796") or ("9462074") or ("20050033855") or ("20030093790") or ("20030195977") or ("20040199655") or ("20040267956") or ("20040220926") or ("20060010003") or	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:13 PM

		("20060277564") or ("20150058496") or ("20100262711") or ("20050251832") or ("20040221088") or ("20040179032") or ("20020161908") or ("20030021282") or ("20080120330") or ("20080120342") or ("20110307545") or ("20050262257") or ("20030236904")).PN.					
L32	0	(L27 L28 L31) and streamlet with multiple near2 bitrates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:14 PM
L33	0	streamlet with multiple near2 bitrates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:14 PM
L34	27	streamlet with multiple near2 bitrates	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:15 PM
L35	27	streamlet with multiple near2 bitrates and duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:15 PM
L36	4	streamlet near3 bit$2rates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:45 AM
L37	9	portion near2 stream with duration with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:51 AM
L38	0	slic$3 near5 portion near2 stream with duration with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:52 AM
L39	6	slicing with stream with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:52 AM
L40	2	(("20030135631") or ("20020188745")).PN.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/09/10 10:09 AM
L41	24	multi-bit near rate near2 encod$3	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 10:28 AM
L42	35	("20020002708"|"20020044528"|"20020170062"|"20030009578"|"20030061305"|"20030072376"|"20030236906"|"20040136327"|"20040202109"|"20040260827"|"20050177618"|"20050207569"|"20080022343"|"20080086570"|"5424455	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 10:38 AM

		"|"5544318"|"5867230"|"5933603"|"5941951"|"5966015"|"5966025"|"6003030"|"6112239"|"6154744"|"6181867"|"6292383"|"6498897"|"6625643"|"6637031"|"6665726"|"6766407"|"6795863"|"7047307"|"7386627"|"7974200").PN.					
L49	1	("20030204519").PN.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/09/10 03:01 PM
L50	1	("10469554").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 04:04 PM
L51	1	("6389473").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 04:37 PM
L52	114	"1298931"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 04:41 PM
L53	1	("20200280594").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 05:23 PM
L54	31	("10469554" OR "10469555" OR "10757156" OR "10951680" OR "20020002708" OR "20020044528" OR "20020131496" OR "20030061305" OR "20030067872" OR "20030067875" OR "20030072376" OR "20030152036" OR "20030236906" OR "20040202109" OR "20040260827" OR "20050177618" OR "20080086570" OR "5414455" OR "5867230" OR "5941951" OR "5996025" OR "6292834" OR "6389473" OR "6490627" OR "6498897" OR "6637031" OR "7047307" OR "7386627" OR "8711701" OR "8818127" OR "9407564").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 11:11 AM
L55	0	streamlet SAME bit$2rates AND low SAME medium SAME	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:16 PM

		high near2 (stream bit$2rate) AND @rlad<"20040430"					
L56	39	streamlet SAME bit$2rates AND low SAME medium SAME high near2 (stream bit$2rate)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:16 PM
L57	2	("6389473" "2003204602" "2004010613").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2022/05/13 06:31 PM
L58	231	"6389473"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2022/05/13 06:32 PM
L59	0	"6389473 OR "20030204602" OR 2004010613".PN.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2022/05/13 06:33 PM
L60	3	("6389473" OR "20030204602" OR "2004010613").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2022/05/13 06:33 PM
L61	6	("20020144276" OR "20030061305" OR "20030204602" OR "20040010613" OR "20040202109" OR "6389473").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/05/13 07:44 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N43	84	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple)	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 11:31 AM
N44	42	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate) (multiple near2 bit$2rate))	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 11:32 AM
N45	69	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:08 PM

N46	22	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration with bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:08 PM
N47	0	file with portion near2 stream near3 duration with bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:14 PM
N48	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple) and @rlad<"20040205"	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:15 PM
N49	39	streamlet SAME bit$2rates AND low SAME medium SAME high near2 (stream bit$2rate)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:17 PM
N50	34	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate) (multiple near2 bit$2rate)) AND low SAME medium SAME high	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:23 PM
N51	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate)multiple) AND @rlad<"20040430"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 01:52 PM
N52	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate)multiple) AND @rlad<"20040430"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 01:52 PM

N53	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 duration SAME MULTIPLE NEAR3 BIT$2RATES	(US-PGPUB; USPAT)	OR	ON	ON	2022/05/13 07:58 PM
N54	7	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 duration SAME BIT$2RATES	(US-PGPUB; USPAT)	OR	ON	ON	2022/05/13 07:58 PM
N55	21	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 duration WITH BIT$2RATE	(US-PGPUB; USPAT)	OR	ON	ON	2022/05/13 07:58 PM

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag Patel
Attorney Docket Number	9401-00254

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag Patel
	Attorney Docket Number	9401-00254

	1	Respondents' Post-Hearing Brief (Redacted) dated March 29, 2022 (321 pages).	
	2	Complainants' Post-Hearing Reply Brief (Redacted) dated April 7, 2022 (105 pages).	
	3	Commission Investigative Staff's Post-Hearing Reply Brief (Redacted) dated April 13, 2022 (42 pages).	
	4	Commission Investigative Staff's Post-Hearing Brief (Redacted) dated April 1, 2022 (311 pages).	
	5	Respondents' Reply Post-Hearing Brief (Redacted) dated April 7, 2022 (106 pages).	
	6	Complainants' Post-Hearing Brief (Redacted) dated March 29, 2022 (326 pages).	

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EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	05/13/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag Patel
	Attorney Docket Number	9401-00254

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

X See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-04-20
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ Examiner's Signature | Initials

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	9401-00254
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Patel, Chirag R
Attorney Docket Number	9401-00254

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6389473	B1	2002-05-14	Carmel et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030061305	A1	2003-03-27	Copley et al.	
	2	20040202109	A1	2004-10-14	Akiyama et al.	
	3	20030204602	A1	2003-10-30	Hudson et al.	
	4	20040010613	A1	2004-01-15	Apostolopoulos et al.	
	5	20020144276	A1	2020-10-03	Radford et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2367219	GB	A	2002-03-27	Vintage Global		
	2	1395014	EP	A1	2004-03-03	Matsushita Electric Ind Co Ltd.		
	3	1298931	EP	A2	2003-04-02	Oplayo		

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Appendix H, Appendix H to Expert Report of Dr. Iain Richardson on Invalidity: Public Use (40 pages).	
	2	The Wayback Machine, dated November 8, 2021 (1 page).	
	3	In the Matter of: Certain Fitness Devices, Videotaped Deposition of BYU Broadcasting, Mark Mitchell, dated December 2, 2021 (123 pages).	
	4	The Wayback Machine, bates labeled RESP-PA06323, dated December 7, 2021 (1 page).	
	5	The Wayback Machine, bates labeled RESP-PA06257, dated November 8, 2021 (1 page).	

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	6	The Wayback Machine, bates labeled RESP-PA06256, dated November 8, 2021 (1 page).	
	7	Move Media, bates labeled RESP-PA06253, dated November 8, 2021 (1 page).	
	8	The Wayback Machine, bates labeled RESP-PA06252, dated November 8, 2021 (1 page).	
	9	BYU Television, bates labeled RESP-PA06247 to RESP-PA06248, dated November 8, 2021 (2 pages).	
	10	Mitchell Exhibit 13, BYU-TV Live, FAQ, bates labeled RESP-PA06275to RESP-PA06276, dated December 2, 2021 (2 pages).	
	11	Mitchell Exhibit 12, BYU Television, The Wayback Machine, bates labeled RESP-PA06268- to RESP-PA06269, dated December 2, 2021 (2 pages).	
	12	Mitchell Exhibit 11, BYU Television, The Wayback Machine, bates labeled RESP-PA06272 to RESP-PA06274, dated December 2, 2021 (3 pages).	
	13	Mitchell Exhibit 10, BYU Television, The Wayback Machine, bates labeled RESP-PA06266 to RESP-PA06267, dated December 2 2021 (2 pages).	
	14	Mitchell Exhibit 7, BYU Television, The Wayback Machine, bates labeled RESP-PA06270 to RESP-PA06271, dated December 2, 2021 (2 pages).	
	15	Mitchell Exhibit 6, bates labeled BYU000012-BYU000013, dated December 2, 2021 (2 pages).	
	16	Mitchell Exhibit 5, BYU Television, The Wayback Machine, bates labeled RESP-PA06263 to RESP-PA06264, dated December 2, 2021 (2 pages).	

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	Attorney Docket Number	9401-00254

	17	Mitchell Exhibit 4, BYU Television, The Wayback Machine, bates labeled RESP-PA06261 to RESP-PA06262, dated December 2, 2021 (2 pages).	
	18	Mitchell Exhibit 3, BYU Television, The Wayback Machine, bates labeled BYU000001, dated December 2, 2021 (1 page).	
	19	Mitchell Exhibit 2, Conference Summary for the 175th Semiannual General Conference, dated December 2, 2021 (3 pages).	
	20	Major Exhibit 62, Official Report of the One Hundred Seventy-fifth Semiannual General Conference of The Church of Jesus Christ of Latter-day Saints, dated November 5, 2021 (128 pages).	
	21	In the Matter of: In Re Certain Fitness Devices, Videotaped Deposition of Peloton Interactive, Inc., Drew Major, dated December 17, 2021 (72 pages).	
	22	In the Matter of: In Re Certain Fitness Devices and Systems Containing Same, Videotaped Deposition of John Edwards, dated November 12, 2021 (191 pages).	
	23	In the Matter of: In Re Certain Fitness Devices and Systems Containing Same, Videotaped Deposition of Robert Drew Major, dated November 5, 2021 (268 pages).	
	24	Uncertified Rough Draft Transcript, Deposition of Mark Hurst, Vol. 2, dated December 3, 2021 (51 pages).	
	25	Hurst Exhibit 68, Move Media, dated November 19, 2021 (1 page).	
	26	Bates labeled RESP-PA06326 to RESP-PA06337, dated December 7, 2021 (12 pages).	
	27	Bates labeled RESP-PA06255 (1 page).	

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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

	28	Bates labeled RESP-PA06254 (1 page).	
	29	International Search Report for EP application 20216568.4 dated April 19, 2021 (15 pages).	
	30	Response to International Search Report filed with EP application 20216568.4 on November 19, 2021 (41 pages).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	05/13/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-04-05
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Electronic Acknowledgement Receipt

EFS ID:	45522567
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Sarah Flaaen
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	9401-00254
Receipt Date:	20-APR-2022
Filing Date:	18-MAY-2020
Time Stamp:	18:30:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	Respondents_Reply_Post-Hearing_Brief_CBI_Redacted.pdf	773383 335513b349607a2e1c13a79e65d0f2e4697d280f	no	106

Warnings:

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2	Non Patent Literature	Staffs_PostHB_Redacted.pdf	3739526 2d22e1788c31115331ad5984ca336479661 3eb93	no	311
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3	Non Patent Literature	Staff_Post-Hearing_Reply_Brief_Redacted.pdf	439576 65d271e4f65aefbd29cf3296be916f7b148a a756	no	42
Warnings:					
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4	Non Patent Literature	Respondents_Post-Hearing_Brief_Redacted.pdf	2139825 bc1e147ccdd8312411539ebaa7e8c84ea92 b327f	no	321
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5	Non Patent Literature	DISH_Initial_Post_Hearing_Brief_Redacted.pdf	1833391 1f11abbc363084cf6e10499b2c20eef9c4d0 2475	no	326
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6	Non Patent Literature	Complainants_Post-Hearing_Reply_Brief_Redacted.pdf	863624 28cf312f6deda2c737df1b8036e18aaba6c1 9c52	no	105
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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Examiner Name	Chirag Patel
Attorney Docket Number	9401-00254

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	Attorney Docket Number	9401-00254

	1	Respondents' Post-Hearing Brief (Redacted) dated March 29, 2022 (321 pages).	
	2	Complainants' Post-Hearing Reply Brief (Redacted) dated April 7, 2022 (105 pages).	
	3	Commission Investigative Staff's Post-Hearing Reply Brief (Redacted) dated April 13, 2022 (42 pages).	
	4	Commission Investigative Staff's Post-Hearing Brief (Redacted) dated April 1, 2022 (311 pages).	
	5	Respondents' Reply Post-Hearing Brief (Redacted) dated April 7, 2022 (106 pages).	
	6	Complainants' Post-Hearing Brief (Redacted) dated March 29, 2022 (326 pages).	

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Examiner Signature		Date Considered	

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Name/Print	Brett A. Carlson	Registration Number	39928

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Electronic Acknowledgement Receipt

EFS ID:	45522433
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Sarah Flaaen
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	9401-00254
Receipt Date:	20-APR-2022
Filing Date:	18-MAY-2020
Time Stamp:	18:15:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	9401-00254_IDS_TL_04202022.pdf	24247 283adb11c98ffc41ee9462be59ea9dce15e81b5b	no	1

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	9401-00254_IDS_04202022.pdf	612489 6c6d6087fc3e0e6d6ef14525cd2246757678 5bdf	no	4

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A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

Total Files Size (in bytes):	636736

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

FILED VIA EFS WEB

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

First Named Inventor:	David F. Brueck	Docket No.:	9401-00254
Serial No.:	16/876,579	Examiner:	Patel, Chirag R.
Filed:	05-18-2020	Group Art Unit:	2454
Title:	APPARATUS, SYSEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	Confirmation No.:	3720

TRANSMITTAL LETTER

Mail Stop AMENDMENT
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The Examiner's attention is directed to the references listed on the attached Form PTO/SB/08A. Copies of the references are submitted concurrently herewith. Citation of these references is respectfully requested.

No concession is made that these documents are prior art, and Applicant expressly reserves the right to antedate the documents as may be appropriate.

Respectfully submitted,

Dated: April 20, 2022

By: /Brett A. Carlson/
Brett A. Carlson
Reg. No. 39,928

KW Law, LLP
6122 N 7th St, Ste D, Phoenix, AZ 85014
Phone: (602) 344-9885 | Email: brett@kwlaw.co

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Patel, Chirag R
Attorney Docket Number	9401-00254

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6389473	B1	2002-05-14	Carmel et al.	

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030061305	A1	2003-03-27	Copley et al.	
	2	20040202109	A1	2004-10-14	Akiyama et al.	
	3	20030204602	A1	2003-10-30	Hudson et al.	
	4	20040010613	A1	2004-01-15	Apostolopoulos et al.	
	5	20020144276	A1	2020-10-03	Radford et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2367219	GB	A	2002-03-27	Vintage Global		
	2	1395014	EP	A1	2004-03-03	Matsushita Electric Ind Co Ltd.		
	3	1298931	EP	A2	2003-04-02	Oplayo		

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Appendix H, Appendix H to Expert Report of Dr. Iain Richardson on Invalidity: Public Use (40 pages).	
	2	The Wayback Machine, dated November 8, 2021 (1 page).	
	3	In the Matter of: Certain Fitness Devices, Videotaped Deposition of BYU Broadcasting, Mark Mitchell, dated December 2, 2021 (123 pages).	
	4	The Wayback Machine, bates labeled RESP-PA06323, dated December 7, 2021 (1 page).	
	5	The Wayback Machine, bates labeled RESP-PA06257, dated November 8, 2021 (1 page).	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

	6	The Wayback Machine, bates labeled RESP-PA06256, dated November 8, 2021 (1 page).	
	7	Move Media, bates labeled RESP-PA06253, dated November 8, 2021 (1 page).	
	8	The Wayback Machine, bates labeled RESP-PA06252, dated November 8, 2021 (1 page).	
	9	BYU Television, bates labeled RESP-PA06247 to RESP-PA06248, dated November 8, 2021 (2 pages).	
	10	Mitchell Exhibit 13, BYU-TV Live, FAQ, bates labeled RESP-PA06275to RESP-PA06276, dated December 2, 2021 (2 pages).	
	11	Mitchell Exhibit 12, BYU Television, The Wayback Machine, bates labeled RESP-PA06268- to RESP-PA06269, dated December 2, 2021 (2 pages).	
	12	Mitchell Exhibit 11, BYU Television, The Wayback Machine, bates labeled RESP-PA06272 to RESP-PA06274, dated December 2, 2021 (3 pages).	
	13	Mitchell Exhibit 10, BYU Television, The Wayback Machine, bates labeled RESP-PA06266 to RESP-PA06267, dated December 2 2021 (2 pages).	
	14	Mitchell Exhibit 7, BYU Television, The Wayback Machine, bates labeled RESP-PA06270 to RESP-PA06271, dated December 2, 2021 (2 pages).	
	15	Mitchell Exhibit 6, bates labeled BYU000012-BYU000013, dated December 2, 2021 (2 pages).	
	16	Mitchell Exhibit 5, BYU Television, The Wayback Machine, bates labeled RESP-PA06263 to RESP-PA06264, dated December 2, 2021 (2 pages).	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

	17	Mitchell Exhibit 4, BYU Television, The Wayback Machine, bates labeled RESP-PA06261 to RESP-PA06262, dated December 2, 2021 (2 pages).	
	18	Mitchell Exhibit 3, BYU Television, The Wayback Machine, bates labeled BYU000001, dated December 2, 2021 (1 page).	
	19	Mitchell Exhibit 2, Conference Summary for the 175th Semiannual General Conference, dated December 2, 2021 (3 pages).	
	20	Major Exhibit 62, Official Report of the One Hundred Seventy-fifth Semiannual General Conference of The Church of Jesus Christ of Latter-day Saints, dated November 5, 2021 (128 pages).	
	21	In the Matter of: In Re Certain Fitness Devices, Videotaped Deposition of Peloton Interactive, Inc., Drew Major, dated December 17, 2021 (72 pages).	
	22	In the Matter of: In Re Certain Fitness Devices and Systems Containing Same, Videotaped Deposition of John Edwards, dated November 12, 2021 (191 pages).	
	23	In the Matter of: In Re Certain Fitness Devices and Systems Containing Same, Videotaped Deposition of Robert Drew Major, dated November 5, 2021 (268 pages).	
	24	Uncertified Rough Draft Transcript, Deposition of Mark Hurst, Vol. 2, dated December 3, 2021 (51 pages).	
	25	Hurst Exhibit 68, Move Media, dated November 19, 2021 (1 page).	
	26	Bates labeled RESP-PA06326 to RESP-PA06337, dated December 7, 2021 (12 pages).	
	27	Bates labeled RESP-PA06255 (1 page).	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

	28	Bates labeled RESP-PA06254 (1 page).	
	29	International Search Report for EP application 20216568.4 dated April 19, 2021 (15 pages).	
	30	Response to International Search Report filed with EP application 20216568.4 on November 19, 2021 (41 pages).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R
	Attorney Docket Number	9401-00254

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-04-05
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson/Sarah Flaaen
Attorney Docket Number:	9401-00254

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
RCE- 2ND AND SUBSEQUENT REQUEST	1820	1	2000	2000
		Total in USD ($)		**2260**

Electronic Acknowledgement Receipt	
EFS ID:	45403025
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Sarah Flaaen
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	9401-00254
Receipt Date:	05-APR-2022
Filing Date:	18-MAY-2020
Time Stamp:	18:46:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$2260
RAM confirmation Number	E202245I47423546
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	9401-00254_IDS_TL.pdf	24209 d4a45feebb38c36e47e929196af03a836532841b	no	1
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	9401-00254_RCE.pdf	697742 399d4b5ef7d564eb4005ab8f12422e0a71f3abbf	no	3
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	9401-00254_IDS.pdf	613607 87b96b0483a5f157d0b98d92f971fc3c3414e21d	no	7
Warnings:					
Information:					
4	Non Patent Literature	EPSearchReport.pdf	682833 320da8ed4624ee2941d21782a3841fb596ce8c96	no	15
Warnings:					
Information:					
5	Non Patent Literature	HurstVol_2.pdf	144205 c5f3caced57f5d35039af5d8806d065e207672df	no	51
Warnings:					
Information:					
6	Non Patent Literature	HurstExhibit67.pdf	188688 97c51d2bd0a5d1592c7b5e3e66f1706ff77a5bf8	no	1
Warnings:					
Information:					

7	Non Patent Literature	EPResponseFiled19Nov2021.pdf	1025279 d24508bfa8fd53f699897f4f60f392e9abf6a1c7	no	41
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Information:					
8	Non Patent Literature	CertainFitnessDevices-12-2-21-Mitchell_full.pdf	401201 a1ac80240274183b6002b0f442adcdd8be5671f8	no	123
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Information:					
9	Non Patent Literature	AppendixH_PublicUseCBIredacted.pdf	347718 2389628758bfb0a6fbd2b43445e969186d5a7240	no	40
Warnings:					
Information:					
10	Non Patent Literature	RESP-PA06326.pdf	24975240 7c4d3dcb2e0068642f95fc18a37effa1e1d0bc74	no	12
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Information:					
11	Non Patent Literature	RESP-PA06254.pdf	413107 4375fc707ed73d247a227081ac03a52e1ff544d0	no	1
Warnings:					
Information:					
12	Non Patent Literature	InReCertainFitnessDevices-11-5-21-Major-Final_full.pdf	801282 36f8e65ad41a12528388ffef1aef9cb264a70782	no	268
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Information:					
13	Non Patent Literature	InReCertainFitnessDevices-11-12-21-Edwards-Final_full.pdf	642008 abc70facf49fc5cc9a4cea1b30c2b2ce4484c987	no	191
Warnings:					
Information:					

14	Non Patent Literature	InReCertainFitnessDevices-12-17-21-Major_full.pdf	285316 b28948679b60851bcb669d658baf21144fa0b846	no	72
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Information:					
15	Non Patent Literature	RESP-PA06255.pdf	1174325 dd06ee180363eb308c13b2328b9639a23407fb81	no	1
Warnings:					
Information:					
16	Non Patent Literature	HurstExhibit68.pdf	233039 1a9b7172802c746fdf3d4e1f488d7f61a45e1de3	no	1
Warnings:					
Information:					
17	Non Patent Literature	MajorExhibit62.pdf	477317 76fd72b5f5719fb50bd4b856d6d3910b761d1525	no	128
Warnings:					
Information:					
18	Non Patent Literature	MitchellExhibit13.pdf	81538 bc7b9cde8b3c45b77aa551069c7309c4e66e8f31	no	2
Warnings:					
Information:					
19	Non Patent Literature	MitchellExhibit12.pdf	211122 ced25e554880902e807aae88543e58ec61ab5ed9	no	2
Warnings:					
Information:					
20	Non Patent Literature	MitchellExhibit11.pdf	158200 67f74808bf8e8ae1301a21fff4d0e1c1cbc06a7d	no	3
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Information:					

21	Non Patent Literature	MitchellExhibit10.pdf	210674 ee643a1c0a6e72b6daa281763f761519013d52ab	no	2
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Information:					
22	Non Patent Literature	MitchellExhibit7.pdf	154015 2b77c236121bfc3442ee8c43ee017e3b8debe646	no	2
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Information:					
23	Non Patent Literature	MitchellExhibit6.pdf	2133797 b14c4de8f45f9e8d0b9032589d14cdb1badfd82c	no	2
Warnings:					
Information:					
24	Non Patent Literature	MitchellExhibit5.pdf	210004 ca0990cd96b0ed99ec28c92a2e8a47aa7b995c11	no	2
Warnings:					
Information:					
25	Non Patent Literature	MitchellExhibit4.pdf	224321 78d7dd3ae9d2120ecc4a4a239344c6cc80f1b121	no	2
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Information:					
26	Non Patent Literature	MitchellExhibit3.pdf	289810 978aac355064dd085b02b9b6bceb427773bd2326	no	1
Warnings:					
Information:					
27	Non Patent Literature	MitchellExhibit2.pdf	143622 a5375447a684328dbf536e1b452f69db433dcd01	no	3
Warnings:					
Information:					

28	Non Patent Literature	RESP-PA06323.pdf	381172 a543fea368934a2c4395e63e0f73ecc30188e412	no	1
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Information:					
29	Non Patent Literature	RESP-PA06247.pdf	1009906 810806810fad24b373a74b72a9b5d525d88df73e	no	2
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Information:					
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Warnings:					
Information:					
31	Non Patent Literature	RESP-PA06252.pdf	965232 d0b5753f71e9afe8573ef9c255f8ffb8a0e0fc34	no	1
Warnings:					
Information:					
32	Non Patent Literature	RESP-PA06256.pdf	1681997 a256e11de2ce24db3f09bf7c69be52a99281cdf8	no	1
Warnings:					
Information:					
33	Non Patent Literature	RESP-PA06257.pdf	1347954 f24c25601fb218f032be23231e2059a097294570	no	1
Warnings:					
Information:					
34	Fee Worksheet (SB06)	fee-info.pdf	40104 a7a6954edd8761701049e4a0c6046fa124f30163	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	43601927	

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

First Named Inventor:	David F. Brueck	Docket No.:	9401-00254
Serial No.:	16/876,579	Examiner:	Patel, Chirag R.
Filed:	05-18-2020	Group Art Unit:	2454
Title:	APPARATUS, SYSEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	Confirmation No.:	3720

TRANSMITTAL LETTER

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Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The Examiner's attention is directed to the references listed on the attached Form PTO/SB/08A. Copies of the references are submitted concurrently herewith. Citation of these references is respectfully requested.

No concession is made that these documents are prior art, and Applicant expressly reserves the right to antedate the documents as may be appropriate.

Respectfully submitted,

Dated: April 5, 2022

By: /Brett A. Carlson/
Brett A. Carlson
Reg. No. 39,928

KW Law, LLP
6122 N 7th St, Ste D, Phoenix, AZ 85014
Phone: (602) 344-9885 | Email: brett@kwlaw.co

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16/876,579	Filing Date	2020-05-18	Docket Number (if applicable)	9401-00254	Art Unit	2454
First Named Inventor	David F. Brueck			Examiner Name	Patel, Chirag R.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☐ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 602406

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-04-05
Name	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	9401-00254	3720

70560 7590 03/09/2022

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

EXAMINER	
PATEL, CHIRAG R	

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
03/09/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@kwlaw.co
ipdept@dish.com
uspto@dockettrak.com

Corrected ***Notice of Allowability***	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the IDS filed on 1/26/22.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 1/26/22.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	607	F	2013-01-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
H04L	/	65	/	4069	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04L	/	29	/	06027	I	2013-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
H04L	/	65	/	80	I	2013-01-01
H04L	/	65	/	608	I	2013-01-01
H04L	/	67	/	02	I	2013-01-01
H04L	/	65	/	1069	I	2013-01-01
H04L	/	67	/	2842	I	2013-01-01
H04L	/	67	/	32	I	2013-01-01
H04N	/	21	/	2662	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	04 March 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220304

Webgroup CZ a.s. Ex. 1002, Page 115 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	04 March 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220304

Webgroup CZ a.s. Ex. 1002, Page 116 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22										
	5		14		23										
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	04 March 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.
PE2E Search	12/15/2021	C.P.
Google Patents / Scholar	12/15/2021	C.P.
Reviewed the Carmel '473 patent	01/25/2022	C.P.

Webgroup CZ a.s. Ex. 1002, Page 118 of 1406

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04N	H04N21/2662, H04N21/8456,	09/10/2021	C.P.
H04L	H04L65/607,H04L65/608, H04L67/02	09/10/2021	C.P.

Webgroup CZ a.s. Ex. 1002, Page 119 of 1406

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021	12/15/2021	01/25/2022	03/04/2022				
	1	✓	=	=	=	=				
	2	✓	=	=	=	=				
	3	✓	=	=	=	=				
	4	✓	=	=	=	=				
	5	✓	=	=	=	=				
	6	✓	=	=	=	=				
	7	✓	=	=	=	=				
	8	✓	=	=	=	=				
	9	✓	=	=	=	=				
	10	✓	=	=	=	=				
	11	✓	=	=	=	=				
	12	✓	=	=	=	=				
	13	✓	=	=	=	=				
	14	✓	=	=	=	=				
	15	✓	=	=	=	=				
	16	✓	=	=	=	=				
	17	✓	=	=	=	=				
	18	✓	=	=	=	=				
	19	✓	=	=	=	=				
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	23	✓	=	=	=	=				
	24	✓	=	=	=	=				
	25	✓	=	=	=	=				
	26	✓	=	=	=	=				
	27	✓	=	=	=	=				
	28	✓	=	=	=	=				
	29	✓	=	=	=	=				
	30	✓	=	=	=	=				

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	1	Investigation No. 337-TA-1265: APPENDIX A TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER CARMEL.	
	2	Investigation No. 337-TA-1265: APPENDIX B TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER AKIYAMA.	
	3	Investigation No. 337-TA-1265: APPENDIX C-1 TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER REALNETWORKS	
	4	Investigation No. 337-TA-1265: APPENDIX C-2 TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: REALNETWORKS EXPERIMENTATION	
	5	Investigation No. 337-TA-1265: APPENDIX D TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER KLEMETS	
	6	Investigation No. 337-TA-1265: EXHIBIT E TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER OPLAYO	
	7	Investigation No. 337-TA-1265: APPENDIX F TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER KIKUCHI	
	8	Investigation No. 337-TA-1265: APPENDIX G TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER TAKEMURA	
	9	Investigation No. 337-TA-1265: APPENDIX H TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: PUBLIC USE [Redacted]	
	10	Investigation No. 337-TA-1265: Exhibit 1 Dr. Iain Richardson curriculum vitae Dec21.	
	11	Investigation No. 337-TA-1265: RICHARDSON REPORT EXHIBIT 3: MATERIALS CONSIDERED	

EFS Web 2.1.18

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	12	Investigation No. 337-TA-1265: Appendix A To Supplemental Expert Report if Dr. Iain Richardson [Redacted]	
	13	Investigation No. 337-TA-1265: SUPPLEMENTAL EXPERT REPORT OF ROBERT L. STOLL	
	14	Investigation No. 337-TA-1265: SUPPLEMENTAL EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY [Redacted]	
	15	Investigation No. 337-TA-1265: SUPPLEMENTAL REBUTTAL EXPERT REPORT OF KEVIN JEFFAY, PHD., REGARDING VALIDITY [Redacted]	
	16	Investigation No. 337-TA-1265: SUPPLEMENTAL REBUTTAL EXPERT REPORT OF TERESA STANEK REA [Redacted]	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	03/04/2022

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-01-26
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ Examiner's Signature | Initials

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	9401-00254
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

KW LAW LLP (Dish Technologies L.L.C.)

6122 N 7th St Suite D
Phoenix, AZ 85014
UNITED STATES

FILING FEE RECEIVED

$7,320

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 02/02/2022

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER	
PATEL, CHIRAG R	

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
02/02/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@lkglobal.com
ipdept@dish.com

Corrected ***Notice of Allowability***	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the printer rush on January 12, 2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 1/6/22.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance: Examiner presents an overview of the Carmel et al. (US 6,389,473) as argued in litigation. Carmel teaches dividing a stream into a sequence of files, the files having a predetermined data size and encoding each file into a corresponding sequence of file, each having the own index and uploading to a server equal to the data rate of the stream. A review of Carmel teaches each slice duration is different as the slice duration of the split up files are different and can be adjusted as Carmel discloses per Col 9 lines 39-48, as the slice duration is adjusted based upon the link bandwidth.

Carmel "Col 9 lines 39-48, "Preferably, computer 34 monitors the rate of data being transmitted over each of links 60, 62, 64, etc., and allocates files 42, 44, 46, 48, etc., according to the data rates. The sizes of the files may be varied by adjusting slice durations T.sub.1, T.sub.2, T.sub.3, etc., and a relatively greater volume of data may be transmitted through links exhibiting relatively greater data rates."

This teaches away from the current claim language where each duration is of a fixed length, not a fixed size with variable duration that can be adjusted based on the current bandwidth, as shown above, as taught by Carmel. A POSITA would know that a higher quality streamlet would be a larger file, as in the number of bytes or megabytes, than a lower quality streamlet for a given duration (1 second, 5 seconds, 1 minute) and the size would not be a predetermined data size as taught by Carmel. Carmel shows this concepts per the disclosure on Col 8 line 56 – Col 9 line 5.

Carmel, Col 8 line 56- Col 9 line 5, ". Size identifier 61 describes the size of those slices in stream 41 that have a fixed size associated therewith, wherein typically the size (or the corresponding resolution) of the level #1 video slices is smaller than that of the level #2 slices."

Carmel shows a relationship between the quality of the compressed audio data, at 2KB per second at a specified quality level, and a variable duration of time which is dependent upon the link bandwidths per Col 11 lines 53-64 and Col 12 lines 3-6,

Carmel, Col 11 lines 53-64, "Similarly, at a set duration step 92, slice durations T.sub.1, T.sub.2, T.sub.3, etc., are optionally adjusted responsive to the link bandwidths. Initially, duration T.sub.1 of slice 1 for file 42 is set to a default value, typically between 1 and 5 sec. For example, to transfer compressed audio data at 2 Kbytes/sec, file 42 may be assigned a file size of 10 Kbytes, with T.sub.1 =5 sec."

Col 12 lines 3-6, "9) Frequently, however, this will not be the case, and the FTP upload rate over link 60 will fluctuate and may be slower than 2 Kbyte/sec. At step 88 (FIG. 5), the time required to upload file 42 is measured and compared to T.sub.1, at the same time as file 44 (slice 2) is being encoded and prepared. Responsive to this measurement of upload time, the duration of subsequent slices, for example, times T.sub.3 and T.sub.4 for files 46 and 48, respectively, is adjusted. "

This teaches away from applicants claim language in which each streamlet is a fixed time duration, having a same time index or same duration, as claimed as opposed to a predetermined data size with variable duration based on bandwidth as taught by Carmel.

Claims: '473 application, "each of the sets have the same time index as their corresponding raw streamlet such that the encoded streamlets of the same set independently yield on playback the same portion of the video,"

and per the instant application claims , "the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video"

Carmel also states that when the computer connects to the server and begins to download the stream, it reads the "index file" to determine what duration in the stream to start streaming the duration and moves the indicator to the point that where it will start streaming. Carmel also teach that each time slice in stream includes multidata at multiple quality levels as disclosed per Col 8 line 56- 67.

Carmel, Col 8 lines 56-67, "Each time slice in stream 41 includes multimedia data at multiple quality levels." Fig. 3D shows that the multiple portion of the level are in 1 packet which consist of a header, Audio level #1, Audio level #2 of multiple slices."

The client can select one of the available quality level based on the bandwidth in the stream. Carmel also teaches a multilevel stream which includes multimedia data at multiple quality levels which consists of audio and video data at level 1 and at level 2. Examiner does not see any disclosure in Carmel that relate to separate files being requested with the multilevel stream as shown in Fig. 3D and the streams consist of headers of the audio and video quality files in stream 41,header, 43, audio level #1, audio level #2, video level #1, Video level #2, as part of a packet which includes a header. There are no concepts taught in Carmel that talks about splitting packet into multiple files and sending only that requested portion of the separate content file as requested by the end-user station at multiple file quality levels of the same duration as claimed for the '483' application as in litigation. More specifically, a thorough review of the prior art fails to teach for the '483' application, (and similar limitations for all the other continuations in the family)

"an encoding module configured to encode each raw streamlet to generate, for each of said raw streamlets, a set including an encoded streamlet for each bitrate supported by the multi-bitrate content streaming, wherein each of the encoded streamlets in each of the sets is stored as a separate content file, wherein the encoded streamlets within each of the sets have the same time index as their corresponding raw streamlet such that the encoded streamlets of the same set independently yield on playback the same portion of the video, wherein the separate content files within each of the sets are independently requestable by end user stations, and wherein shifts between the different bit rates are made at the time indexes during streaming of each of the videos; and a web server to be coupled over the Internet to the end user station stations to receive requests from the end user stations for different ones of the separate content files from different ones of the sets and to transmit the requested ones of the separate content files to the requesting one of the end user stations, wherein each of the end user stations initiate each of the shifts between the different bit rates during streaming of each of the videos through a request for the separate content file storing a different bit rate one of the encoded streamlets for a subsequent one of the time indexes"

While a thorough review of the references teaches portions of the claim language which relate to splitting the stream into a sequence of files, and selecting a quality of the stream by using an index to determine the start portion of streaming, and a multi-level stream, it fails to teach or render obvious, as claimed with this current application,

"wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion

of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream."

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

/Chirag R Patel/

Primary Examiner, Art Unit 2454

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.
PE2E Search	12/15/2021	C.P.
Google Patents / Scholar	12/15/2021	C.P.
Reviewed the Carmel '473 patent	01/25/2022	C.P.

Webgroup CZ a.s. Ex. 1002, Page 134 of 1406

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04N	H04N21/2662, H04N21/8456,	09/10/2021	C.P.
H04L	H04L65/607,H04L65/608, H04L67/02	09/10/2021	C.P.

Webgroup CZ a.s. Ex. 1002, Page 135 of 1406

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021	12/15/2021	01/25/2022					
	1	✓	=	=	=					
	2	✓	=	=	=					
	3	✓	=	=	=					
	4	✓	=	=	=					
	5	✓	=	=	=					
	6	✓	=	=	=					
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	27	✓	=	=	=					
	28	✓	=	=	=					
	29	✓	=	=	=					
	30	✓	=	=	=					

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	607	F	2013-01-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
H04L	/	65	/	4069	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04L	/	29	/	06027	I	2013-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
H04L	/	65	/	80	I	2013-01-01
H04L	/	65	/	608	I	2013-01-01
H04L	/	67	/	02	I	2013-01-01
H04L	/	65	/	1069	I	2013-01-01
H04L	/	67	/	2842	I	2013-01-01
H04L	/	67	/	32	I	2013-01-01
H04N	/	21	/	2662	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454 (Primary Examiner)	25 January 2022 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

U.S. Patent and Trademark Office — Part of Paper No.: 20220125

Webgroup CZ a.s. Ex. 1002, Page 137 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	25 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220125

Webgroup CZ a.s. Ex. 1002, Page 138 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22										
	5		14		23										
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	25 January 2022	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20220125

Webgroup CZ a.s. Ex. 1002, Page 139 of 1406

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

/C.R.P/	1	Investigation No. 337-TA-1265: Redacted REBUTTAL EXPERT REPORT OF TERESA STANEK REA	
/C.R.P/	2	Investigation No. 337-TA-1265: Redacted REBUTTAL EXPERT REPORT OF KEVIN JEFFAY, PHD., REGARDING VALIDITY	
/C.R.P/	3	Investigation No. 337-TA-1265: Redacted EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY	
/C.R.P/	4	Investigation No. 337-TA-1265: Redacted EXPERT REPORT OF ROBERT L. STOLL	

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	01/25/2022

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-01-06
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ (Examiner's Signature) | (Initials)

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	066.0141X1C9
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

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05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

LKGLOBAL (Dish Technologies L.L.C.)

7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253
UNITED STATES

FILING FEE RECEIVED

$7,320

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	1	Investigation No. 337-TA-1265: APPENDIX A TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER CARMEL.	
	2	Investigation No. 337-TA-1265: APPENDIX B TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER AKIYAMA.	
	3	Investigation No. 337-TA-1265: APPENDIX C-1 TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER REALNETWORKS	
	4	Investigation No. 337-TA-1265: APPENDIX C-2 TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: REALNETWORKS EXPERIMENTATION	
	5	Investigation No. 337-TA-1265: APPENDIX D TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER KLEMETS	
	6	Investigation No. 337-TA-1265: EXHIBIT E TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER OPLAYO	
	7	Investigation No. 337-TA-1265: APPENDIX F TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER KIKUCHI	
	8	Investigation No. 337-TA-1265: APPENDIX G TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: ANTICIPATION AND OBVIOUSNESS OVER TAKEMURA	
	9	Investigation No. 337-TA-1265: APPENDIX H TO EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY: PUBLIC USE [Redacted]	
	10	Investigation No. 337-TA-1265: Exhibit 1 Dr. Iain Richardson curriculum vitae Dec21.	
	11	Investigation No. 337-TA-1265: RICHARDSON REPORT EXHIBIT 3: MATERIALS CONSIDERED	

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	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	12	Investigation No. 337-TA-1265: Appendix A To Supplemental Expert Report if Dr. Iain Richardson [Redacted]	
	13	Investigation No. 337-TA-1265: SUPPLEMENTAL EXPERT REPORT OF ROBERT L. STOLL	
	14	Investigation No. 337-TA-1265: SUPPLEMENTAL EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY [Redacted]	
	15	Investigation No. 337-TA-1265: SUPPLEMENTAL REBUTTAL EXPERT REPORT OF KEVIN JEFFAY, PHD., REGARDING VALIDITY [Redacted]	
	16	Investigation No. 337-TA-1265: SUPPLEMENTAL REBUTTAL EXPERT REPORT OF TERESA STANEK REA [Redacted]	

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-01-26
Name/Print	Brett A. Carlson	Registration Number	39928

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	**01/26/2022 11:52:56 AM ET**	**066.0141X1C9**

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60504121	FILING DATE	05/18/2020
CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 18

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
20220126_IDS_066-0141X1C9.pdf	5	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
20220126_IDSCertStmnt_066-0141X1C9.pdf	1	Transmittal Letter	95 KB
NPL_20211208-AppendixA_Carmel.pdf	153	Non Patent Literature	1945 KB
NPL_20211208-AppendixB_Akiyama.pdf	68	Non Patent Literature	443 KB
NPL_20211208-AppendixC-1_RealNetworks.pdf	120	Non Patent Literature	5128 KB

NPL_20211208-AppendixC-2_RealNetworksTesting.pdf	27	Non Patent Literature	3944 KB
NPL_20211208-AppendixD_Klemets.pdf	69	Non Patent Literature	390 KB
NPL_20211208-AppendixE_Oplayo.pdf	128	Non Patent Literature	2307 KB
NPL_20211208-AppendixF_Kikuchi.pdf	66	Non Patent Literature	421 KB
NPL_20211208-AppendixG_Takemura.pdf	39	Non Patent Literature	329 KB
NPL_20211208-AppendixH_PublicUseCBI_Redacted.pdf	40	Non Patent Literature	310 KB
NPL_20211208-Ex01_IainRichardson_cv_Dec21.pdf	10	Non Patent Literature	144 KB
NPL_20211208-Ex03_MaterialsConsidered.pdf	8	Non Patent Literature	112 KB
NPL_20220120-AppendixAToSupplExpertReportIainRichardson_Redacted.pdf	2	Non Patent Literature	86 KB
NPL_20220120-SupplementalExpertOfRobertLStoll.pdf	9	Non Patent Literature	1507 KB
NPL_20220120-SupplExpertReportOfIainRichardson_Redacted.pdf	13	Non Patent Literature	251 KB

NPL_20220124-SupplementalRebuttalExpertReportOfKevinJeffay-FS_Redacted.pdf	16	Non Patent Literature	373 KB
NPL_20220124-SupplementalRebuttalExpertReportOfTeresaStanekRea-FS_Redacted.pdf	21	Non Patent Literature	294 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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NPL_20220120-AppendixAToSupplExpertReportIainRichardson_Redacted.pdf	47CCA1D049F46405A31C8D8324B56C45C64A992AED47928FA58361EA033D3867E9708EC6871A473B9A3CC28C2C9B75E6B71B1DDBBE20EE9BA07E06AE3ECF96EF
NPL_20220120-SupplementalExpertOfRobertLStoll.pdf	81C780DD6775A5C9FE5BE978CBCD23F9767EEA7303AD0C1758550CE0ED77080539CA83185C801BBF11B424675EE4778DDFF8FBA02A3658EB6D2A9428C74A5D9B
NPL_20220120-SupplExpertReportOfIainRichardson_Redacted.pdf	9DCB9AC82B994B938593549FCCCC8B42EC522856062E56FB20425B019E7A5CF5403DF89F3025550345 2A97D5BA28FE4A636EB458E703AC2FDAAC40EFC4E6FBA3

NPL_20220124-SupplementalRebuttalExpertReportOfKevinJeffay-FS_Redacted.pdf	01A13FC3781F1B8531B6A77789D230DFCC5030068BC145C7734D646346225D21C641CBC3C2F80DA42F3CD9851966D6DD79385E32FE50A0A5FB2926C4D67940F0
NPL_20220124-SupplementalRebuttalExpertReportOfTeresaStanekRea-FS_Redacted.pdf	BEB80D64565C746953C03A521DE05C9507830E8A99E9406598163444F8CFD47E1E1E5B4025E3C1A36C1308903F4416FA59B5F7330B48DCDD73B86DC9EB32F791

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IDS CERTIFICATION STATEMENTS

I. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(b): (check one box)**

☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

☐ Within three months of the date of entry of the national stage as set forth in 1.491 in an international application.

☐ Before the mailing date of a first Office Action on the merits. In the event that a first Office Action on the merits has been mailed, please consider this IDS under 37 C.F.R. 1.97(c) and see the statement under 1.97(e) or charge deposit account 50-2091 the fee specified by 37 C.F.R. 1.17(p) if such statement is not selected in Section IV.

☐ Before the mailing of a first Office Action after the filing of a request for continued examination under 1.114.

II. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(c):**

☐ After the period specified in 37 C.F.R. 1.97(b) and before the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, and accompanied by:

- ☐ a statement specified in 1.97(e) as subsequently provided in this IDS; or
- ☐ the fee set forth in 1.17(p).

III. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(d):**

☑ After the period specified in 37 C.F.R. 1.97(c) and on or after the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, but before or simultaneous with payment of the issue fee, and accompanied by a statement specified in 1.97(e) as subsequently provided in this IDS **and** the fee set forth in 1.17(p).

IV. **Statement under 37 C.F.R. 1.97(e) (check only one box)**

The undersigned hereby states that:

☐ Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS.

☑ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this IDS.

V. **Statement under 37 C.F.R. §1.704(d)** :

☐ The undersigned hereby states that each item of information contained in the information disclosure statement: (i) was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement; or (ii) is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement..

VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

If the Examiner has any questions concerning this IDS, the Examiner is requested to contact the undersigned at the telephone number associated with Customer No. 70560 . If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule, with a petition if necessary, and charge the appropriate fee to Deposit Account No. 50-2091.

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	01/26/2022 11:52:56 AM ET	066.0141X1C9

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60504121	AUTHORIZED BY	Brett Carlson
CUSTOMER #	70560	FILING DATE	05/18/2020
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	DAVID F. BRUECK

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 1269	E20221PB53331526	Francene Stewart

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
502091	37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.21 (Miscellaneous fees and charges)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1806	SUBMISSION OF AN INFORMATION DISCLOSURE STATEMENT	260.00	1	260.00
			TOTAL AMOUNT:	$260.00

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Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
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	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	1	Investigation No. 337-TA-1265: Redacted REBUTTAL EXPERT REPORT OF TERESA STANEK REA	
	2	Investigation No. 337-TA-1265: Redacted REBUTTAL EXPERT REPORT OF KEVIN JEFFAY, PHD., REGARDING VALIDITY	
	3	Investigation No. 337-TA-1265: Redacted EXPERT REPORT OF DR. IAIN RICHARDSON ON INVALIDITY	
	4	Investigation No. 337-TA-1265: Redacted EXPERT REPORT OF ROBERT L. STOLL	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-01-06
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IDS CERTIFICATION STATEMENTS

I. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(b): (check one box)**

☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

☐ Within three months of the date of entry of the national stage as set forth in 1.491 in an international application.

☐ Before the mailing date of a first Office Action on the merits. In the event that a first Office Action on the merits has been mailed, please consider this IDS under 37 C.F.R. 1.97(c) and see the statement under 1.97(e) or charge deposit account 50-2091 the fee specified by 37 C.F.R. 1.17(p) if such statement is not selected in Section IV.

☐ Before the mailing of a first Office Action after the filing of a request for continued examination under 1.114.

II. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(c):**

☐ After the period specified in 37 C.F.R. 1.97(b) and before the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, and accompanied by:

- ☐ a statement specified in 1.97(e) as subsequently provided in this IDS; or
- ☐ the fee set forth in 1.17(p).

III. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(d):**

☑ After the period specified in 37 C.F.R. 1.97(c) and on or after the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, but before or simultaneous with payment of the issue fee, and accompanied by a statement specified in 1.97(e) as subsequently provided in this IDS **and** the fee set forth in 1.17(p).

IV. **Statement under 37 C.F.R. 1.97(e) (check only one box)**

The undersigned hereby states that:

☐ Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS.

☑ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this IDS.

V. **Statement under 37 C.F.R. §1.704(d)** :

☐ The undersigned hereby states that each item of information contained in the information disclosure statement: (i) was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement; or (ii) is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement..

VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	**01/06/2022 12:24:14 PM ET**	**066.0141X1C9**

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60475006	FILING DATE	05/18/2020
CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 9

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
NPL1_20211222_REDACTED-ReaRebuttalReport_Redacted.pdf	83	Non Patent Literature	702 KB
NPL2a_20211222_REDACTED-RebuttalExpertReportOfKevinJeffayPhD.pdf	100	Non Patent Literature	1869 KB
NPL2b_20211222_REDACTED-RebuttalExpertReportOfKevinJeffayPhD.pdf	101	Non Patent Literature	1962 KB

NPL2c_20211222_REDACTED-RebuttalExpertReportOfKevinJeffayPhD.pdf	101	Non Patent Literature	886 KB
NPL2d_20211222_REDACTED-RebuttalExpertReportOfKevinJeffayPhD.pdf	94	Non Patent Literature	1329 KB
NPL3_20211208_REDACTED-RichardsonExpertReportOnInvalidity.pdf	152	Non Patent Literature	5679 KB
NPL4_REDACTED-ExpertReportOfRobertLStoll_Redacted.pdf	89	Non Patent Literature	1355 KB
20220106_IDS_066-0141X1C9.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	1010 KB
20220106_IDSCertStmnt_066-0141X1C9.pdf	1	Transmittal Letter	100 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage

submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	01/06/2022 12:24:14 PM ET	066.0141X1C9

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60475006	AUTHORIZED BY	Brett Carlson
CUSTOMER #	70560	FILING DATE	05/18/2020
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	DAVID F. BRUECK

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 1269	E202216C24460057	Francene Stewart

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
502091	37 CFR 1.17 (Patent application and reexamination processing fees)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1806	SUBMISSION OF AN INFORMATION DISCLOSURE STATEMENT	260.00	1	260.00
			TOTAL AMOUNT:	$260.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70560 7590 01/05/2022

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 01/05/2022

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/05/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70560 7590 01/05/2022
LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	04/05/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, CHIRAG R	2454	709-219000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Webgroup CZ a.s. Ex. 1002, Page 171 of 1406

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 01/05/2022

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SCOTTSDALE, AZ 85253

EXAMINER	
PATEL, CHIRAG R	
ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 01/05/2022

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the amendment filed on November 17, 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 11/17/21, 11/17/21, 11/17/21, 11/17/21.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance: Applicants have filed a terminal disclaimer to overcome the obvious double patent rejections with respect to US 10,469,555. A relevant prior art, Grigorovitch et al. (US 2005/0066063) teaches that a single file stores a portion of a video stream and audio stream in multiple bit-rates as performing multi-bit-rate encoding and are selected based on a bandwidth. It also teaches that the media cache will create a segment for each portion of the received stream that is not immediately adjacent in time, when the user uses a seek bar to forward or rewind the playback media. Srivara (US 2003/0204519) stores the entire song in multiple bit-rate encoding files and transmit the entire file in a single bit-rate in accordance with the quality selection. The prior art are different from the claimed invention in that the each streamlet correspond to a portion of a video, and is encoded at a response one of the plurality of different bitrate and refers to the same portion of the video in the low stream, medium quality and high-quality stream and transmit only that portion which has the same duration at the at the requested bitrate for playback as requested, as claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

/Chirag R Patel/
Primary Examiner, Art Unit 2454

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021	12/15/2021						
	1	✓	=	=						
	2	✓	=	=						
	3	✓	=	=						
	4	✓	=	=						
	5	✓	=	=						
	6	✓	=	=						
	7	✓	=	=						
	8	✓	=	=						
	9	✓	=	=						
	10	✓	=	=						
	11	✓	=	=						
	12	✓	=	=						
	13	✓	=	=						
	14	✓	=	=						
	15	✓	=	=						
	16	✓	=	=						
	17	✓	=	=						
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	21	✓	=	=						
	22	✓	=	=						
	23	✓	=	=						
	24	✓	=	=						
	25	✓	=	=						
	26	✓	=	=						
	27	✓	=	=						
	28	✓	=	=						
	29	✓	=	=						
	30	✓	=	=						

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	607	F	2013-01-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
H04L	/	65	/	4069	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04L	/	29	/	06027	I	2013-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
H04L	/	65	/	80	I	2013-01-01
H04L	/	65	/	608	I	2013-01-01
H04L	/	67	/	02	I	2013-01-01
H04L	/	65	/	1069	I	2013-01-01
H04L	/	67	/	2842	I	2013-01-01
H04L	/	67	/	32	I	2013-01-01
H04N	/	21	/	2662	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	15 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20211215

Webgroup CZ a.s. Ex. 1002, Page 178 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	15 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

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Webgroup CZ a.s. Ex. 1002, Page 179 of 1406

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	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22										
	5		14		23										
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	15 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

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Webgroup CZ a.s. Ex. 1002, Page 180 of 1406

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.
PE2E Search	12/15/2021	C.P.
Google Patents / Scholar	12/15/2021	C.P.

Webgroup CZ a.s. Ex. 1002, Page 181 of 1406

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	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04N	H04N21/2662, H04N21/8456,	09/10/2021	C.P.
H04L	H04L65/607,H04L65/608, H04L67/02	09/10/2021	C.P.

Webgroup CZ a.s. Ex. 1002, Page 182 of 1406

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	1	MUNTEAN, G-M., "A New Adaptive Multimedia Streaming System for All-iP Multi-Service Networks", IEEE Trans. On Broadcasting, March 2004, pp. 1-10, Vol. 50, No. 1.	
	2	Akamai buys InterVu, February 7, 2000.	
	3	Akamai, Akamai Completes Acquisition of Speedera Networks	
	4	Bill Gates Unveils the Next Wave of Digital Media with Windows Media 9 Series, September 3, 2002.	
	5	Darwin Steaming Server Source Code Developer Notes, June 15, 2021, Darwin Steaming Server 2	
	6	IBM Goes Straight to Video - CNET, June 15, 2021	
	7	News in Brief: IBM VideoCharger, December 18, 1996	
	8	BIRNEY, "Intelligent Streaming", May 21, 2021	
	9	InterVu & Excalibur Partner to Deliver Live Internet Newscasts - Bloomberg, December 9, 1999.	
	10	Introduction to Streaming Media with RealOne Player, October 1, 2002.	
	11	Macromedia Delivers Macromedia Flash Communication Server MX Breakthrough server unifies communications and applications to deliver live, human interactions on the Internet, July 9, 2002.	

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	12	Press Releases: Macromedia Flash Media Server 2 Now Available. Flash Media Server 2 Brings the Power of the Flash Platform to Web Video.	
	13	Move Networks: The Story of a Failure - GigaOm	
	14	QuickTime 6: Summary of Changes and Enhancements	
	15	CHOU, et al., "Rate-Distortion Optimized Receiver-Driven Streaming over Best-Effort Networks", IEEE Fourth Workshop on Multimedia Signal Processing, 3 October 2001, pp. 1-10	
	16	FESTA P., RealNetworks tests G2, July 13, 1998.	
	17	RealNetworks Production Guide, with RealOne Player, October 1, 2002.	
	18	RealSystem G2 Production Guide BETA 1 Release	
	19	Sandpiper Networks Signs Partner Deals - InternetNews, October 7, 1999.	
	20	TOPIC, M. "Streaming Media Demystified", McGraw-Hill TELECOM, 2002	
	21	GALLAGHER, B., "Streaming Video From End to End", ITProToday, Compute Engines, Feb. 28, 1999	
	22	Move Networks: The Fall of Move Networks, Jan. 26, 2010.	

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	23	CONKLIN, G.J., et al. "Video Coding for Streaming Media Delivery on the Internet", IEEE Trans. on Circuits and Systems for Video Technology, March 3, 2001, pp. 281, Vol. 11. No 3.

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EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	12/15/2021

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Patents (multi-bit rate encoding stream low medium high) segment streamle

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Intelligent network streaming and execution system for conventionally coded ...

US · US8892249B2 · Daniel T. Arai · Numecent Holdings, Inc.

Priority 2001-02-14 · Filed 2012-11-26 · Granted 2014-11-18 · Published 2014-11-18

In a system that partitions an application program into page segments, a minimal portion of the application program is installed on a client system. The client prefetches page segments from the application server or the application server pushes additional page segments to the client. The ...

Method and apparatus for authentication of data streams with adaptively ...

WO US JP · US8266015B2 · Craig B. Gentry · Ntt Docomo, Inc.

Priority 2003-08-15 · Filed 2009-09-16 · Granted 2012-08-28 · Published 2012-08-28

Methods, components, and systems for efficient authentication, either through a digital signature or message authentication codes, and verification of a digital stream sent from a source to a receiver via zero or more intermediaries, such that the source or intermediary (or both) can remove ...

Transcoding a JPEG2000 compressed image

EP US JP DE · US7382922B2 · Rajan L. Joshi · Eastman Kodak Company

Priority 2003-07-01 · Filed 2004-06-30 · Granted 2008-06-03 · Published 2008-06-03

A JPEG2000 compressed image is transcoded to a lower bit-rate or lower resolution, or both, without having to decompress the initial JPEG2000 image and then recompress it to a lower bit-rate and/or resolution. Instead, arithmetic decoding is performed only to the nearest higher bit-rate layer, up ...

Methods and compositions to improve the efficacy and specificity of FNAi

WO EP US AT AU CA DE ES · ES2887118T3 · Phillip Zamore · Univ Massachusetts

Priority 2003-06-02 · Filed 2004-06-02 · Granted 2021-09-03 · Published 2021-09-03

1. A method of enhancing the ability of an antisense strand of an RNAi agent to act as a guide strand in mediating RNAi, which comprises decreasing the base pair strength between the 5 'end of the antisense strand and the 3' end of the coding strand of the duplex when compared to the base pair ...

Method and apparatus for fast metadata generation, delivery and access for live ...

KR · KR1005898823B1 · 셜리 홍 · 비쥬얼 인코포레이티드

Priority 2003-02-19 · Filed 2004-02-18 · Granted 2006-06-14 · Published 2006-06-14

Techniques for fast indexing of video broadcasts are provided that create meaningful and practical highlight hierarchies of broadcast television programs in real time, including efficient manual processes and automatic indexing steps. As one method, certain keywords describing the highlights are ...

Recording medium, reproduction apparatus, recording method, reproduction method ...

WO EP US CN JP KR AT AU CA DK ES RU TW ZA · JP2009021997A · Joseph Mccrossan · Panasonic Corp

Priority 2003-04-28 · Filed 2008-06-26 · Published 2009-01-29

<P>PROBLEM TO BE SOLVED: To provide a reproduction apparatus capable of providing update of graphics synchronized with display of a picture even when the quantity of data to be written on a graphics plane is large. <P>SOLUTION: An AVClip used as an object of this reproduction apparatus is ...

Optimized Server for Streamed Applications

US · US20150235015A1 · Anne Marie Holler · Numecent Holdings, Inc.

Priority 2000-11-06 · Filed 2014-09-03 · Published 2015-08-20

An optimized server for streamed applications provides a streamed application server optimized to provide efficient delivery of streamed applications to client systems across a computer network such as the Internet. The server persistently stores streamed application program sets that contain ...

Recording medium, reproduction device, recording method, program, and ...

WO EP US CN JP KR CA DE · WO2004075547A1 · Tomoyuki Okada · Matsushita Electric Industrial Co., Ltd.

Priority 2003-02-19 · Filed 2004-02-18 · Published 2004-09-02

In a BD-ROM, an AV Clip and a plurality of reproduction interval information (Play Item) are recorded. The AV Clip includes a moving picture stream multiplexed with a plurality of elementary streams. The reproduction interval information is Playable_PID_entries showing the reproduction start point ...

Apparatus method and system for increased digital media recording throughput



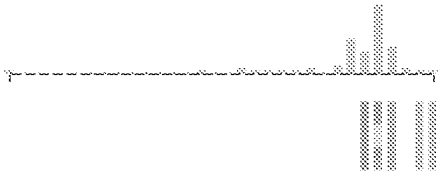
US · US6819393B1 · Glen Alan Jaquette · International Business Machines Corporation
Priority 2003-12-03 · Filed 2003-12-03 · Granted 2004-11-09 · Published 2004-11-09
A source data stream is distributed to two or more compression paths that provide a corresponding number of compressed data streams that are concurrently encoded onto a recording medium as a set of media tracks. In one embodiment, buffer space within each compression path is monitored and the ...

Classification and detection of computer intrusions

Google Scholar · citeseerx.ist.psu.edu · Kumar S
Published 1995
... There is a type field with every event that distinguishes among events in the event **stream**. ... Setting a threshold too **low** results in false positives and setting it too **high** results in false ... Our abstract classification hierarchy has four categories in which a category at a **higher** level ...

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Assignees	Inventors	CPCs
Eastman Kodak Company		4%
International Business Machines Corporation		4%
Nicholas Ryan		2.7%
Endeavors Technology, Inc.		2.7%
Numecent Holdings, Inc.		2.7%

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Attorney Docket Number	066.0141X1C9

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	1	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Akiyama et al	
	2	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Arye et al.	
	3	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Carmel et al.	
	4	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Chou et al.	
	5	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Durrant et al.	
	6	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Gentric	
	7	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Kitamura	
	8	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Klemets et al.	
	9	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Oplayo et al.	
	10	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QOAS	
	11	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QuickTime Changes	

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	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	12	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QuickTime	
	13	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Ravi	
	14	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") RealOne Player	
	15	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Walker	
	16	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Wang	
	17	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Wu	
	18	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") RealSystem G2	
	19	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Akiyama et al.	
	20	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Ayre	
	21	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Carmel et. al.	
	22	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Chou et. al.	

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	30	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") QuickTime	
	31	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Ravi	
	32	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") RealOne Player	
	33	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Walker	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	34	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Wang	
	35	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Wu	
	36	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Dey	
	37	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Microsoft	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	12/15/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39,928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ Examiner's Signature | Initials

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	066.0141X1C9
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

LKGLOBAL (Dish Technologies L.L.C.)

7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253
UNITED STATES

FILING FEE RECEIVED

$7,320

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
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L4	3	(("7369610") or ("20050055425") or ("20030103571")).PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2020/06/12 10:30 AM
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L7	1	("9571551").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2020/06/12 10:46 AM
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		6604118"|"6618752"|"6708213"|"6721723"|"6731600"|"6757796"|"6760772"|"6795863"|"6845107"|"6850965"|"6859839"|"6874015"|"6968387"|"6976090"|"7054365"|"7054774"|"7054911"|"7075986"|"7093001"|"7096271"|"7099954"|"7116894"|"7174385"|"7194549"|"7240100"|"7260640"|"7274740"|"7295520"|"7310678"|"7325073"|"7328243"|"7330908"|"7334044"|"7349358"|"7349976"|"7369610"|"7376747"|"7391717"|"7408984"|"7412531"|"7477688"|"7523181"|"7536469"|"7546355"|"7558869"|"7577750"|"7593333"|"7599307"|"7609652"|"7653735"|"7707303"|"7719985"|"7760801"|"7779135"|"7788395"|"7797439"|"7817985"|"7818444"|"7925781"|"8036265"|"8370514"|"8402156"|"8521836"|"8612624"|"8683066"|"8686066"|"8868772"|"8880721"|"9344496"|"9462074").PN.					
L29	0	(L25 L26 L27 L28) and streamlet with "same" near2 duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/02/01 05:05 PM
L30	7	(L25 L26 L27 L28) and streamlet with duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/02/01 05:06 PM
L31	46	(("8521836") or ("7558869") or ("7707303") or ("7925781") or ("8880721") or ("9344496") or ("8683066") or ("8686066") or ("6708213") or ("6757796") or ("9462074") or ("20050033855") or ("20030093790") or ("20030195977") or ("20040199655") or ("20040267956") or ("20040220926") or ("20060010003") or	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:13 PM

		("20060277564") or ("20150058496") or ("20100262711") or ("20050251832") or ("20040221088") or ("20040179032") or ("20020161908") or ("20030021282") or ("20080120330") or ("20080120342") or ("20110307545") or ("20050262257") or ("20030236904")).PN.					
L32	0	(L27 L28 L31) and streamlet with multiple near2 bitrates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:14 PM
L33	0	streamlet with multiple near2 bitrates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:14 PM
L34	27	streamlet with multiple near2 bitrates	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:15 PM
L35	27	streamlet with multiple near2 bitrates and duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/02/01 05:15 PM
L36	4	streamlet near3 bit$2rates with duration	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:45 AM
L37	9	portion near2 stream with duration with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:51 AM
L38	0	slic$3 near5 portion near2 stream with duration with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:52 AM
L39	6	slicing with stream with bit$2rate	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 09:52 AM
L40	2	(("20030135631") or ("20020188745")).PN.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/09/10 10:09 AM
L41	24	multi-bit near rate near2 encod$3	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 10:28 AM
L42	35	("20020002708"|"20020044528"|"20020170062"|"20030009578"|"20030061305"|"20030072376"|"20030236906"|"20040136327"|"20040202109"|"20040260827"|"20050177618"|"20050207569"|"20080022343"|"20080086570"|"5424455	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 10:38 AM

		"|"5544318"|"5867230"|"5933603"|"5941951"|"5966015"|"5966025"|"6003030"|"6112239"|"6154744"|"6181867"|"6292383"|"6498897"|"6625643"|"6637031"|"6665726"|"6766407"|"6795863"|"7047307"|"7386627"|"7974200").PN.					
L49	1	("20030204519").PN.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	OFF	OFF	2021/09/10 03:01 PM
L50	1	("10469554").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 04:04 PM
L51	1	("6389473").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 04:37 PM
L52	114	"1298931"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO)	OR	ON	ON	2021/09/10 04:41 PM
L53	1	("20200280594").PN.	(US-PGPUB; USPAT; USOCR)	OR	OFF	OFF	2021/09/10 05:23 PM
L54	31	("10469554" OR "10469555" OR "10757156" OR "10951680" OR "20020002708" OR "20020044528" OR "20020131496" OR "20030061305" OR "20030067872" OR "20030067875" OR "20030072376" OR "20030152036" OR "20030236906" OR "20040202109" OR "20040260827" OR "20050177618" OR "20080086570" OR "5414455" OR "5867230" OR "5941951" OR "5996025" OR "6292834" OR "6389473" OR "6490627" OR "6498897" OR "6637031" OR "7047307" OR "7386627" OR "8711701" OR "8818127" OR "9407564").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 11:11 AM
L55	0	streamlet SAME bit$2rates AND low SAME medium SAME	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:16 PM

		high near2 (stream bit$2rate) AND @rlad<"20040430"					
L56	39	streamlet SAME bit$2rates AND low SAME medium SAME high near2 (stream bit$2rate)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:16 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N43	84	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple)	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 11:31 AM
N44	42	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate) (multiple near2 bit$2rate))	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 11:32 AM
N45	69	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:08 PM
N46	22	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration with bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:08 PM
N47	0	file with portion near2 stream near3 duration with bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:14 PM
N48	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple)	(US-PGPUB; USPAT)	OR	ON	ON	2021/09/10 12:15 PM

		and @rlad<"20040205"					
N49	39	streamlet SAME bit$2rates AND low SAME medium SAME high near2 (stream bit$2rate)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:17 PM
N50	34	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate) (multiple near2 bit$2rate)) AND low SAME medium SAME high	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 12:23 PM
N51	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate)multiple) AND @rlad<"20040430"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 01:52 PM
N52	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) AND streamlet near3 encod$3 AND ((multi NEAR bit$2rate)multiple) AND @rlad<"20040430"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/15 01:52 PM

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5414455	A	1995-05-09	HOOPER Donald F et al.	
	2	5867230	A	1999-02-02	WANG Feng Chi et al.	
	3	5941951	A	1999-08-24	DAY Michael Norman et al.	
	4	5996025	A	1999-11-30	DAY Michael Norman et al.	
	5	6292834	B1	2001-09-18	RAVI et al.	
	6	6389473	B1	2002-05-14	CARMEL et al.	
	7	6490627	B1	2002-12-03	KALRA et al.	
	8	6498897	B1	2002-12-24	NELSON et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	9	6637031	B1	2003-10-21	CHOU	
	10	7047307	B2	2006-05-16	LI	
	11	7386627	B1	2008-06-10	LANGO et al.	
	12	8711701	B2	2014-04-29	JU	
	13	8818127	B2	2014-08-26	HAYATA et al.	
	14	9407564	B2	2016-08-02	MAJOR et al.	
	15	10469554	B2	2019-11-05	BRUECK et al.	
	16	10469555	B2	2019-11-05	BRUECK et al.	
	17	10757156	B2	2020-08-25	MAJOR et al.	
	18	10951680	B2	2021-03-16	BRUECK et al.	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020002708	A1	2002-01-03	ARYE	
	2	20020044528	A1	2002-04-18	POGREBINSKY et al.	
	3	20020131496	A1	2002-09-19	VASUDEVAN et al.	
	4	20030061305	A1	2003-03-27	COPLEY et al.	
	5	20030067872	A1	2003-04-10	HARRELL et al.	
	6	20030067875	A1	2003-04-10	YOSHIDA et al.	
	7	20030072376	A1	2003-04-17	KRISHNAMACHARI et al.	
	8	20030152036	A1	2003-08-14	QUIGG Brown et al.	
	9	20030236906	A1	2003-12-25	KLEMETS et al.	
	10	20040202109	A1	2004-10-14	AKIYAMA et al.	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	11	20040260827	A1	2004-12-23	WANG	
	12	20050177618	A1	2005-08-11	ZIMLER et al.	
	13	20080086570	A1	2008-04-10	DEY et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1394973	EP	B1	2010-05-26	MATSUSHITA ELECTRIC IND CO LTD		
	2	03041413	WO	A1	2003-05-15	PA CONSULTING SERVICES LIMITED		
	3	2005000116	KR	A	2005-01-06	SAMSUNG ELECTRONICS CO LTD		
	4	0245372	WO	A3	2002-09-06	BRITISH TELECOMMUNICATION PUBLIC LTD CO		
	5	2006086717	WO	A1	2006-08-17	VIDIATOR ENTERPRISES INC.		
	6	2004057832	WO	A1	2004-07-08	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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	Attorney Docket Number	066.0141X1C9

	7	2004021668	WO	A1	2004-03-11	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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NON-PATENT LITERATURE DOCUMENTS [Remove]

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	12/15/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39,928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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	38	DISH - Respondent's Joint Disclosure of Supplemental Invalidity Contentions in Response to Individual Interrogatories.	
	39	MIRROR - RESPONDENTS LULULEMON ATHLETICA INC. and CURIOUSER PRODUCTS INC. d/b/a MIRROR FIRST AMENDED RESPONSE TO COMPLAINT UNDER SECTION 337 OF THE TARIFF ACT OF 1930, AS AMENDED, STATEMENT OF PUBLIC INTEREST AND NOTICE OF INSTITUTION OF INVESTIGATION.	
	40	PELOTON - RESPONDENT PELOTON INTERACTIVE, INC.'S FIRST AMENDED RESPONSE TO COMPLAINT AND TO NOTICE OF INVESTIGATION	
	41	ICON - RESPONDENTS' JOINT DISCLOSURE OF INITIAL INVALIDITY CONTENTIONS IN RESPONSE TO INDIVIDUAL INTERROGATORIES	
	42	RESPONDENTS' NOTICE OF PRIOR ART	
	43	ICON and Free Motion Fitness, Inc. VERIFIED RESPONSE OF ICON HEALTH & FITNESS, INC., FREE MOTION FITNESS, INC., AND NORDICTRACK, INC. TO COMPLAINT OF DISH DBS CORPORATION, DISH TECHNOLOGIES L.L.C., AND SLING TV L.L.C. AND TO NOTICE OF INVESTIGATION	

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EXAMINER SIGNATURE			
Examiner Signature	/CHIRAG R PATEL/	Date Considered	12/15/2021

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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39,928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carslson	Registration Number	39,928

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	**11/17/2021 12:14:49 PM ET**	**066.0141X1C9**

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60403498	FILING DATE	05/18/2020
CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 65

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
20211117_IDS-NPLsList2_066-0141.pdf	6	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
20211117_IDS-NPLsList3_066-0141.pdf	7	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
20211117_IDSCertStmnt_066-0141.pdf	1	Transmittal Letter	123 KB
NPL4_BillGatesUnveils.pdf	7	Non Patent Literature	6820 KB
NPL5_DarwinStreamingServer.pdf	3	Non Patent Literature	2541 KB

NPL6_IBMGoesStraightToVideo.pdf	3	Non Patent Literature	3621 KB
NPL1_ANewAdaptive-Muntean.pdf	10	Non Patent Literature	3080 KB
NPL2_AkamaiBuysInterVu.pdf	3	Non Patent Literature	4054 KB
NPL3_AkamaiCompletesAcquisition.pdf	2	Non Patent Literature	3045 KB
NPL11_MacromediaDelivers.pdf	5	Non Patent Literature	8889 KB
NPL12_MacromediaFlash.pdf	2	Non Patent Literature	5290 KB
NPL13_MoveNetworks.pdf	3	Non Patent Literature	3493 KB
NPL7_IBMVideoCharger.pdf	2	Non Patent Literature	2272 KB
NPL8_IntelligentStreaming.pdf	5	Non Patent Literature	12677 KB
NPL9_InterVu&Excalibr.pdf	2	Non Patent Literature	453 KB
NPL19_SandpiperNetworksSignsPartnerDeals.pdf	2	Non Patent Literature	2298 KB
NPL16_RealNetwordsTestsG2.pdf	2	Non Patent Literature	2519 KB
NPL15_Rate-Distortion-Chou.pdf	10	Non Patent Literature	11502 KB
NPL18_RealSystemG2ProductionGuideBETA.pdf	130	Non Patent Literature	16108 KB
NPL17_RealNetworksProductionGuide.pdf	662	Non Patent Literature	15717 KB

NPL14_QuickTime6Summary.pdf	15	Non Patent Literature	22193 KB
NPL20_StreamingMediaDemystified-Pt3--.pdf	145	Non Patent Literature	16898 KB
NPL21_StreamingVideoFromEndToEnd.pdf	9	Non Patent Literature	15756 KB
NPL22_TheFallOfMoveNetworks.pdf	3	Non Patent Literature	4187 KB
NPL23_VideoCoding.pdf	13	Non Patent Literature	5349 KB
NPL20_StreamingMediaDemystified-Pt1--.pdf	200	Non Patent Literature	23606 KB
NPL20_StreamingMediaDemystified-Pt2--.pdf	200	Non Patent Literature	23321 KB
ExhibitA-5_DISH_564_156ClaimChart-Durrant.pdf	37	Non Patent Literature	382 KB
ExhibitA-6_DISH_564_156ClaimChart-Gentric.pdf	271	Non Patent Literature	1920 KB
ExhibitA-1_DISH_564_156ClaimChart-AkiyamaCombined.pdf	135	Non Patent Literature	1007 KB
ExhibitA-2_DISH_564_156ClaimChart-AryeUS20020002708A1.pdf	166	Non Patent Literature	1374 KB
ExhibitA-3_DISH_564_156ClaimChart-Carmel.pdf	163	Non Patent Literature	955 KB

ExhibitA-4_DISH_564_156ClaimChart-Chou_031.pdf	47	Non Patent Literature	489 KB
ExhibitA-11_DISH_564_156ClaimChart-QuickTimeChanges.pdf	25	Non Patent Literature	258 KB
ExhibitA-12_DISH_564_156ClaimChart-Quicktime.pdf	24	Non Patent Literature	236 KB
ExhibitA-13_DISH_564_156ClaimChart-RaviUS6292834.pdf	43	Non Patent Literature	559 KB
ExhibitA-7_DISH_564_156ClaimChart-KitamuraUnified3.pdf	154	Non Patent Literature	1055 KB
ExhibitA-8_DISH_564_156ClaimChart-Klemets.pdf	95	Non Patent Literature	678 KB
ExhibitA-9_DISH_564_156ClaimChart-OplayoEP1298931.pdf	108	Non Patent Literature	737 KB
ExhibitA-10_DISH_564_156ClaimChart-QOAS.pdf	35	Non Patent Literature	9048 KB
ExhibitA-16_DISH_564_156ClaimChart-Wang_230.pdf	33	Non Patent Literature	348 KB
ExhibitA-17_DISH_564_156ClaimChart-Wu.pdf	41	Non Patent Literature	407 KB

ExhibitA-19_DISH_564_156ClaimChart-Microsoft-sjz.pdf	166	Non Patent Literature	1185 KB
ExhibitA-14_DISH_564_156ClaimChart-RealOnePlayer.pdf	59	Non Patent Literature	7125 KB
ExhibitA-15_DISH_564_156ClaimChart-Walker.pdf	60	Non Patent Literature	573 KB
ExhibitB-3_DISH_554_680_555ClaimChart-Carmel.pdf	385	Non Patent Literature	1523 KB
ExhibitB-4_DISH_554_680_555ClaimChart-Chou_031.pdf	64	Non Patent Literature	532 KB
ExhibitB-5_DISH_554_680_555ClaimChart-Durrant.pdf	57	Non Patent Literature	409 KB
ExhibitB-6_DISH_554_680_555ClaimChart-Gentric-Pt1.pdf	300	Non Patent Literature	2030 KB
ExhibitB-1_DISH_554_680_555ClaimChart-AkiyamaCombined.pdf	360	Non Patent Literature	2121 KB
ExhibitB-2_DISH_554_680_555ClaimChart-AryeUS20020002708.pdf	358	Non Patent Literature	1949 KB
ExhibitB-11_DISH_554ClaimChart-QuickTimeChanges.pdf	56	Non Patent Literature	394 KB

ExhibitB-9_DISH_554ClaimChart-OplayoEP1298931.pdf	279	Non Patent Literature	1487 KB
ExhibitB-8_DISH_554ClaimChart KlemetsFINAL.pdf	322	Non Patent Literature	2101 KB
ExhibitB-7_DISH_554_KitamuraUnified3.pdf	510	Non Patent Literature	2966 KB
ExhibitB-6_DISH_554_680_555ClaimChart-Gentric-Pt2.pdf	399	Non Patent Literature	2609 KB
ExhibitB-10_DISH_554ClaimChart-QOAS.pdf	60	Non Patent Literature	3298 KB
ExhibitB-13_DISH_554ClaiChart-RaviUS6292834.pdf	60	Non Patent Literature	492 KB
ExhibitB-14_DISH_554ClaimChart-RealOnePlayer.pdf	79	Non Patent Literature	4618 KB
ExhibitB-15_DISH_554ClaimChart-Walker.pdf	70	Non Patent Literature	538 KB
ExhibitB-12_DISH_554ClaimChart-Quicktime.pdf	55	Non Patent Literature	371 KB
ExhibitB-19_DISH_554ClaimChart-DeyFINAL.pdf	155	Non Patent Literature	1072 KB
ExhibitB-	503	Non Patent Literature	2312 KB

20_DISH_554ClaimChart-Microsoft-sjz.pdf			
ExhibitB-16_DISH_554ClaimChart-Wang_230.pdf	56	Non Patent Literature	407 KB
ExhibitB-17_DISH_554ClaimChart-Wu.pdf	60	Non Patent Literature	438 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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NPL5_DarwinStreamingServer.pdf	A733D906470ED0C1B442DBF2C7E1353B7D6C2BF8C67363770F5AC036CF9327EC447879D0957B9891F844CA3049749E9DEA615EB67C2178278DB38376BD5EFA39
NPL6_IBMGoesStraightToVideo.pdf	83D34840251CDB7E0F8D410B7E55781582D66E3BFB458E3363A49716AC70C507CA373FDE6B0B9590504D754C2AB6EB74CF4145E25F78E5A7C9B5D301BEDBE4B9

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NPL20_StreamingMediaDemystified-Pt1--.pdf	174977178AC58A3E8003E2C9709060129B4A5CDA1B830146CA0FAFE5B9B3B17F38F196B63B1F765D77C74259A7B45E0E72E764B6382B525017365BF65C931BDA

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ExhibitA-5_DISH_564_156ClaimChart-Durrant.pdf	7D5BCCD7CBEBBEF3E91B04FC52E1A7FE93EF0DCDA28A555D6A791D16316A3B215D6E31104D31958404886ACD5D7394E5D1259E45AC70AFC1C2E42488068F1343
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ExhibitA-4_DISH_564_156ClaimChart-Chou_031.pdf	A88B70C4A4C4A341CE9AD659DC2DB1321936500064038754CB2DC9B1FAA81291063EDD4FC6CC4FC1C724392EAA7767D7D3349FCA9D06E41885760709B0CB5FA1
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ExhibitA-12_DISH_564_156ClaimChart-Quicktime.pdf	E7847929883094D05BD331EDA5F210B3DF81EF2CD3E26624F5F6E98BE3ABB57C6D89747975377A226644058F8D74A8B912F5E95856A19E807A9CBAE673685A3C
ExhibitA-13_DISH_564_156ClaimChart-RaviUS6292834.pdf	8A48AAD1E34D41E766151E719929A6B9B5691868C100B9BD5C95F6516F7D97BC124D904553F27B1E1BE4C2BDEBB6459D4B866EB77AB05384AB182258266322CA

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ExhibitA-8_DISH_564_156ClaimChart-Klemets.pdf	A0176F636A431B55B1CFE929A2ECD3840C8635DFF0A1AA8565F7AB880016C4EABAA3163EAAB6738A9E8622707E183B9AAF1B22CC8BF1C35EE06BE714A5301F36
ExhibitA-9_DISH_564_156ClaimChart-OplayoEP1298931.pdf	FDF546CB65FA6F897254CE105F1DBEE15B04CD345AAAE118DE58ABF3BC9663CCF9DDE296A1820CEC702C8BBFFD9128FCB782FFBCEC4ACB474579D3688B18095E
ExhibitA-10_DISH_564_156ClaimChart-QOAS.pdf	523B02C910A4DC73427198OB9772C27BD29E2829E14D771048BD728FFDB72DC5DC886D0B2E2A79C2D710AF1A9BF0F353DF7B2D2D23F6C5DF046519528ECCE4EE
ExhibitA-16_DISH_564_156ClaimChart-Wang_230.pdf	9CB2B846F54738D93D1F05ACD1BD53B07697C498F16A7B5846D2D24165C6D81B567869AC42CDC95CF151DC5847A534266A023E75B3699150CFDE7B8F36659F0B
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ExhibitA-19_DISH_564_156ClaimChart-Microsoft-sjz.pdf	91DE4F2282E54DDF7422AD946EF1495A911AEFBFC66DB5B81A2F2BC03467D603A77577968CA5C45C3CAED60D97152DBD7FFE17D99B0A4642D6102D67B5EF04EF
ExhibitA-14_DISH_564_156ClaimChart-RealOnePlayer.pdf	77AA2DED5FECB3E037460777AE2732016D2EAA932FC6CA759357583370487F2DDFB81588AF49ADFE363586409E347C6528F92A05271F2D123A148D02EE70258C
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ExhibitB-3_DISH_554_680_555ClaimChart-Carmel.pdf	0F5ABB0218FEA5A89C28E64C0A101C475F8836CA655FE7879FF25BA8953102E3304C28FE487A3F702B0AD6F49DA5D8D1B10725C4FB6CBCD64966D58E54BA2D93

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ExhibitB-5_DISH_554_680_555ClaimChart-Durrant.pdf	E9C6F529CEE992408DC3A977E5A66206BF833C5106357E7347577F515517D5CEFE2B4B1E42D68A436C1883F669604C3858DC027B209778F01816E270D322355B
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ExhibitB-8_DISH_554ClaimChart KlemetsFINAL.pdf	A090303A604A80F5D62CBB96D61A7F7F5CA62E34AD58FA95D7C2E67831C78093A32B517CE25286CDB0B4342B10E44960E6E92282F4E00C50BEC5E02AAA5023E8
ExhibitB-7_DISH_554_KitamuraUnified3.pdf	B23FCAFB3F2D66857FE9C228121A51DDBE6B70065FB386B83ECA0645DC81419195A0FF87C3FDD83F4C62F8908B5FA0A4F9C51424B7277A42D13D72517E086A3A
ExhibitB-6_DISH_554_680_555ClaimChart-Gentric-Pt2.pdf	CFBEC3CFB0C48BB71612B5667DDD4AD6030D818179A6F9BA87CA425AB86D0BA16975B0B25C2F1F2D4E45DD0B2876A5012F9E9C09276EC545F57F119476980 9B7

ExhibitB-10_DISH_554ClaimChart-QOAS.pdf	5B33781086CDC22AFDE2F0705C3DC1E5600E871B0D437AB5299AE77A562B5CFDF88AA6B56CC9ECCCB88050C08DDAAAC15F3A2BFF13116CCF2FE553EC1C56CE19
ExhibitB-13_DISH_554ClaiChart-RaviUS6292834.pdf	3D754E56463F5650D57C6B66867D8DBB218C0F93B6E4E510C1039D6A13825361F838C25541F7A6B75D2C4A2AC9A48A58A191A638361EFAF4C93F76213000B8AD
ExhibitB-14_DISH_554ClaimChart-RealOnePlayer.pdf	074EAB06A4AE58E14E944E1B2CB30BAC1F145BF30EEAB5A553FACBA4AD022324E470AF48C674ACB4FFD08FDAE864B37951C51FAC19894305A9ADE89048EF587B
ExhibitB-15_DISH_554ClaimChart-Walker.pdf	42A1A5F06B4B26530EA87838D527E09626BE9997F018C15D62C5F68C5D264A92818E68DACF909A67391911F0C052FE4684BABD169A5E4561152FF3F617686857
ExhibitB-12_DISH_554ClaimChart-Quicktime.pdf	DABE9A2A5A04A2B23BDADF31277402D1C678B5A12529D922EA4606814AACACE8AF37D61393A3D30BAC02276FB93B3B9DEBCCB5C74A143A20015D6E89BBB803E1
ExhibitB-19_DISH_554ClaimChart-DeyFINAL.pdf	EC8B2B8F00F14B830208AC063C62E77E18B1A46CE564912F5C3A5DC93353382975CF8F95251D84604DADE52592C5CF6D3A622F409088EF6E387434FA695F3C81
ExhibitB-20_DISH_554ClaimChart-Microsoft-sjz.pdf	BD5794CD9583512760CB915E457B14C99CA3B4C5616AB40F92ECBFA7C9093DC5769C449966AAD7B9346F2695E88D8F7A8810D1D9E1E905562413433D2B757047
ExhibitB-16_DISH_554ClaimChart-Wang_230.pdf	46BCFAFF47C89E9ED597A909EF687786D97B0D0494027C72DC6684B948AE1CA79BD44F6D7BFB7939BDD6C9952CB7A1D86C40BCEF4635E3F690E77CBC62BD8976
ExhibitB-17_DISH_554ClaimChart-Wu.pdf	32ACE078B1E886EEE25120CE351618C976B07A190872380174FA949FAE39FDFE6B0124631A812B3AB16B4F9DF622D0960505E8D9B9590E66E1BF0EA2F86236E6

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☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

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☐ Before the mailing date of a first Office Action on the merits. In the event that a first Office Action on the merits has been mailed, please consider this IDS under 37 C.F.R. 1.97(c) and see the statement under 1.97(e) or charge deposit account 50-2091 the fee specified by 37 C.F.R. 1.17(p) if such statement is not selected in Section IV.

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The undersigned hereby states that:

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☐ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this IDS.

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VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

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	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

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	1	MUNTEAN, G-M., "A New Adaptive Multimedia Streaming System for All-iP Multi-Service Networks", IEEE Trans. On Broadcasting, March 2004, pp. 1-10, Vol. 50, No. 1.	
	2	Akamai buys InterVu, February 7, 2000.	
	3	Akamai, Akamai Completes Acquisition of Speedera Networks	
	4	Bill Gates Unveils the Next Wave of Digital Media with Windows Media 9 Series, September 3, 2002.	
	5	Darwin Steaming Server Source Code Developer Notes, June 15, 2021, Darwin Steaming Server 2	
	6	IBM Goes Straight to Video - CNET, June 15, 2021	
	7	News in Brief: IBM VideoCharger, December 18, 1996	
	8	BIRNEY, "Intelligent Streaming", May 21, 2021	
	9	InterVu & Excalibur Partner to Deliver Live Internet Newscasts - Bloomberg, December 9, 1999.	
	10	Introduction to Streaming Media with RealOne Player, October 1, 2002.	
	11	Macromedia Delivers Macromedia Flash Communication Server MX Breakthrough server unifies communications and applications to deliver live, human interactions on the Internet, July 9, 2002.	

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	12	Press Releases: Macromedia Flash Media Server 2 Now Available. Flash Media Server 2 Brings the Power of the Flash Platform to Web Video.	
	13	Move Networks: The Story of a Failure - GigaOm	
	14	QuickTime 6: Summary of Changes and Enhancements	
	15	CHOU, et al., "Rate-Distortion Optimized Receiver-Driven Streaming over Best-Effort Networks", IEEE Fourth Workshop on Multimedia Signal Processing, 3 October 2001, pp. 1-10	
	16	FESTA P., RealNetworks tests G2, July 13, 1998.	
	17	RealNetworks Production Guide, with RealOne Player, October 1, 2002.	
	18	RealSystem G2 Production Guide BETA 1 Release	
	19	Sandpiper Networks Signs Partner Deals - InternetNews, October 7, 1999.	
	20	TOPIC, M. "Streaming Media Demystified", McGraw-Hill TELECOM, 2002	
	21	GALLAGHER, B., "Streaming Video From End to End", ITProToday, Compute Engines, Feb. 28, 1999	
	22	Move Networks: The Fall of Move Networks, Jan. 26, 2010.	

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	23	CONKLIN, G.J., et al. "Video Coding for Streaming Media Delivery on the Internet", IEEE Trans. on Circuits and Systems for Video Technology, March 3, 2001, pp. 281, Vol. 11. No 3.

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	Examiner Name	Chirag R. Patel
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☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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	1	5414455	A	1995-05-09	HOOPER Donald F et al.	
	2	5867230	A	1999-02-02	WANG Feng Chi et al.	
	3	5941951	A	1999-08-24	DAY Michael Norman et al.	
	4	5996025	A	1999-11-30	DAY Michael Norman et al.	
	5	6292834	B1	2001-09-18	RAVI et al.	
	6	6389473	B1	2002-05-14	CARMEL et al.	
	7	6490627	B1	2002-12-03	KALRA et al.	
	8	6498897	B1	2002-12-24	NELSON et al.	

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	9	6637031	B1	2003-10-21	CHOU	
	10	7047307	B2	2006-05-16	LI	
	11	7386627	B1	2008-06-10	LANGO et al.	
	12	8711701	B2	2014-04-29	JU	
	13	8818127	B2	2014-08-26	HAYATA et al.	
	14	9407564	B2	2016-08-02	MAJOR et al.	
	15	10469554	B2	2019-11-05	BRUECK et al.	
	16	10469555	B2	2019-11-05	BRUECK et al.	
	17	10757156	B2	2020-08-25	MAJOR et al.	
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	1	20020002708	A1	2002-01-03	ARYE	
	2	20020044528	A1	2002-04-18	POGREBINSKY et al.	
	3	20020131496	A1	2002-09-19	VASUDEVAN et al.	
	4	20030061305	A1	2003-03-27	COPLEY et al.	
	5	20030067872	A1	2003-04-10	HARRELL et al.	
	6	20030067875	A1	2003-04-10	YOSHIDA et al.	
	7	20030072376	A1	2003-04-17	KRISHNAMACHARI et al.	
	8	20030152036	A1	2003-08-14	QUIGG Brown et al.	
	9	20030236906	A1	2003-12-25	KLEMETS et al.	
	10	20040202109	A1	2004-10-14	AKIYAMA et al.	

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	11	20040260827	A1	2004-12-23	WANG	
	12	20050177618	A1	2005-08-11	ZIMLER et al.	
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	3	2005000116	KR	A	2005-01-06	SAMSUNG ELECTRONICS CO LTD		
	4	0245372	WO	A3	2002-09-06	BRITISH TELECOMMUNICATION PUBLIC LTD CO		
	5	2006086717	WO	A1	2006-08-17	VIDIATOR ENTERPRISES INC.		
	6	2004057832	WO	A1	2004-07-08	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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	7	2004021668	WO	A1	2004-03-11	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carlson	Registration Number	39,928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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(71) Applicant *(for all designated States except US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **VAN DER SCHAAR, Mihaela** [US/US]; P.O. Box 3001, Briarcliff Manor, NY 10510-8001 (US). **LI, Qiong** [US/US]; P.O. Box 3001, Briarcliff Manor, NY 10510-8001 (US).

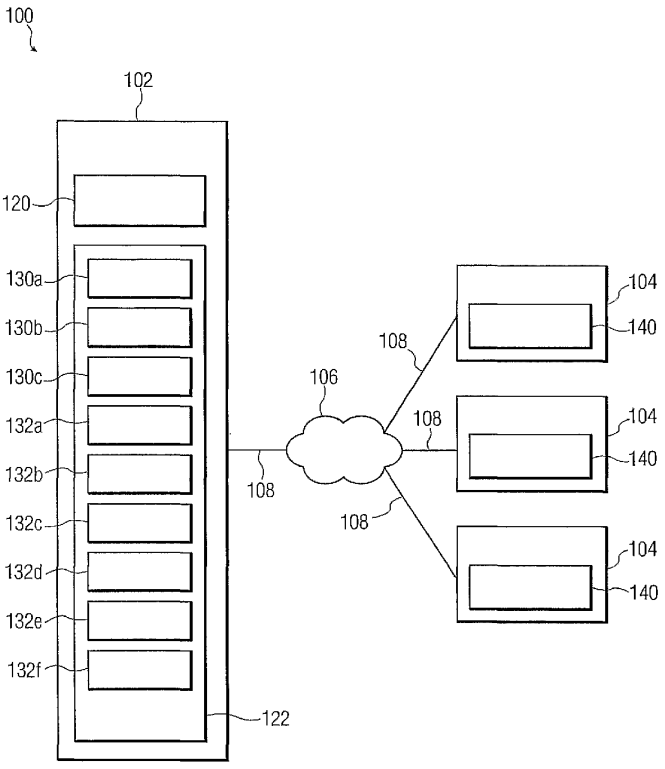
(74) Common Representative: **KONINKLIJKE PHILIPS ELECTRONICS N.V.**; c/o BELK, Michael, P.O. Box 3001, Briarcliff Manor, NY 10510-8001 (US).

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(54) Title: MULTI-TRACK HINTING FOR RECEIVER-DRIVEN STREAMING SYSTEM



(57) Abstract: A receiver-driven streaming method is provided. The method includes receiving an original coded video stream from a transmitter 102 at a receiver 104. An available bit rate is measured at the receiver 104. A request for a different coded video stream and a switching stream is sent from the receiver 104 to the transmitter 102 based on the available bit rate. The requested switching stream is received from the transmitter 102 at the receiver 104. The requested coded video stream is received from the transmitter 102 at the receiver 104.Switching streams 132a-132f are stored separately from coded video streams 130a-130c, and each switching stream 132a-132f and coded video stream 130a-130c is stored in a separate track from each other. In this way, switching streams 132a-132f may be generated offline. Also, the receiver 104 controls the streams provided by the transmitter 102 by requesting specific switching streams 132a-132f and coded video streams 130a-103c.

WO 2004/057832 A1

Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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MULTI-TRACK HINTING FOR RECEIVER-DRIVEN STREAMING SYSTEM

The present invention relates generally to multi-track hinting and streaming systems and, more particularly, to a multi-track hinting for receiver-driven streaming system for non-scalable video coding using switching frames and method.

With the rapid development of broadband Internet technologies, video streaming is envisioned to become the dominant Internet application in the near future. Similarly, the falling cost of wireless local area network (WLAN) products has led to their increased use in consumer homes. Also, although currently most WLANs are predominantly used for data transfer, the higher bandwidth provided by new WLAN technologies, such as IEEE 802.11a and IEEE 802.11g, may ultimately lead to their increasing use for video transmission. Furthermore, future wireless video applications will have to work over an open, layered, Internet-style network with a wired backbone and wireless extensions. Therefore, common protocols will have to be used for transmission across both the wired and wireless portions of the network. These protocols will most likely be future extensions of the existing protocols that are based on the Internet Protocol (IP).

Consequently, due to the inherent resource sharing nature of the Internet and wireless networks, multimedia communications of the future will mainly use variable bandwidth channels. Hence, if streaming of video content is performed over this type of network, the instantaneous data rate must frequently be tailored to fit the available resources. This can be achieved in a very flexible way by the approach of scalable coding. Scalable video-coding schemes are able to provide a simple and flexible framework for transmission over heterogeneous networks.

However, in order to provide the required adaptation to bandwidth variations, device characteristics and user requirements, multiple non-scalable video coding with a different data rate needs to be transmitted using an appropriate streaming architecture. The MPEG-4 Systems Group has developed and standardized the streaming strategy for non-scalable coded video over IP networks. However, this strategy is unable to efficiently adapt to channel conditions, complexity constraints and user preferences. In addition, conventional systems such as these require the

transmitter to be responsible for inserting the correct switching frames into the video stream to accomplish smooth switching.

In accordance with the present invention, a multi-track hinting for receiver-driven streaming system for non-scalable video coding using switching frames and method are provided that substantially eliminate or reduce disadvantages and problems associated with conventional systems and methods. In particular, each receiver may independently adapt its received video optimally to its own perceived network conditions.

According to one embodiment of the present invention, a receiver-driven streaming method is provided. The method includes receiving an original coded video stream from a transmitter at a receiver. An available bit rate is measured at the receiver. A request for a different coded video stream and a switching stream is sent from the receiver to the transmitter based on the available bit rate. The requested switching stream is received from the transmitter at the receiver. The requested coded video stream is received from the transmitter at the receiver.

According to another embodiment of the present invention, a receiver-driven streaming method is provided that includes transmitting an original coded video stream from a transmitter to a receiver. A request for a different coded video stream and a switching stream is received from the receiver at the transmitter. The requested switching stream is transmitted from the transmitter to the receiver. The requested coded video stream is transmitted from the transmitter to the receiver.

Technical advantages of one or more embodiments of the present invention include providing an improved streaming system. In a particular embodiment, coded video streams at different bit rates and switching streams are stored in separate tracks. In this way, a receiver-driven streaming system is provided that may respond more quickly to network changes than a transmitter-driven streaming system, thereby achieving better performance. This is due to the ability of each receiver to independently adapt its received video optimally to its own perceived network conditions.

Other technical advantages will be readily apparent to one skilled in the art from the following figures, description, and claims.

Webgroup CZ a.s. Ex. 1002, Page 266 of 1406

Before undertaking the DETAILED DESCRIPTION, it may be advantageous to set forth definitions of certain words and phrases used throughout this patent document: the terms "include" and "comprise," as well as derivatives thereof, mean inclusion without limitation; the term "or," is inclusive, meaning and/or; the phrases "associated with" and "associated therewith," as well as derivatives thereof, may mean to include, be included within, interconnect with, contain, be contained within, connect to or with, couple to or with, be communicable with, cooperate with, interleave, juxtapose, be proximate to, be bound to or with, have, have a property of, or the like; and the term "controller" means any device, system or part thereof that controls at least one operation, such a device may be implemented in hardware, firmware or software, or some combination of at least two of the same. It should be noted that the functionality associated with any particular controller may be centralized or distributed, whether locally or remotely. In particular, a controller may comprise one or more data processors, and associated input/output devices and memory, that execute one or more application programs and/or an operating system program. Definitions for certain words and phrases are provided throughout this patent document, those of ordinary skill in the art should understand that in many, if not most instances, such definitions apply to prior, as well as future uses of such defined words and phrases.

For a more complete understanding of the present invention and its advantages, reference is now made to the following description taken in conjunction with the accompanying drawings, wherein like reference numerals represent like parts, in which:

FIGURE 1 is a block diagram illustrating a receiver-driven streaming system in accordance with one embodiment of the present invention;

FIGURES 2A-B are block diagrams illustrating a multi-track hinting file format in accordance with one embodiment of the present invention;

FIGURE 3 is a flow diagram illustrating a receiver-driven streaming method from the perspective of the transmitter of FIGURE 1 in accordance with one embodiment of the present invention; and

Webgroup CZ a.s. Ex. 1002, Page 267 of 1406

FIGURE 4 is a flow diagram illustrating a receiver-driven streaming method from the perspective of one of the receivers of FIGURE 1 in accordance with one embodiment of the present invention.

FIGURES 1 through 4, discussed below, and the various embodiments used to describe the principles of the present invention in this patent document are by way of illustration only and should not be construed in any way to limit the scope of the invention. Those skilled in the art will understand that the principles of the present invention may be implemented in any suitably arranged streaming system.

FIGURE 1 is a block diagram illustrating a receiver-driven streaming system 100 in accordance with one embodiment of the present invention. The system 100 comprises a transmitter 102, at least one receiver 104 and a network 106 for providing communication between the transmitter 102 and the receivers 104. It will be understood that the system 100 may comprise any other suitable components of a streaming system, such as other suitable servers coupled to the network 106, without departing from the scope of the present invention.

The transmitter 102 comprises a processor 120 and a memory 122. The processor 120 is operable to code video streams at different bit rates, store the coded video streams in separate tracks in the memory 122, generate switching streams for the coded video streams, and store the switching streams in separate tracks in the memory 122. The transmitter 102 is also operable to generate and store a hinting track (not illustrated in FIGURE 1) for each coded video stream and switching stream. The processor 120 is also operable to transmit the coded video streams and the switching streams to the receivers 104 through the network 106.

The memory 122 may comprise random access memory (RAM), a combination of RAM and read only memory (ROM), or any other suitable form of memory. According to one embodiment, the memory 122 may comprise a non-volatile RAM, such as flash memory. The memory 122 is operable to store a plurality of coded video streams 130 and a plurality of switching streams 132.

For the illustrated embodiment, the memory 122 stores three coded video streams 130: one coded video stream 130a at a first bit rate (CVS-BR1), one coded video stream 130b at a second bit rate (CVS-BR2), and one coded video stream 130c at a third bit rate (CVS-BR3). In addition, the illustrated memory 122 stores six

switching streams 132, one for each of the possible bit rate changes between the three bit rates for the three coded video streams 130. However, it will be understood that the memory 122 may store any suitable number of coded video streams 130 and switching streams 132 without departing from the scope of the present invention.

For example, even for an embodiment in which the memory 122 stores three coded video streams 130, the memory 122 may store only four switching streams 132a,c,d,f. For this embodiment, coded video streams 130 may only be changed to an adjacent coded video stream 130, instead of allowing the coded video stream 130a to be changed directly to the coded video stream 130c, for example. Thus, the coded video stream 130a would first be changed to the coded video stream 130b and then changed to the coded video stream 130c.

Each receiver 104 comprises a processor 140 that is operable to receive a coded video stream 130 from the transmitter 102 through the network 106, to measure the available bit rate for the receiver 104 from the network 106, and to request a switching stream 132 and a different coded video stream 130 from the transmitter 102 based on the available bit rate. Thus, each receiver 104 may independently optimize its video stream being provided by the transmitter 102 based on the network conditions for that receiver 104. As used herein, "each" means every one of at least a subset of the identified items.

In one embodiment, the network 106 comprises a packet data network, such as the Internet, or other suitable network. However, the network 106 may also comprise any interconnection found on any computer network such as a local area network (LAN), a wide area network (WAN), or any other communications and data exchange systems created by connecting two or more computers.

The transmitter 102 and the receivers 104 are operable to communicate with the network 106 over communication lines 108, which may be any type of communication link capable of supporting data transfer. In one embodiment, the communication lines 108 may comprise, alone or in combination, Integrated Services Digital Network (ISDN), Asymmetric Digital Subscriber Line (ADSL), T1 or T3 communication lines, hardwire lines, or telephone links. It will be understood that the communication lines 108 may comprise other suitable types of data communication

links. The communication lines 108 may also connect to a plurality of intermediate servers between the network 106 and the transmitter 102 and the receivers 104.

At least a portion of the transmitter 102 and/or the receiver 104 may comprise logic encoded in media. The logic comprises functional instructions for carrying out program tasks. The media comprises computer disks or other computer-readable media, application-specific integrated circuits, field-programmable gate arrays, digital signal processors, other suitable specific or general purpose processors, transmission media or other suitable media in which logic may be encoded and utilized.

FIGURES 2A-B are block diagrams illustrating a multi-track hinting file format 142 in accordance with one embodiment of the present invention. For description purposes, FIGURE 2A illustrates the file format 142 with respect to the coded video streams 130, while FIGURE 2B illustrates the file format 142 with respect to the switching streams 132. However, it will be understood that the file format 142 comprises the combination of the two illustrations.

The illustrated embodiment of the file format 142 corresponds to the embodiment in which the transmitter 102 stores three coded video streams 130 and six switching streams 132. Thus, it will be understood that the file format 142 may be altered so as to accommodate different numbers of coded video streams 130 and/or switching streams 132.

In addition to the three coded video streams 130, the file format 142 of FIGURE 2A comprises three hinting tracks 160. As indicated by the arrows, each hinting track 160 corresponds to one of the coded video streams 130.

Similarly, in addition to the six switching streams 132, the file format 142 of FIGURE 2B comprises six hinting tracks 162. As indicated by the arrows, each hinting track 162 corresponds to one of the switching streams 132. Thus, the combined file format 142 provides a separate hinting track 160, 162 for each of these streams 130, 132.

FIGURE 3 is a flow diagram illustrating a receiver-driven streaming method from the perspective of the transmitter 102 in accordance with one embodiment of the present invention. The method begins at step 200 where the transmitter 102 codes a video stream for transmission to the receiver 104. At step 202, the transmitter 102

stores the coded video stream 130 in the memory 122 and also stores the hinting track for the coded video stream 130.

At decisional step 204, a determination is made regarding whether or not all coded video streams 130 at all desired bit rates have been stored in the memory 122. If the video stream has not been coded and stored at all the desired bit rates, the method follows the No branch from decisional step 204 and returns to step 200 where the transmitter 102 codes the video stream at another bit rate and then to step 202 where the transmitter 102 stores the coded video stream 130 in a separate track from any other coded video stream 130 and also stores the hinting track for the coded video stream 130.

However, if the video stream has been coded and stored in separate tracks at all the desired bit rates, the method follows the Yes branch from decisional step 204 to step 206. At step 206, the transmitter 102 stores a switching stream 132 for switching between coded video streams 130 in the memory 122 and also stores the hinting track for the switching stream 132.

At decisional step 208, a determination is made regarding whether or not all desired switching streams 132 have been stored in the memory 122. If all the desired switching streams have not been stored, the method follows the No branch from decisional step 208 and returns to step 206 where the transmitter 102 stores another switching stream 132 for switching between additional coded video streams 130 in a separate track from any other switching stream 132 in the memory 122 and also stores the hinting track for the switching stream 132.

However, if all the desired switching streams have been stored in separate tracks, the method follows the Yes branch from decisional step 208 to step 210. At step 210, the transmitter 102 transmits an original coded video stream 130 to the receiver 104. In addition, the transmitter 102 transmits to the receiver 104 data to inform the receiver 104 of the different bit rates corresponding to the stored coded video streams 130.

At decisional step 212, a determination is made regarding whether or not a request for a different coded video stream 130 has been received from the receiver 104. In addition to the different coded video stream 130, the request comprises a request for the switching stream 132 that corresponds to the difference between the

original coded video stream 130 and the requested coded video stream 130. If no such request is received, the method follows the No branch from decisional step 212 and comes to an end. However, if such a request is received, the method follows the Yes branch from decisional step 212 to step 214.

At step 216, the transmitter 102 transmits the requested switching stream 132 to the receiver 104. At step 218, the transmitter 102 transmits the requested coded video stream 130 to the receiver 104, at which point the method returns to decisional step 212 to determine whether or not an additional request for another coded video stream 130 has been received.

FIGURE 4 is a flow diagram illustrating a receiver-driven streaming method from the perspective of the receiver 104 in accordance with one embodiment of the present invention. The method begins at step 300 where the receiver 104 receives the original coded video stream 130 from the transmitter 102. In addition, the receiver 104 receives data that informs the receiver 104 of the different bit rates corresponding to the the coded video streams 130 stored in the transmitter 104. At step 302, the receiver 104 measures the available bit rate for the receiver 104 from the network 106.

At decisional step 304, a determination is made regarding whether or not the receiver 104 should request a switch in bit rates for the coded video stream 130 based on the available bit rate. If the receiver 104 decides not to request a switch in bit rates, the method follows the No branch from decisional step 304 and returns to step 302 where the available bit rate continues to be measured. However, if the receiver 104 decides to request a switch in bit rates, the method follows the Yes branch from decisional step 304 to step 306.

At step 306, the receiver 104 sends a request for a different coded video stream 130 to the transmitter 102, with the requested coded video stream 130 based on the available bit rate. In addition to the different coded video stream 130, the request comprises a request for the switching stream 132 that corresponds to the difference between the original coded video stream 130 and the requested coded video stream 130. At step 308, the receiver 104 receives the requested switching stream 132 from the transmitter 102. At step 310, the receiver 104 receives the requested coded

Webgroup CZ a.s. Ex. 1002, Page 272 of 1406

video stream 130, after which the method returns to step 302 where the available bit rate continues to be measured.

Although the present invention has been described with several embodiments, various changes and modifications may be suggested to one skilled in the art. It is intended that the present invention encompass such changes and modifications as fall within the scope of the appended claims.

Webgroup CZ a.s. Ex. 1002, Page 273 of 1406

CLAIMS:

1. A receiver-driven streaming method, comprising:

receiving an original coded video stream from a transmitter at a receiver;

measuring an available bit rate at the receiver;

sending a request for a different coded video stream and a switching stream based on the available bit rate from the receiver to the transmitter;

receiving the requested switching stream from the transmitter at the receiver; and

receiving the requested coded video stream from the transmitter at the receiver.

2. The method of Claim 1, the receiver and the transmitter coupled to each other through a network.

3. The method of Claim 1, the transmitter operable to store at least three coded video streams and at least four switching streams for each of a plurality of video streams.

4. The method of Claim 1, the transmitter operable to store at least three coded video streams and at least six switching streams for each of a plurality of video streams.

5. A receiver-driven streaming method, comprising:

transmitting an original coded video stream from a transmitter to a receiver;

receiving a request for a different coded video stream and a switching stream from the receiver at the transmitter;

transmitting the requested switching stream from the transmitter to the receiver; and

transmitting the requested coded video stream from the transmitter to the receiver.

6. The method of Claim 5, further comprising:

coding a plurality of video streams at a plurality of bit rates at the transmitter; and

storing each of the coded video streams in a separate track at the transmitter.

7. The method of Claim 6, further comprising transmitting from the transmitter to the receiver data to inform the receiver of the plurality of bit rates corresponding to the stored coded video streams.

8. The method of Claim 5, further comprising storing each of a plurality of switching streams in a separate track at the transmitter.

9. The method of Claim 5, further comprising storing in separate tracks at the transmitter at least three coded video streams and at least four switching streams for each of a plurality of video streams.

10. The method of Claim 5, further comprising storing in separate tracks at the transmitter at least three coded video streams and at least six switching streams for each of a plurality of video streams.

11. A receiver-driven streaming system, comprising:

a computer-processable medium; and

logic stored on the computer-processable medium, the logic operable to receive an original coded video stream, to measure an available bit rate, to send a request for a different coded video stream and a switching stream based on the available bit rate, to receive the requested switching stream, and to receive the requested coded video stream.

Webgroup CZ a.s. Ex. 1002, Page 275 of 1406

12. A receiver-driven streaming system, comprising:

a computer-processable medium; and

logic stored on the computer-processable medium, the logic operable to transmit an original coded video stream, to receive a request for a different coded video stream and a switching stream, to transmit the requested switching stream, and to transmit the requested coded video stream.

13. The system of Claim 12, the logic further operable to code a plurality of video streams at a plurality of bit rates and to store each of the coded video streams in a separate track and to transmit data to inform a receiver of the plurality of bit rates corresponding to the stored coded video streams.

14. The system of Claim 12, the logic further operable to store each of a plurality of switching streams in a separate track.

15. The system of Claim 12, the logic further operable to store in separate tracks at least three coded video streams and at least four switching streams for each of a plurality of video streams.

16. The system of Claim 12, the logic further operable to store in separate tracks at least three coded video streams and at least six switching streams for each of a plurality of video streams.

17. A receiver-driven video stream, comprising:

an original coded video stream;

a different coded video stream and a switching stream requested by a receiver measuring an available bit rate at the receiver and sending a request for the different coded video stream and the switching stream based on the available bit rate.

18. The receiver-driven video stream of Claim 17, wherein the original coded video stream, the different coded video stream and the switching stream are selected from at least three coded video streams and at least four switching streams.

19. The receiver-driven video stream of Claim 17, wherein the original coded video stream, the different coded video stream and the switching stream are selected from at least three coded video streams and at least six switching streams.

20. The receiver-driven video stream of Claim 17, wherein streaming of the original coded video stream, the different coded video stream and the switching stream is based at least in part on one or more hinting tracks each corresponding to one of a plurality of coded video streams coded at different bit rates and one or more hinting tracks each corresponding to one of a plurality of switching streams for switching from a coded video stream at a first bit rate to a coded video stream at a second bit rate.

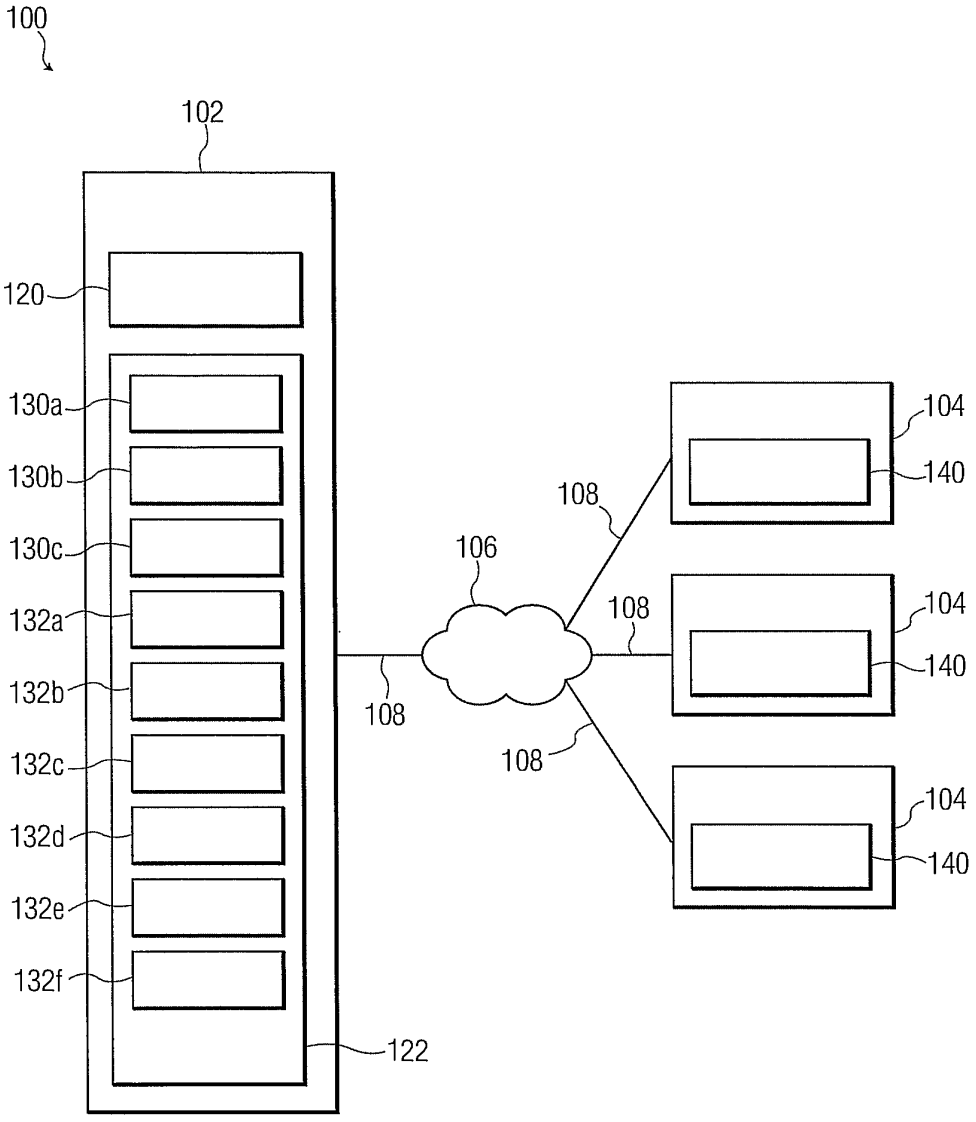

100
102
120
130a
130b
130c
132a
132b
132c
132d
132e
132f
122
108
106
108
108
108
104
140
104
140
104
140

FIG. 1

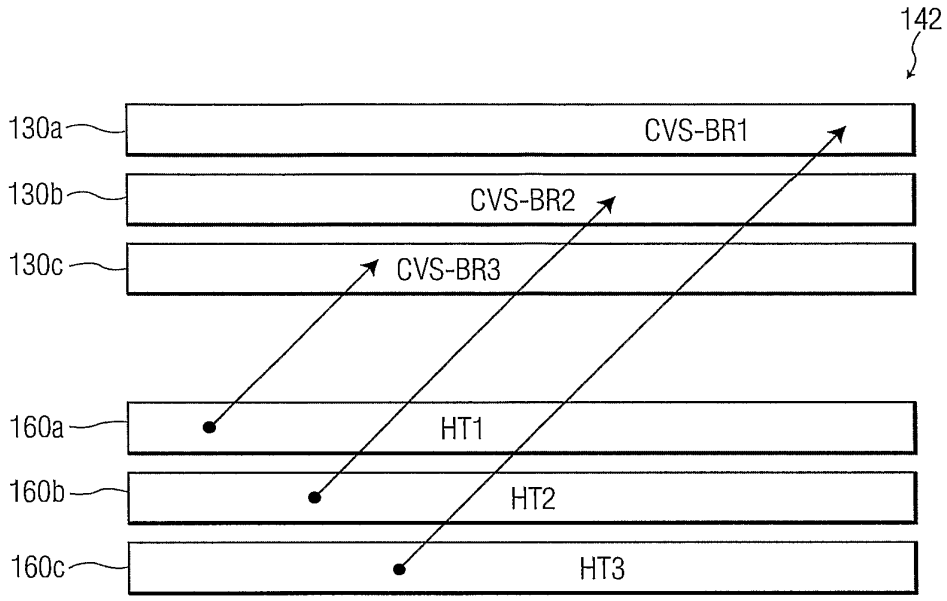

142
130a
CVS-BR1
130b
CVS-BR2
130c
CVS-BR3
160a
HT1
160b
HT2
160c
HT3

FIG. 2A

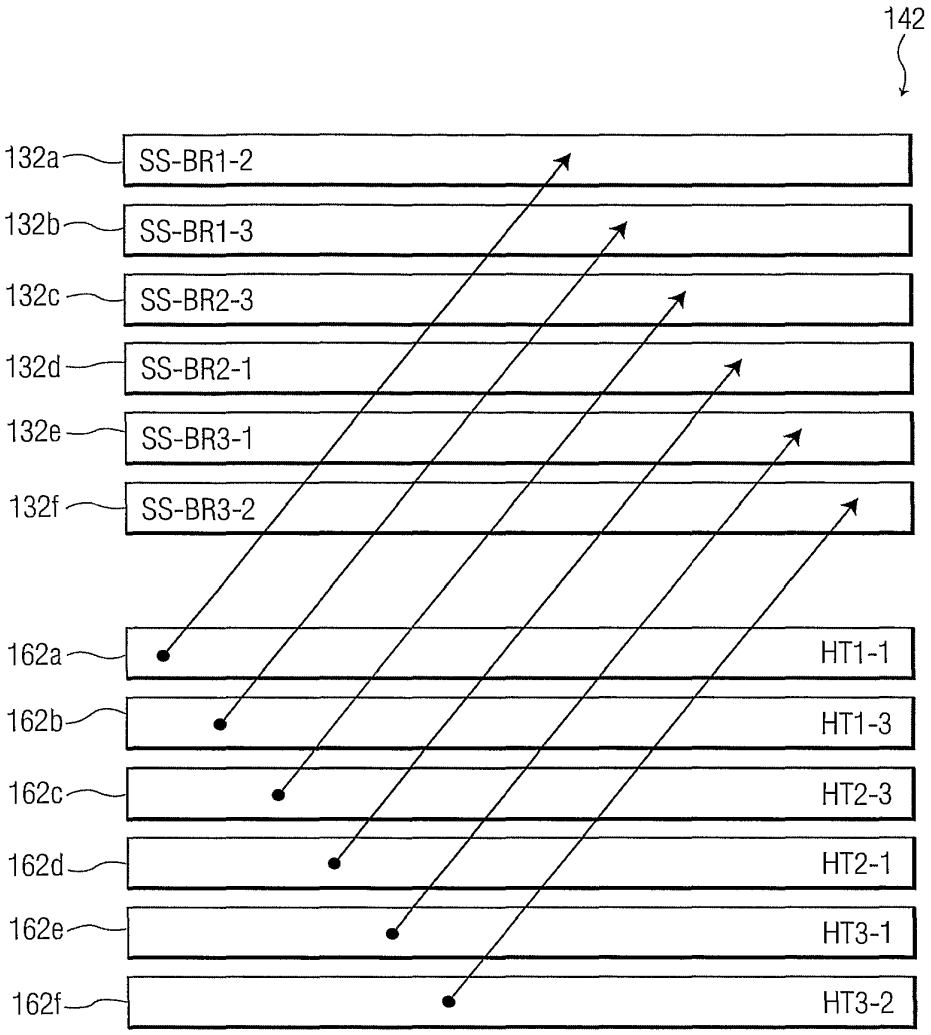

142
132a
SS-BR1-2
132b
SS-BR1-3
132c
SS-BR2-3
132d
SS-BR2-1
132e
SS-BR3-1
132f
SS-BR3-2
162a
HT1-1
162b
HT1-3
162c
HT2-3
162d
HT2-1
162e
HT3-1
162f
HT3-2

FIG. 2B

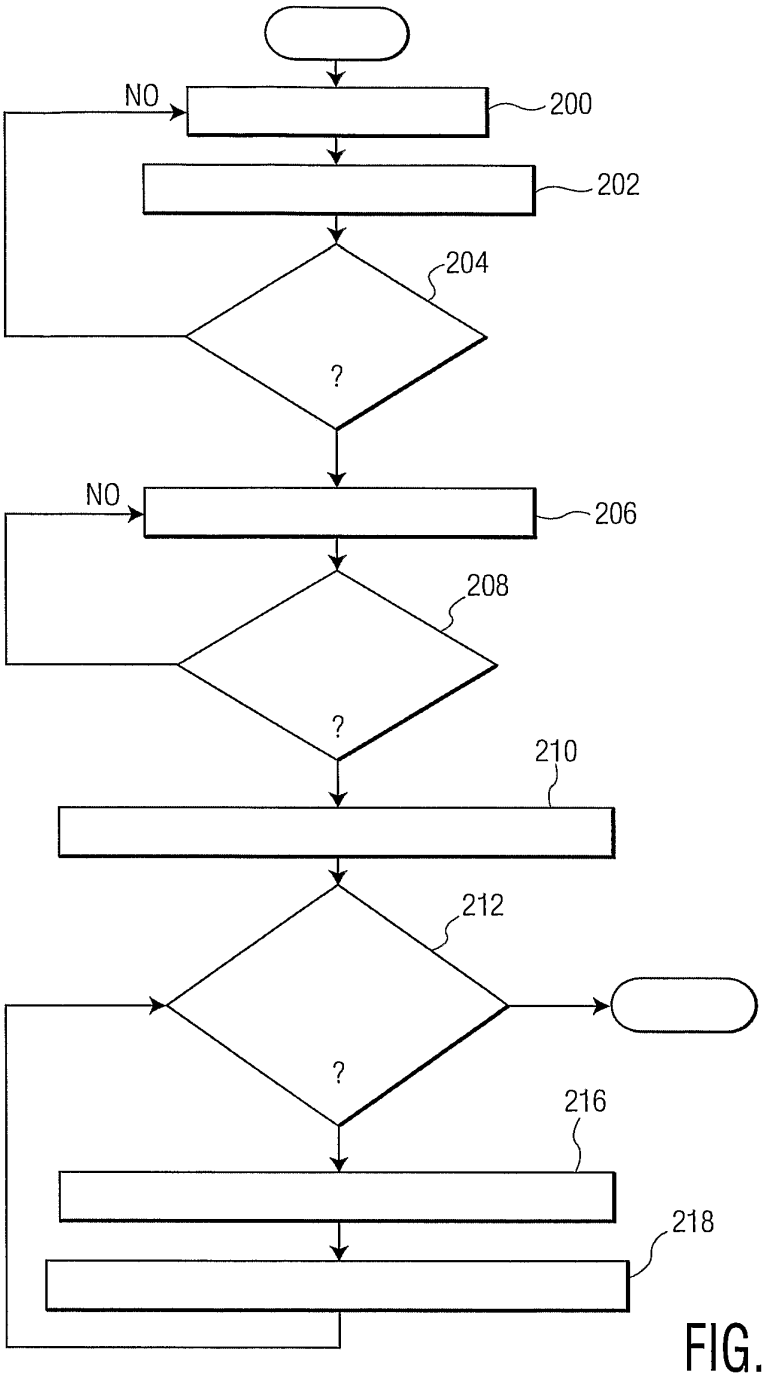


FIG. 3

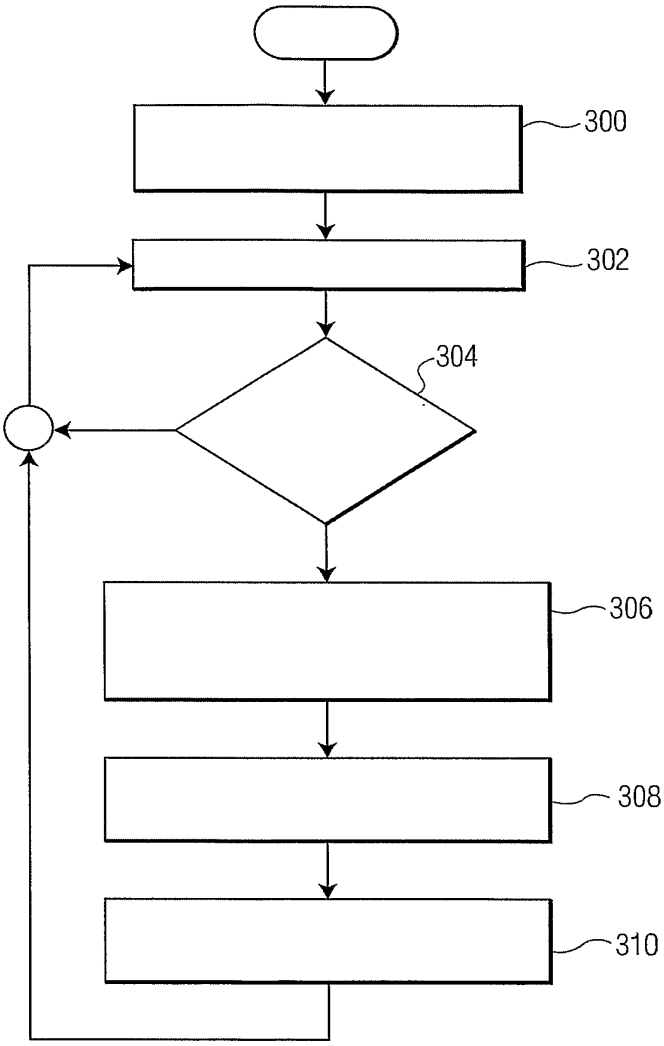


FIG. 4

INTERNATIONAL SEARCH REPORT

Internati pplication No
PCT/IB 03/06004

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/06 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, COMPENDEX, INSPEC, PAJ, IBM-TDB, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/002708 A1 (ARYE RAM) 3 January 2002 (2002-01-03) abstract page 1, paragraph 5 paragraph '0012! - paragraph '0013! page 2, paragraph 16 - paragraph 24 page 3, paragraph 36 -page 4, paragraph 39 page 5, paragraph 54 - paragraph 58 page 6, paragraph 67 - paragraph 69 claims 1,13; figures 1,3,5 ---	1-20
X	US 6 148 005 A (PANCHA PRAMOD ET AL) 14 November 2000 (2000-11-14) abstract column 1, line 61 -column 2, line 42 column 5, line 63 -column 6, line 30 column 7, line 33 -column 8, line 38 claim 1; figure 3 --- -/--	1-20

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 March 2004	22/03/2004

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

Webgroup CZ a.s. Ex. 1002, Page 283 of 1406

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	DE 101 01 075 A (GAP FILMS COMMERCIAL PRODUCTIO) 25 July 2002 (2002-07-25) abstract column 2, paragraph 16 -column 3, paragraph 17 column 4, paragraph 34 -column 5, paragraph 35 column 5, paragraph 40 claims 1,3,10; figures 1,4	1-20

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

Webgroup CZ a.s. Ex. 1002, Page 284 of 1406

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internatio plication No
PCT/IB 03/06004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002002708 A1	03-01-2002	AU 6529701 A	08-01-2002
		CN 1439227 T	27-08-2003
		EP 1297705 A1	02-04-2003
		JP 2004502356 T	22-01-2004
		WO 0201874 A1	03-01-2002
		AU 7017601 A	08-01-2002
		EP 1305944 A2	02-05-2003
		WO 0201782 A2	03-01-2002
		US 2002009143 A1	24-01-2002
US 6148005 A	14-11-2000	NONE	
DE 10101075 A	25-07-2002	DE 10101075 A1	25-07-2002

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(71) Applicant *(for all designated States except US)*: **PA CONSULTING SERVICES LIMITED** [GB/GB]; 123 Buckingham Palace Road, London SW1W 9SR (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DURRANT, Simon** [GB/GB]; 43 Withipoll Street, Ipswich, Suffolk IP4 2BZ (GB). **MULROY, Pat** [IE/GB]; 61 Cemetary Road, Ipswich, Suffolk IP4 2JA (GB). **YANG, Dekun** [CN/GB]; 24 Arreton Close, Leicester, Leicestershire LE2 3PP (GB).

(74) Agents: **DRIVER, Virginia, Rozanne** et al.; Page White & Farrer, 54 Doughty Street, London WC1N 2LS (GB).

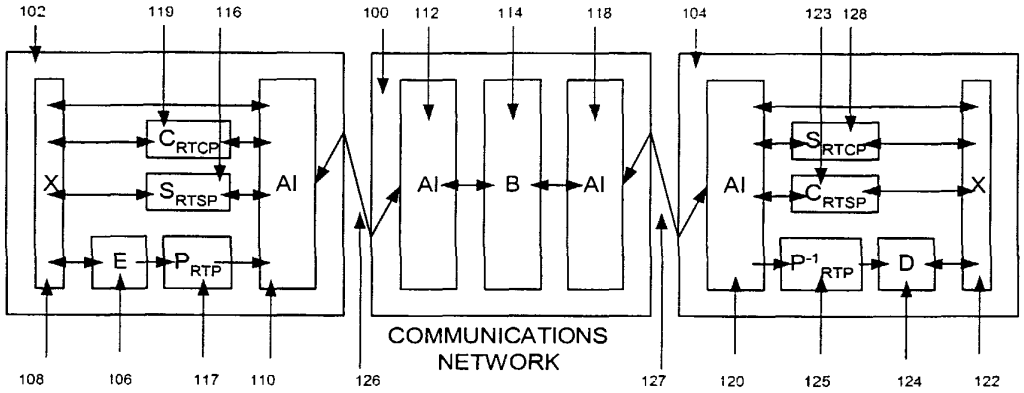
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ERROR CONTROL TO VIDEO ENCODER



(57) Abstract: A method of generating a compressed video data stream (CVDS) from a video stream, for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of: (a) determining values of one or more error rate parameters associated with the wireless channel; (b) determining values of one or more bit rate parameters associated with the wireless channel; (c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters; (d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

WO 03/041413 A1

ERROR CONTROL TO VIDEO ENCODER

FIELD OF THE INVENTION

The present invention relates to video streaming, and, more particularly, to the streaming of video data over a wireless communications network.

The invention has been developed primarily to allow video to be streamed in a UMTS or GPRS mobile telecommunications network using streamable formats such as MPEG-4 and H.263. However it will be appreciated by those skilled in the art that the invention is not limited to use with those particular standards

BACKGROUND TO THE INVENTION

Robust transmission of real time video data over wireless networks promises to be one of important applications of the wireless packet data services. Robustness is one of the key issues because a wireless network is a bandwidth-constrained as well as error-prone environment. Bandwidth constraint forces video data to be compressed into lower bit-rate video streams before it can be transmitted over a wireless mobile network. Channel errors in a wireless mobile network range from random bit errors to burst errors.

Existing video compression standards such as MPEG-4 and H.263 use three kinds of coding techniques: motion compensated prediction to encode temporal redundancy, Discrete Cosine Transform (DCT) with quantisation to encode spatial redundancy, and Variable-Length Code (VLC) for entropy encoding. These compression mechanisms are based on exploiting both the spatial dependency and temporal dependency which make the compressed video stream susceptive to any transmission errors. Both motion-compensation based predictive coding and VLC are sensitive to transmission errors. A single bit error can cause failure in VLC decoding. Use of predictive coding leads to error

propagation. Error resilient encoding is one of important issues in the reliable transmission of video data over noisy channels.

Existing video compression standards provide some error resilience to minimise the amount of data that has to be discarded whenever errors are detected: for example, the use of reversible VLC and the periodic insertion of resynchronisation markers so that the decoder regains synchronisation more quickly when transmission errors occur. Another mechanism is to increase the ratio of intra to inter-coding both at frame and block level to stop any residual error propagation at the expense of reducing the compression gain.

For real-time wireless streaming video applications, one of the key issues is how to achieve best possible encoding robustness under the bandwidth and time constraints of the wireless networks. Each wireless channel is associated with Quality of Service (QoS) parameters indicative of among other things the error rate parameters. During the transmission of video data between a transmitter and a receiver, QoS parameters vary with time randomly and asynchronously for the transmitter and the receiver. It is important for the transmitter to exploit wireless channel conditions and select appropriate error resilient mechanisms for successful end to end real time video transmission over the wireless channel.

It is the object of this invention to provide a method of making best use of error rate parameters associated with wireless channels for generating compressed video data stream with improved quality when transmitted over the wireless channels.

SUMMARY OF INVENTION

The present invention provides a method of generating a Compressed Video Data Stream (CVDS) for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of:

a) determining values of one or more error rate parameters associated with the wireless channel;
b) determining values of one or more bit rate parameters associated with the wireless channel;
c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters;
d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

In accordance with the described embodiment of the present invention, a CVDS transmitter in a mobile handset comprises an encoder controller and a prior art video encoder. Preferably the video encoder has several adjustable encoding parameters for altering the degree of error resilience of the generated CVDS. The encoder controller ascertains the error rate parameters associated with the wireless channel between the transmitter and the receiver, and derives the encoding parameters for generating the CVDS with improved error resilience while meeting the bandwidth constraints of the wireless channel.

The basic idea underlying the present invention is to make best use of error rate parameters associated with the wireless channels for generating CVDS with improved quality when transmitted over said wireless channels. The encoder controller may ascertain the error rate parameters from several sources. In an embodiment of the invention where the transmitter is a mobile transmitter and the receiver is a network receiver, the encoder controller can ascertain the error rate parameters associated with the wireless channel between the transmitter and the network from the air interface. In another embodiment of the invention where the transmitter is a network transmitter and the receiver is a mobile receiver, the encoder controller can ascertain the error rate parameters associated with the wireless channel between the network and the receiver. In yet another embodiment of the invention where a mobile transmitter transmits CVDS to a mobile receiver, the encoder controller can ascertain the error rate parameters from the two sources described above. The end to end feedback from the receiver and the transmitter is used to convey the information related to the error rate parameters.

In a preferred embodiment of the invention, the CVDS is packetised into IP format packet before being sent to the transmitter air interface. The IP packet is constructed by three wrapping operations respectively: (1) wrapping the CVDS in an RTP format packet, (2) wrapping the RTP packet in a UDP format packet, and (3) wrapping the UDP packet in a IP format packet.

The present invention can apply to both unidirectional streaming arrangement and bidirectional conversational arrangement. In the streaming arrangement the end to end feedback of error rate parameters can be performed via an RTCP session or an RTSP session. RTCP packets are wrapped in UDP and further IP format. RTSP packets are wrapped in TCP format and further IP format packets. In the conversational arrangement the end to end feedback of error rate parameters can be performed via a SIP session. SIP packets are wrapped in UDP format and further IP format packets.

Preferably, the wireless networks are UMTS or GPRS mobile telecommunications networks. Each wireless channel is associated with Quality of Service (QoS) parameters indicative of among other things the error rate information. At session initiation and when wireless channel characteristics are to be modified, the network provides each mobile handset with a QoS parameter set that is indicative of the available bit rate, error rate conditions of the wireless channel between the mobile handset and the network. The QoS parameter set is read at the mobile handset by the encoder controller or the decoder controller. The error rate parameters are derived from the QoS parameters associated with the wireless channels.

In a preferred embodiment of the invention, the video data is divided into a sequence of frames, with each frame being further divided into a number of Group of Blocks (GOB) or a number of slices, and with each GOB or slice being further divided into a number of blocks. Preferably, the encoder parameters including frame rate, frame type indicative of either intra-coded frame or inter-coded frame, block type indicative of either intra-coded block or inter-coded block, and quantisation parameter.

According to the preferred embodiment, the error control of video encoding is achieved by a combination of the following operations:

a) setting proper ratio of intra-coded frames and inter-coded frames;
b) allocating GOBs or slices with suitable sizes such that the headers of GOBs or slices can be used as resynchronisation markers for the decoder to regain synchronisation quickly when transmission errors occur;
c) setting proper ratio of intra-coded blocks and inter-coded blocks for each GOB or slices in each inter-coded frame.

In a preferred embodiment of the invention, the rate control of video encoding operates in conjunction with the error control such that the generated CVDS is error resilient as well as within the bit rate budget associated with the channel bandwidth. Preferably, the encoder controller performs the rate control based on the derived parameters of the error control and the current encoding status information (e.g. instantaneous bit rate generated by the encoder and the motion estimation). The rate control is used for:

a) setting proper frame rate;
b) setting proper quantisation parameters;

such that the generated CVDS can match the bit rate constraints of the wireless channels.

In an embodiment of the present invention, the CVDS comprises a plurality of layers including the base layer and enhanced layers in which each layer comprises a sequence of frames which may be of the same type (intra-coded or inter-coded) or a mixture of types. Each layer can be carried via an RTP session. Preferably, more than one wireless channels are available and each wireless channel is used to transmit an RTP session. In this embodiment, in conjunction with the above error control operations, the error control also includes mapping CVDS layers into wireless channels such that the base layer is mapped into the wireless channel with better transmission quality.

BRIEF DESCRIPTION OF DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a simplified schematic diagram of a UMTS communication system showing a network and two mobile handsets, where one handset is the transmitter and the other a receiver, for streaming video;

Figure 2 is a simplified schematic diagram of a UMTS communication system showing a network and two mobile handsets, where each handset is simultaneously a transmitter and a receiver for conversational video;

Figure 3 shows the construction of a UDP/IP packet containing MPEG-4 video payload data;

Figure 4 shows the construction of a UDP/IP packet containing RTCP data;

Figure 5 shows the construction of multiple substreams with a common IP address and different UDP addresses per substream;

Figure 6 shows the construction of a TCP/IP packet containing RTSP and SDP data;

Figure 7 shows the construction of a TCP/IP packet containing SIP and SDP data;

Figure 8, Figure 10 and Figure 12 show single and multiple RTP/RTCP sessions and an RTSP session (also labelled more generically as IP Sessions), mapped onto single and multiple wireless channels for streaming video;

Figure 9, Figure 11 and Figure 13 show single and multiple RTP/RTCP sessions and a SIP session (also labelled more generically as IP Sessions), mapped onto single and multiple wireless channels for conversational video;

Figure 14 shows Quality of Service (QoS) parameters associated with the wireless channels between mobile handsets and networks, and the sending of these and other QoS parameters between the mobile handsets via IP sessions for streaming video;

Figure 15 shows QoS parameters associated with the wireless channels between mobile handsets and networks, and the sending of these and other QoS parameters between the mobile handsets via IP sessions for conversational video;

Figure 16 and Figure 17 shows typical mapping of compressed video data stream frames onto base and enhanced substreams;

Figure 18 is a flowchart showing sequential operations performed by the encoder controller;

Figure 19 is a flowchart showing sequential operations performed by the decoder controller; and

Figure 20 is a flowchart showing sequential operations performed by the encoder.

DETAILED DESCRIPTION OF PREFERRED AND OTHER EMBODIMENTS

The preferred embodiment of the present invention is applied to a network and associated mobile handsets designed to operate under the current GPRS or proposed UMTS standard.

Referring to the drawings, and Figure 1 in particular, there is shown a UMTS network 100 that is used to establish an end to end link between a first mobile handset 102 and a second mobile handset 104. The communication session between the first mobile handset 102 and the second mobile handset 104 is unidirectional. Mobile handset 102 is acting solely as a transmitter of compressed video data, whilst mobile handset 104 is acting solely as a receiver of compressed video data. This is termed the streaming arrangement.

In the embodiment shown in Figure 2, the communication session between the first mobile handset 142 and the second mobile handset 144 is bi-directional. Mobile handset 142 is acting both as a transmitter and a receiver of compressed video data, and mobile handset 144 is also acting as a transmitter and receiver of compressed video data. This is termed the conversational arrangement. In Figure 2 the functions and operations of the second mobile handset 144 are identical to the functions and operations of the first mobile handset 142.

It will be appreciated that the transmitter function and operation of mobile handsets 142 and 144 is identical to that of the transmitter function and operation of mobile handset 102. It will also be appreciated that the receiver function and operation of mobile handsets 142 and 144 is identical to that of the receiver function and operation of mobile handset 104. In the case of mobile handsets 142 and 144, the receiver and transmitter functions and operations are present within

the same mobile handset. In mobile handsets 102 and 104 only the transmitter or the receiver function is present respectively. It will be appreciated that the mobile handsets 142 and 144 can also operate exclusively as transmitters or receivers to produce the streaming arrangement, in addition to their conventional conversational arrangement, if so configured.

In Figure 1 the first mobile handset includes a transmitter controller 108, a Real Time Streaming Protocol (RTSP) server 116, an encoder 106, a Real Time Protocol (RTP) packetiser 117, a Real Time Control Protocol (RTCP) client 119 and a transmitter air interface 110, which are operatively interconnected with each other as shown. The encoder 106 accepts raw video data (RVD) from a video source such as a camera (not shown) associated with the first mobile handset 102 and encodes it into a compressed video data stream (CVDS) format, as discussed in detail below. This is then packetised by the RTP packetiser 117. According to the normal operation of a mobile communications network, the transmitter air interface 110 establishes a wireless channel with a transmit side air interface 112 in the network 100, which in turn is in communication with a network backbone 114.

The network 100 also includes a receive side air interface 118 that establishes a wireless channel with a receiver air interface 120 disposed in the second mobile handset 104. The second mobile handset 104 also includes a receiver controller 122, an RTSP client 123, an RTP depacketiser 125, an RTCP server 128 and a decoder 124. These are operatively interconnected with each other as shown.

In Figure 2 the mobile handsets 142 and 144 includes all the components that are present in both the mobile handset 102 for the transmitter function, with the exception of the RTSP server 116, and the mobile handset 104 for the receiver function, with the exception of the RTSP client 123. The RTSP server 116 is replaced by a SIP User Agent (UA) 146 in mobile handset 142 and the RTSP client 123 is replaced by a SIP UA 148 in mobile handset 144. The components of the transmitter function, the components of the receiver function, the User Agent and the air interface for mobile handsets 142 and 144 are operatively interconnected with each other as shown. It will be appreciated that

the function and operation of the mobile communications network shown in Figure 2 is as above.

In a UMTS network, the mobile handsets 102, 104, 142 and 144 are designated User Equipment (UE), the air interface elements 112 and 118 correspond to the Universal Terrestrial Radio Access Network (UTRAN), the backbone element 114 corresponds to the Core Network (CN).

According to normal mobile communications network operation, an end to end link is established between the first and second mobile handsets 102, and 104 (or 142 and 144), comprising a first wireless channel 126 between the first mobile handset and the network and a second wireless channel 127 between the network and the second mobile handset. Wireless channels are established using different frequencies and/or spreading codes and/or time slots in a manner well known in the mobile communications art. They allow for bi-directional communication, both for data and control information.

As part of the wireless channel control information, the wireless channel 126 between the transmitter air interface 110 and the transmit side air interface 112 carries Quality of Service parameters (QoS), from the network 100 to the first mobile handset 102 (or 142). Similarly, the wireless channel 127 between the air interface 118 and the receiver side air interface 120 carries Quality of Service parameters (QoS), from the network 100 to the second mobile handset 104 (or 144).

The packetised CVDS is transmitted over the end to end link defined between the two mobile handsets 102 and 104 (or 142 and 144), across wireless channels 126 and 127. In the preferred embodiment, the CVDS takes the form of an MPEG-4 stream, but other suitable streaming formats, such as H.263 can also be used. Both of these standards are applicable to variable bitrate and low bitrate video, e.g. bitrates of 10kbps or higher. It is particularly preferred that the transmission be in RTP format, as discussed in detail below in relation to Figure 3, Figure 4, Figure 5.

Turning to Figure 3, the packetisation of the raw MPEG-4 data for transmission is shown. This packetisation takes place in the first mobile handset 102 or 142 under the control of the transmitter controller 108 before sending the

packets to the transmitter air interface 110. Upon emerging from the wireless network of the transmitter the packets travel over a packet switched network to the wireless network of the receiver. Here the packets are sent to the receive side air interface 118 and on to the second mobile handset 104 or 144 via wireless channel 127.

Figure 3 shows the packetisation layers for a single MPEG-4 packet 200 in the form in which it leaves the encoder 106. It will be appreciated that a stream of such packets will be generated from the incoming RVD. The MPEG-4 video data 200 is wrapped in an RTP format packet layer 201. This, in turn, is wrapped in a UDP format packet layer 202, which in turn is packetised into an Internet Protocol (IP) packet 203. It is this IP packet 203 that is presented by the RTP packetiser 117 to the transmitter air interface 110 for transmission over the wireless channel. This layering format, defined by IETF, is known and is included in the developing UMTS standard for video transmission.

Each of the packetisation layers of the packet is directed to a particular part of the overall communication. They will not be described in detail because they are already known in the art and conform to the respective standards. However the principal component of each packet will be described insofar as is necessary to understand the embodiments of the invention that follow.

The MPEG-4 layer 200 contains the coded video data. The RTP layer 201 contains sequence numbers, time stamps, and payload bits that enable a depacketiser and decoder to decode it and replay at the correct time and in the correct sequence in relation to other packets from the same stream. The UDP layer is used for asynchronous communication of the data over the wireless communications channel and is a "best effort" connectionless protocol. The IP packet 203 contains an IP address which identifies the mobile receiver 104 or 144 as the destination. The IP packet header may also contain a Differentiated Services Code Point (DSCP) which could be used by a diffserv-enabled core network to determine how that packet should be forwarded by nodes inside that network.

Figure 4 shows the packetisation layers for a single RTCP packet 205 in the form in which it leaves the RTCP server 128. The RTCP packet is wrapped in a UDP format packet layer 206, and packetised into an IP packet 207.

Turning to Figure 5, the CVDS can be transmitted over the wireless channels in one or multiple substreams, each transported by an RTP session, (and an associated RTCP session) where these are mapped to one or multiple wireless channels that may have different quality parameters. In this case the IP address 208 is common to both substreams. Routing through the transmission chain is achieved by characterising different substreams by different socket numbers 210 and 212 in the UDP address.

It will be understood that some of the receiving handsets, or, indeed, the transmitting handset may not be capable of forming a multi wireless channel connection with the network. This may be because of equipment incompatibilities or network resource issues, for example. In this case, it is still possible for the video layers to be allocated to multiple wireless channels in accordance with the above embodiment, whilst multiplexing the video onto a single wireless channel for those not capable of forming the requisite multi wireless channel connection.

In the streaming arrangement of Figure 1, the IP packet of Figure 3 is transmitted directly from the first mobile handset 102, via the network 100, to the second mobile handset 104.

Once received at the receiver air interface 120, the packets are forwarded to the RTP depacketiser 125, where the MPEG-4 data 200 is re-constructed. The packets must be re-ordered using RTP layer data 201 such as frame timestamps and the data from the plurality of substreams must be re-assembled. The re-constructed MPEG-4 data 200 is then sent from the RTP depacketiser 125 to the decoder 124, where it is decoded for replay on, for example, a visual display (not shown) on the second mobile handset 104.

In the return direction (i.e., from the second mobile handset 104 to the first mobile handset 102 in this example), control information is returned in accordance with the known RTCP and RTSP protocols, with the latter using the known Session Description Protocol (SDP).

Figure 8 and Figure 10 show the IP sessions between a streaming server and client. The RTCP sessions provide feedback on the data transmission quality for each RTP session. RTSP additionally provides an overriding control connection from RTSP client 123 to RTSP server 116, using SDP to provide a description of the connection between client and server. It is known in the art that, when a session changes, an RTSP control packet containing a new SDP packet is sent to the remote entity.

The packetisation of the SDP and RTSP information is shown in Figure 6. The SDP information 306 is wrapped in an RTSP packet 300. An RTSP packet 300 is wrapped in a Transport Control Protocol (TCP) packet 302, which is within an IP packet 304. This packet is built up by the RTSP client 123 and supplied to the receiver air interface 120 for transmission to the receive side air interface 118 of the network 100. The destination address of this RTSP packet is that of the first mobile handset 102.

In the preferred embodiment shown in Figure 1, the RTSP packet passes to the transmit side air interface 112 via the backbone 114 for transmission to the transmitter air interface 110, to the RTSP server 116 and thence to the transmitter controller 108. Also, control information is exchanged between both mobile handsets 102 and 104 in accordance with the known RTCP protocol.

In the conversational arrangement of Figure 2 the IP packet of Figure 3 is transmitted and received between the mobile handsets 142 and 144, via the network 100, in the same way as for the streaming arrangement described above. The encoded video packet is also processed in the same way as for the streaming arrangement described above.

For the control of bi-directional communications sessions the Session Initiation Protocol (SIP) is used instead of RTSP. This is managed by user agents 146 and 148 in mobile handsets 142 and 144 respectively. SIP uses SDP to provide a description of the connection between two peer user agents. It is known in the art that, when a session changes, a SIP control packet containing a new SDP payload is sent to the peer user agent.

Figure 9 and Figure 11 show the IP sessions between two peer user agents 146 and 148. The SIP session provides an overriding connection control

between user agents 146 and 148 using the SDP. Again, control information is also exchanged between both mobile handsets 142 and 144 in accordance with the known RTCP protocol. The RTCP session will provide feedback on the data transmission quality for each RTP session.

The packetisation of the SIP information is shown in Figure 7, where the packet is denoted 308. An SDP payload 307 is encapsulated within the SIP packet 308. A SIP packet 308 is wrapped in a User Datagram Protocol (UDP) packet 310, which is within an IP packet 305. This packet is built up by the user agent 148 and supplied to the air interface 127 for transmission to the receive side air interface 118 of the network 100. The destination address of this SIP packet is that of the other mobile handset 142. It will be understood that user agents 146 and 148 are interchangeable in this scenario.

In the preferred embodiment shown in Figure 2, the SIP packet passes to the transmit side air interface 112 via the backbone 114 for transmission to the transmitter air interface 126 and thence to the transmitter controller 108 via the user agent 146.

In use, a user of, say, the first mobile handset, 102 or 142, places a call to the second mobile handset 104 or 144, by dialling the second handset's mobile number.

The first mobile handset's number is mapped to a first IP address taken from a pool of IP addresses, and the second mobile handset's number is mapped to a second IP address taken from the pool of IP addresses. This mapping persists for as long as the connection is maintained. Once the connection is broken, usually because one or both of the users hang up, the mapping is removed and the IP addresses are returned to the pool for reuse. It will be appreciated that this arrangement means that packets can be routed using the allocated IP addresses instead of the phone numbers.

There follows a description of the basic elements of call set-up at the wireless level to aid understanding of the invention.

When a user requests a call, the requested quality class of the wireless channel is communicated to the network 100. In particular, the first mobile handset 102 or 142 can request a particular QoS from the UMTS network, which

specifies, for example, guaranteed and maximum bitrates. On this basis, and assuming there are sufficient network resources available, a wireless communications channel is established between the first mobile handset 102 or 142 and the network 100, the wireless channel having defined QoS criteria.

Alternatively the first mobile handset 102 or 142 might request the network resources as a number of wireless channels each with associated QoS (see later for multiple wireless channel discussion).

The second mobile handset 104 or 144 must similarly establish a connection with the network 100, establishing a wireless communications channel with an independent QoS criteria to that of the wireless channel established by the first handset 102 or 142.

Once the wireless communications channel or set of channels is established, video data from, say, a camera (not shown) associated with the first mobile handset 102 or 142 is received by the encoder 106, which in turn generates a sequence of CVDS video data. The video data is sent to the RTP packetiser 117, where it is packetised as described above and sent to the second mobile handset as described above. The receiving mobile handset is mobile handset 104 if mobile handset 102 is the transmitter; mobile handset 144 if mobile handset 142 is the transmitter; and mobile handset 142 if mobile handset 144 is the transmitter.

As other users make and break wireless communications channels and the network 100 continuously monitors user resource allocations, it can be the case that available bandwidth for any particular call changes, either increasing or decreasing. If a user has a multiple wireless channel allocation, one or more of the wireless channels may be terminated. It will be understood that these bandwidth changes can take place at a number of points along a given wireless communications channel. For example, it could take place between the first mobile handset 102 (or 142) and the network, or between the network and the second handset 104 (or 144).

Other factors, such as distance of a handset from a base station with which it is communicating, or strong multi-path reflections, can also cause the effective bandwidth or quality of a wireless channel to be reduced.

Any change in effective bandwidth or quality can have two consequences. If the bandwidth increases it could in principle be possible to transmit video data at a higher bitrate. If it decreases, however, the rate at which video data can reliably be transmitted also decreases, possibly below the value that was set at the start of transmission. To accommodate these consequences the QoS parameter set including the available bitrate and bit error rate on the wireless channel between the first mobile handset 102 or 142 and the network 100 is monitored by the controller 108 at the first mobile handset 102 or 142.

In the preferred form, at session initiation and when wireless channel characteristics are to be modified, the UMTS network provides the first mobile handset with a QoS parameter set that is indicative of the available bitrate (i.e. bandwidth) on the wireless communications channel. Such a QoS parameter set is supplied through the protocol stack in known wireless systems from the air interface 112 of the network to the air interface 110 of the transmitting mobile handset 102 or 142. It is normally supplied across a wireless control channel on the downlink of the call.

According to the developing UMTS standard, the QoS parameter set is indicative of various transmission parameters, including the transmissible bitrate over the wireless channel, the signal to noise ratio, the error rate and a priority indicator which is an indication provided from the network to the transmitting mobile handset of the likely priority to be placed on the call. This is therefore an indicator of the bandwidth and likely reliability of the wireless communication channel that has been opened for the particular wireless channel. It will be appreciated in this context that the word "call" is used herein to describe the transmission of video data as well or instead of voice data. The QoS parameter set is read at the mobile handset 102 or 142 by the controller 108 and the transmissible bitrate is extracted from it.

The quality of the wireless communication channel between the network 100 and the second mobile handset 104 or 144 is also monitored. In the preferred form, a QoS parameter set indicative of, amongst other things, the available bandwidth for the RTP session mapped onto this wireless channel is ascertained in the second mobile handset 104 or 144 derived from the wireless control

channel information it receives from the network according to the relevant wireless standard (in this case UMTS).

The QoS parameter set is dealt with at the second mobile handset 104 or 144 in a novel manner. The session control protocol (both bi-directional using SIP and unidirectional using RTSP) and have already been discussed. SDP provides for the exchange and updating of session description information such as codec and bitrate.

For the streaming arrangement (shown in Figure 1), according to the existing RTSP standard, various control parameters are conveyed by the RTSP packets including, for example, video commands such as PLAY and PAUSE. The standard also provides an ANNOUNCE instruction The system described herein uses the ANNOUNCE provision in the RTSP standard to cause elements of the QoS parameter set determined in the wireless environment and/or other derived parameters to be placed into an SDP payload which itself is placed in an RTSP packet for transmission from the second mobile handset 104 to the mobile handset 102. The thus constructed novel packets are transmitted by the RTSP client 123, via the receiver air interface and the received side air interface to the network backbone 114. From here they travel to the RTSP server 116 via the transmission side air interface 112 and the transmitter air interface 110.

For the conversational arrangement (in Figure 2), according to the existing SIP standard, SDP payload are conveyed by the SIP packets to control the bi-directional communication between two mobile handsets. A session is initiated using the INVITE instruction, which itself contains a session description in the SDP format. The standard provides for a session to be modified by either agent by issuing a subsequent INVITE instruction. The system described herein uses the re-INVITE provision in the SIP standard to cause the quality parameter determined in the wireless environment and/or other derived parameters to be placed into an SDP packet which itself is placed in a SIP packet for transmission from the receiving mobile handset 144 to the transmitting mobile handset 142. The thus constructed novel packets are transmitted by the session control agent 148, via the receiver air interface 120 and the received side air interface 118 to

the network backbone 114. From here they travel to the session control agent 146 via the transmission side air interface 112 and the transmitter air interface 120.

It can be understood that user agents 146 and 148 are interchangeable in this scenario. For both streaming and conversational arrangements the RTP sessions carrying the video data each have associated RTCP sessions carrying control information back to the transmitter. The system described herein can, in addition to or instead of using RTSP or SIP, use the RTCP application defined (APP) packet to transfer application data (in this case the wireless and other derived QoS parameters) from the receiver to the transmitter.

In both the streaming (Figure 1) and conversational (Figure 2) arrangements, when a session control packet is received at the transmitting mobile handset, this along with locally derived QoS parameters can be used to modify the encoded bitrate as already discussed above. In this way, the bitrate of the video stream transmitted from the encoder can be adapted to the wireless channel between a transmitting mobile handset and the network and also to the wireless channel between the network and a receiving mobile handset. In the streaming arrangement and now referencing Figure 8 and Figure 10, there are shown two ways of transmitting a CVDS from an encoder 106 to a decoder 124 using RTP between an RTP packetiser 117 and an RTP depacketiser 125. RTCP control messages are sent between RTCP server 128 and RTCP client 119. RTSP control messages are sent between an RTSP server 116 and an RTSP client 123. Figure 8 shows a prior art method of streaming CVDS transported by an RTP session 804 and associated RTCP session 805. RTSP control messages are sent via RTSP session 806. It will be appreciated that at least some part of the end to end communications channel is wireless. In Figure 8 the RTP session containing all the frames of the video stream and the RTCP session containing all RTCP control messages are multiplexed onto a single wireless channel, with the CVDS parameters and frame sequencing being derived according to the QoS parameter of the wireless channel at call set up.

Figure 9 shows the prior art for conversational arrangement. Each mobile handset is depicted with an RTP packetiser (117 or 134), an RTP depacketiser (133 or 125) and a user agent (146 or 148). For a conversational arrangement, a

CVDS is transmitted from RTP packetiser 117 to RTP depacketiser 125 using RTP session 814 and RTCP session 815 simultaneously with a CVDS transmitted from RTP packetiser 134 to RTP depacketiser 133 using RTP session 816 and RTCP session 817. A single SIP session 818 controls all the RTP/RTCP sessions. In Figure 9, as in Figure 8, the RTP sessions containing all the frames of the video stream, the RTCP sessions corresponding to these and the SIP session containing all of the SIP control messages are multiplexed onto a single wireless channel, with the CVDS parameters and frame sequencing being selected according to the QoS parameter of the wireless channel at call set up.

Figure 10 shows a preferred embodiment of the invention for the streaming arrangement, in which there is a plurality of wireless channels. In the example shown there are three wireless channels. RTP/RTCP sessions 824/825 and 826/827 are used for transmitting the two substreams of a CVDS and RTSP control messages are sent via RTSP session 828. The wireless channels are provided at call set up as previously described in a situation where the encoder 106, RTP packetiser 117, RTCP client 119 and RTSP server 116 are in a first mobile handset, and the decoder 124, RTP depacketiser 125, RTCP server 128 and RTSP client 123 are in a second mobile handset in accordance with requested QoS and bandwidth parameters according to the UMTS standard.

As with previous embodiments, the CVDS substreams are transported via RTP between the RTP packetiser 117 and RTP depacketiser 125, RTCP control messages are sent between RTCP server 128 and RTCP client 119 and control messages are transmitted via an RTSP session between the RTSP server 116 and RTSP client 123. As shown in the example Figure 8, one RTSP session covers all the RTP/RTCP sessions between any two entities while each CVDS substream requires an individual RTP session and an associated RTCP session.

Figure 11 shows a preferred embodiment of the invention for the conversational arrangement, in which there is a plurality of wireless channels. In the example shown there are three wireless channels. RTP/RTCP sessions 834/835 and 836/837 are used for transmitting the two substreams of a CVDS generated by the encoder 106. RTP/RTCP sessions 838/839 and 840/841 are used for transmitting the two substreams of a CVDS generated by the encoder

129. The SIP control messages are sent via SIP session 842. Figure 11 shows that the base layers produced by encoders 106 and 129, carried by RTP sessions 834 and 838 and packetised by RTP packetisers 117 and 134, use the up and down links of the same wireless bearer at each mobile handset. Similarly, the enhanced layers from the encoders 106 and 129, carried by RTP sessions 836 and 840 and packetised by RTP packetisers 117 and 134, use the up and down links of the same wireless bearer at each mobile handset. It will be appreciated that there are many other possible mappings between RTP/RTCP sessions to wireless bearer. The wireless channels are provided at call set up as previously described and in accordance with requested QoS and bandwidth parameters according to the UMTS standard. As shown in the example, one SIP session 845 covers all the RTP/RTCP sessions between any two entities while each CVDS substream requires an individual RTP session and an associated RTCP session.

Since wireless channels for the transmit side and receive side are allocated separately there is no guarantee that the number of transmit side and receive side wireless channels will be the same. In the streaming arrangement shown in Figure 12 there is one transmit side wireless channel and three receive side wireless channels. On the receive side RTP/RTCP sessions 844/845 and 846/847 and RTSP session 848 are each mapped to a separate wireless channel. On the transmit side all IP sessions 844-848 are mapped to the same wireless channel.

Figure 13 shows the situation for the conversational arrangement, where for the handset containing user agent 146 there is only one wireless channel, whilst for the handset containing user agent 148 there are three wireless channels. In the handset containing user agent 148 the RTP/RTCP sessions 853/854 and 857/858 are mapped to the same wireless channel. However the RTP/RTCP sessions 851/852 and 855/856 are mapped to another wireless channel and the SIP control 859 is mapped to yet another wireless channel. In the handset containing user agent 146 all IP sessions of all types 851-859 are mapped to the same wireless channel.

Under the proposed UTMS standard (and others), wireless channels can be defined in terms of a number of quality of service parameters, such as priority, maximum and guaranteed bandwidth, residual bit error rate and delay.

In the embodiment of Figure 10, the first RTP session 824 is defined as carrying the base substream, having an example bitrate of 16kbps, whilst the second RTP session 826 has a bitrate of 32kbps. The first wireless channel has the lowest bitrate but highest priority and the base substream is allocated to it. The enhancement substream is allocated to the second wireless channel, since it has the lower priority. This ensures that the most important video data is allocated to the wireless channel with the highest priority. The first RTP session can also be marked with the highest priority DSCP for prioritised transport over the IP component of a diffserv enabled core network.

As discussed above in relation to other embodiments, the allocation of resources within a UMTS network is dynamic, and this can mean that bandwidths allocated to either of the RTP sessions can fluctuate with (amongst other things) network load. In the preferred embodiment shown in Figure 1 and Figure 2, the bandwidth available for each wireless channel is known to the transmitter controller 108 as it monitors the network messages at the transmitter air interface 110. In the event that the available bandwidth on one or more of the wireless channels is commanded by the network 100 to be reduced, an assessment is made as to whether it is desirable to reallocate the frames between substreams. For example, assuming the substream frame structure of Figure 16, if the second RTP session bandwidth fell to, say, 16kbps an assessment would be taken to determine whether to simply reduce the number of P and B frames generated and leave other substreams unchanged, or whether a better overall quality would be achieved by including some of the P and B frames on the base substream at the expense of say, reduced resolution in the I frames.

It is not necessarily the case that reallocation will happen automatically and immediately without any assessment of context. In one form, the preferred embodiment is configured to maintain a history of wireless channel behaviour in relation to the quality parameter. As an example, a sudden drop in bandwidth on a wireless channel to which relatively high priority substream or frame type is

mapped may not be a trigger for the frame mapping to be changed. If there is a history of short-term bursts of bandwidth loss, it is likely that the higher bandwidth will be available shortly, and it may ultimately be more efficient to allow the short-term reduction to be ignored. Typically, an assessment of this type will be made by the transmitter controller 108. It will be understood that quite sophisticated proportional, integral and differential factors can be taken in to account to build a relatively sophisticated model of any wireless channel's behaviour (and likely future behaviour) over time. Such modelling well known to those skilled in the relevant art, and so is not described further here.

Similar history data can be collected for the other types of a quality data collected in earlier embodiments of the invention, and similarly used to make decisions about how and when to alter outputs of, for example, the encoder. In general, if there is a history of short-term bandwidth problems, then it may be more efficient or may provide a visibly better overall video streamed image if the bitrate out of the encoder is not immediately altered when the bandwidth initially drops. Rather, it will in some cases be preferable to wait until the bandwidth has remained low for a predetermined time period or number of frames before changing the output of the encoder.

Wireless channels between mobile handset and network have a certain QoS, which is provided for the mobile user of a network service. In an embodiment of the invention, a set of QoS parameters including Bitrate (BR) and Bit Error Rate (BER) are used for controlling the video encoder. These QoS parameters are conveyed between the encoder controller and the decoder controller via IP sessions. Referring to Figure 14, a wireless channel between transmitter 102 and network has QoS parameters BR and BER. A wireless channel between network and receiver 104 has QoS parameters BR' and BER'. The encoder controller 108 sends BR to decoder controller 122 via an RTSP session 866. Having received BR from the encoder controller 108, the decoder controller 122 sends BER' and the calculated Request Bitrate (RBR) to the encoder controller 108 via an RTSP session 866 or RTCP session 865. The encoder controller and the decoder controller will be discussed in detail below.

The encoder controller 108 is used to control the video encoder 106 with the objective of improving the error resilience of video encoding while meeting the bitrate constraint of wireless channels.

In a preferred embodiment of the invention, the video encoder is an MPEG-4 or H.263 compliant encoder. The input video source is encoded into an MPEG-4 or H.263 compliant bit stream. The video data can be constructed using a plurality of different types of frames, which are referred to as I, P and B frames. I frames are self-contained still frames of video data, whereas P and B frames constitute intermediate frames that are predicatively encoded. The precise composition of the frames varies in accordance with the particular standards and application of the standards and is known *per se*.

MPEG-4 specifies a plurality of layers, including the base layer and enhanced layers, in which each layer is comprised of a sequence of frames which may be of the same type (I, P, B) or a mixture of types. As already described, in a wireless network the mobile may be allocated one wireless channel or a plurality of wireless channels. In the preferred form, each wireless channel is used to transmit a single RTP/RTCP session pair. Each RTP session carries an optimum sequence of I, P and B frames, known as a substream. The term "substream" is used rather than "layer" because the frame sequencing onto wireless channels can be varied dynamically and need not be one of the layer sequences pre-defined in MPEG-4 or other known video encoding standards. Other partitions of coded video data for error resilient purposes (e.g. Data Partitioning Modes of MPEG-4/H.263) are also possible and could be represented by substreams.

Figure 16 and Figure 17 illustrate example compositions of a video data stream in accordance with the MPEG-4 video standard. In the example two temporally scalable substreams are used with I frames on the base substream while P and B frames are carried on the enhanced substream. In the illustrated example in Figure 17, only the base substream is used, comprising interleaved I and P frames. The encoder controller can thus control the bitrate of the video data stream for each wireless channel by manipulation of the number of substreams used for transmission, and the number and type of frames per substream.

Video encoding under MPEG-4 or H.263 standards operates on a frame-by-frame basis. Each frame is divided into either Group of Blocks (GOBs) or slices. A GOB comprises of macroblocks of one or several rows in a video frame. Slices are more flexible and can partition the frame into a variable number of macroblocks. A macroblock in turn comprises of four luminance and two spatially corresponding colour difference blocks of image data. All blocks in an I-frame are intra-coded. Blocks in an inter-coded P or B-frame can be of both intra-coded blocks (I-blocks) and inter-coded blocks (P-blocks or B-blocks).

The increase of I-block/P-block ratio (I_b/P_b) in P-frames or I-block/B-block ratio (I_b/B_b) in B-frames has two consequences: (1) improving the error resilience because more intra-coded blocks result in less error propagation; (2) increasing the bitrate because inter-coded blocks comprise substantially smaller amounts of data than intra-coded blocks. The encoder controller controls the encoder to make the best use of wireless channel utilisation for error resilient video encoding.

The error control can also be achieved by allocating GOBs or slices in a frame wherein the header of each GOB or slice can serve as synchronisation markers for decoder to regain synchronisation.

Figure 18 illustrates the operation of the encoder controller 108. The encoder controller operates by a closed-loop process. In the first step 400, the encoder controller obtains relevant information from various sources including the BR and BER associated with the wireless channel between the encoder and the network from air interface, the RBR and BER' via IP control session from the decoder, latency jitter (ΔL) of RTP packets from the RTCP client 123 and the instantaneous bitrate (IBR) from the encoder. In the second step 410, the encoder controller determines the target BR (BR_{target}) and the frame type (FT) based on the BR, RBR and IBR. In the third step 420, the encoder controller determines the I_b/P_b ratio for P-frames and the I_b/B_b for B-frames and the synchronisation marker rate R_{sync} for all frames. In the fourth step 430, the encoder controller determines the QP and the frame rate (FR) for the frame based on the I_b/P_b or I_b/B_b, and BR_{target}. In the fifth step 440, the encoder controller sends the encoding parameters FT, FR, R_{sync}, I_b/P_b or I_b/B_b, and QP to the encoder. In the sixth step 445, the encoder controller sends BR via IP control

session to the decoder. Then the encoder controller goes back to the first step 400.

Figure 19 illustrates the operation of the decoder controller 122. The decoder controller operates by a closed-loop process. In the first step 450, the decoder controller obtains relevant information from various sources including the BR' and BER' associated with the wireless channel between the decoder and the network from air interface, the BR associated with the wireless channel between the encoder and the network via IP session from the encoder. In the second step 460, the decoder controller determines ΔL of RTP packets received. In the third step 470, the decoder controller calculates RBR based on ΔL, BR and BR'. In the fourth step 480, the decoder controller sends the RBR and BER' via IP control session to the encoder controller. Then the decoder controller goes back to the first step 450 .Figure 20 illustrates the operation of the encoder 106. The encoder operates on a frame-by-frame basis. In the first step 490, the encoder obtains the encoding parameters including FT, FR, R_{sync}, I_b/P_b or I_b/B_b, and QP from the encoder controller. In the second step 492, the encoder allocates GOBs or slices for inter-coded frames based on R_{sync}. In the third step 494, the encoder further allocates the I-block distribution within P or B-frames based on I_b/P_b or I_b/B_b. In the fourth step 496, the encoder encodes the frame using the above encoding parameters and adds it to the CVDS. In the fifth step 498, the encoder calculates the IBR and sends it to the encoder controller. Then the encoder goes back to the first step, to process the next frame.

Although various aspects of the invention have been described with reference to specific embodiments, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.

DEFINITIONS

Unless the contrary intention clearly appears from the context in which certain words are used, the following definitions apply to words used in this specification:

WIRELESS CHANNEL; a physical radio channel with associated QoS parameters, e.g. UMTS Radio Access Bearer.

END TO END LINK; an end to end communications link between transmitter and receiver containing a transmit side wireless channel and / or a receive side wireless channel;

IP SESSION; An IP communications session between two IP hosts carrying either control or application data. Examples are a RTP session, a RTCP session, a RTSP session and a SIP session. One or more IP sessions can be mapped to a wireless channel;

COMPRESSED VIDEO DATA STREAM (CVDS); an overall video stream, where the original stream of image frames is compressed by means of an encoder;

FRAME; a video encoder outputs a number of different frame types. These include full still images and derivative images that have different data transmission requirements, have different sensitivity to errors and may have dependency on other frames. In the MPEG-4 video standard, frames are also known as Video Object Planes (VOPS);

SUBSTREAM; a CVDS may be split into a number of substreams for the purposes of transmission over a channel or plurality of channels. Each substream can be used as a means of transmitting a sequence of video frames that may be of different types. A substream is not necessarily the same as a layer as defined in video standards such as MPEG-4 and H.263. A substream could also be used to transmit any part of the coded frame data that can be successfully partitioned for error resilient purposes (e.g. DCT coefficients and motion vector data in data partitioning modes of MPEG-4/H.263). Each substream is transported by an RTP session and an associated RTCP session.

RTCP SERVER; an entity generating RTCP Receiver Reports based on the reception of RTP packets. These are sent to the transmitter of the RTP packets, where an RTCP client uses them.

RTCP CLIENT; an entity that uses RTCP Receiver Reports. These are sent from the receiver of the RTP packets, where an RTCP server generates them.

CLAIMS

1. A method of generating a compressed video data stream (CVDS) from a video stream, for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of:

(a) determining values of one or more error rate parameters associated with the wireless channel;

(b) determining values of one or more bit rate parameters associated with the wireless channel;

(c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters;

(d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

2. A method according to claim 1, wherein step (a) includes ascertaining the error rate parameters associated with the wireless channel between the transmitter and the receiver, and step (d) includes controlling encoding of the video stream to improve an error resilience of the CVDS whilst meeting the bandwidth constraints of the wireless channel.

3. A method according to claim 2, where the transmitter is a mobile transmitter and the receiver is a network receiver, wherein the error rate parameters are derived from data taken from an air interface associated with the transmitter.

4. A method according to claim 2, where the transmitter is a network transmitter and the receiver is a mobile receiver, wherein the error rate parameters are derived from data taken from an air interface associated with the receiver and communicated via end to end feedback between the receiver and the transmitter.

5. A method according to 2, where both receiver and transmitter are mobile, wherein the error rate parameters are derived as in 3 and 4 and are combined in the transmitter.

6. A method according to claims 4 & 5, wherein the end to end feedback is carried out by one or more IP sessions between the receiver and the transmitter, wherein each IP session is one of an RTCP, RTSP or SIP session.

7. A method according to any one of the preceding claims, wherein the communications network is a UMTS or GPRS mobile telecommunications network.

8. A method according to claim 7, wherein the error rate and bit rate parameters are derived from Quality of Service (QoS) parameters associated with the wireless channel

9. A method according to claim 8, further including the step, prior to step (a), of initiating a session in which one or more of the wireless channels is established for transmission of the CVDS, the initiation of the session including receiving in the transmitter the QoS parameters from the network.

10. A method according to claim 9, when the QoS parameters are provided to the transmitter again in the event that they are modified.

11. A method according to any one of the preceding claims, wherein the CVDS is packetised into IP format packet prior to transmission.

12. A method according to claim 11, wherein the transmitter is a mobile handset and the IP packetisation includes the substeps of:

wrapping the CVDS in an RTP format packet;

wrapping the RTP packet in a UDP format packet; and

wrapping the UDP packet in an IP format packet for supply to an air interface associated with the transmitter for transmission to the receiver via the network

13. A method according to claim 12, wherein the receiver is configured to transmit a CVDS to the transmitter in accordance with any one of the preceding claims.

14. A method according to any one of the preceding claims, wherein the encoding parameters include any one or more of the following:

a frame rate;

a frame type, being indicative of either intra-coded frame or inter-coded frame;

a block type, being indicative of either intra-coded block or inter-coded block; and

a quantisation parameter.

15. A method according to claim 14, wherein the video data is divided into a sequence of frames, with each frame being further divided into Groups of Blocks (GOBs) or slices, each GOB or slice being further divided into a number of macroblocks.

16. A method according to claim 15, wherein the encoding parameters include any one or more of the following;

a ratio of intra-coded frames to inter-coded frames;

sizes of GOBs or slices, the sizes being selected such that headers of GOBs or slices can be used as resynchronisation markers for the decoder to regain synchronisation quickly when transmission errors occur;

a ratio of intra-coded blocks and inter-coded blocks for each GOB or slices in each inter-coded frame;

17. A method according to any one of the preceding claims, wherein the CVDS comprises a plurality of layers including a base layer and enhanced layers, each layer comprising a sequence of frames.

18. A method according to claim 17, wherein each layer is carried via an RTP session.

19. A method according to claim 18, wherein more than one transmit side and/or receive side wireless channel is open between the transmitter and the receiver, and each wireless channel is used to transmit an RTP session.

20. A method according to claim 19, wherein layers of the CVDS are mapped onto the wireless channels such that the base layer is mapped into the wireless channel with better transmission quality.

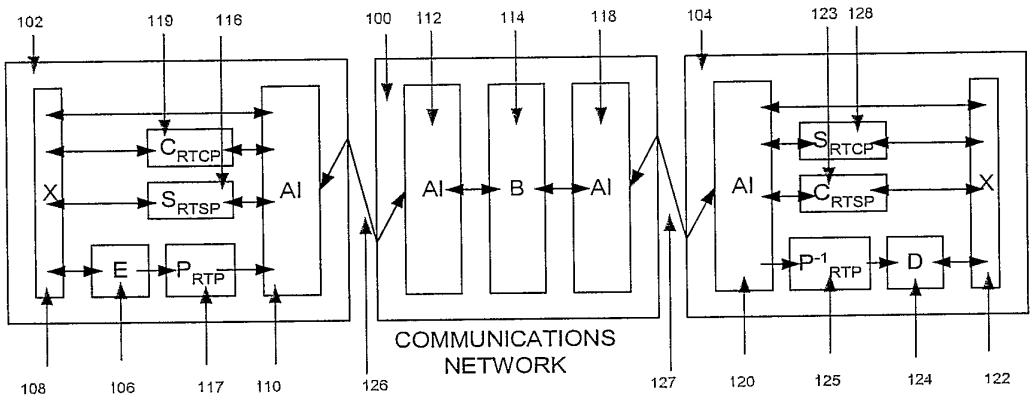


Figure 1

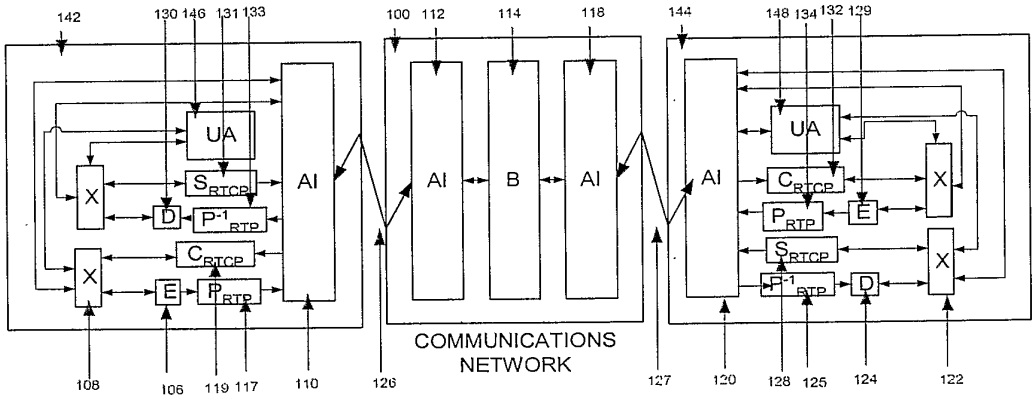


Figure 2

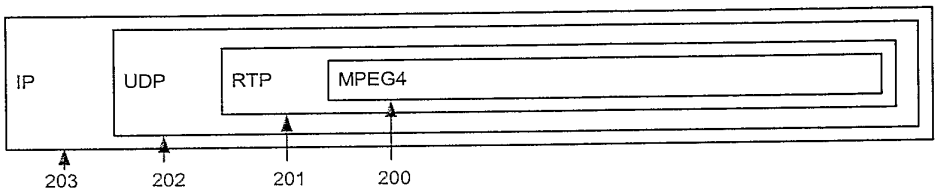


Figure 3

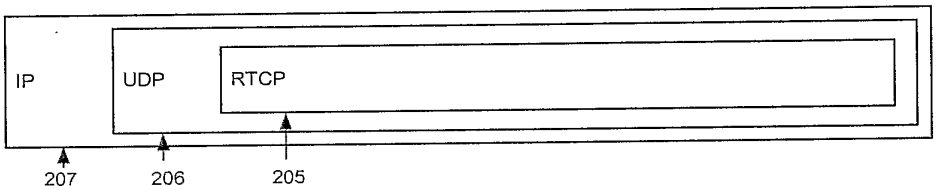


Figure 4

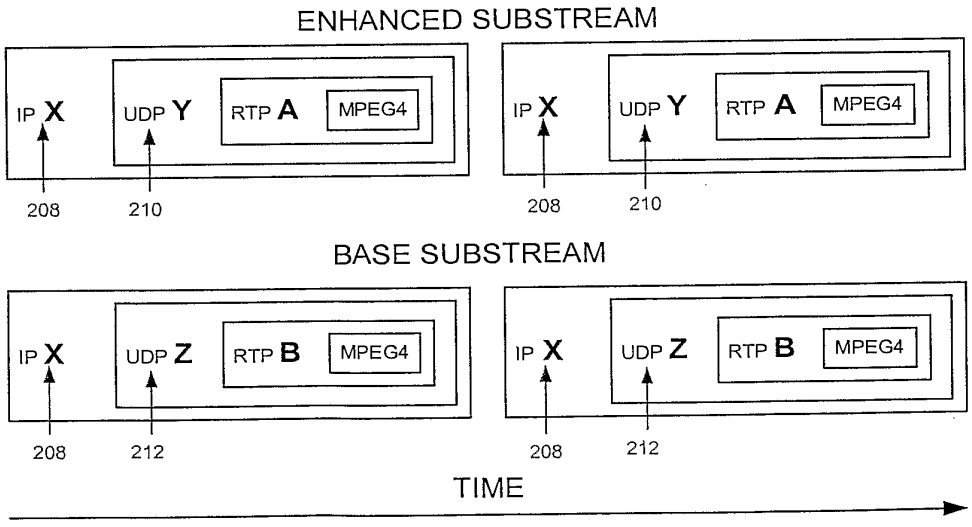


Figure 5

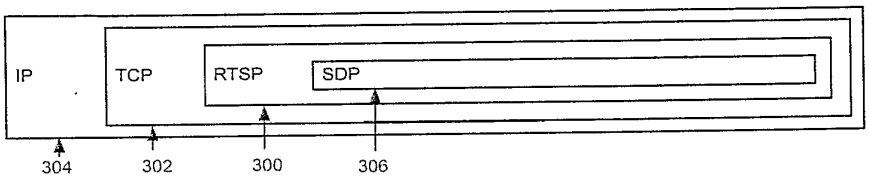


Figure 6

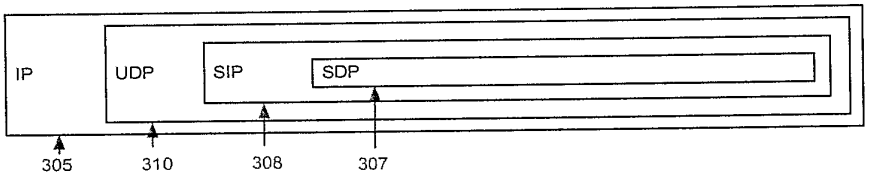


Figure 7

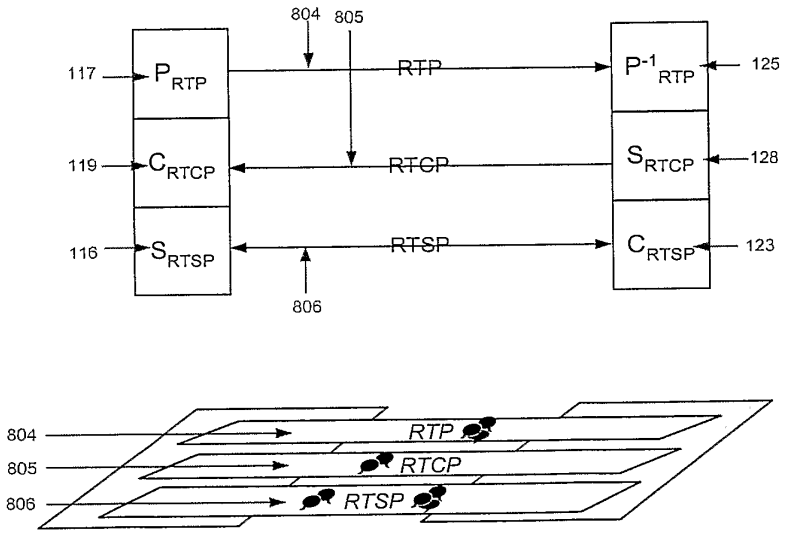


Figure 8

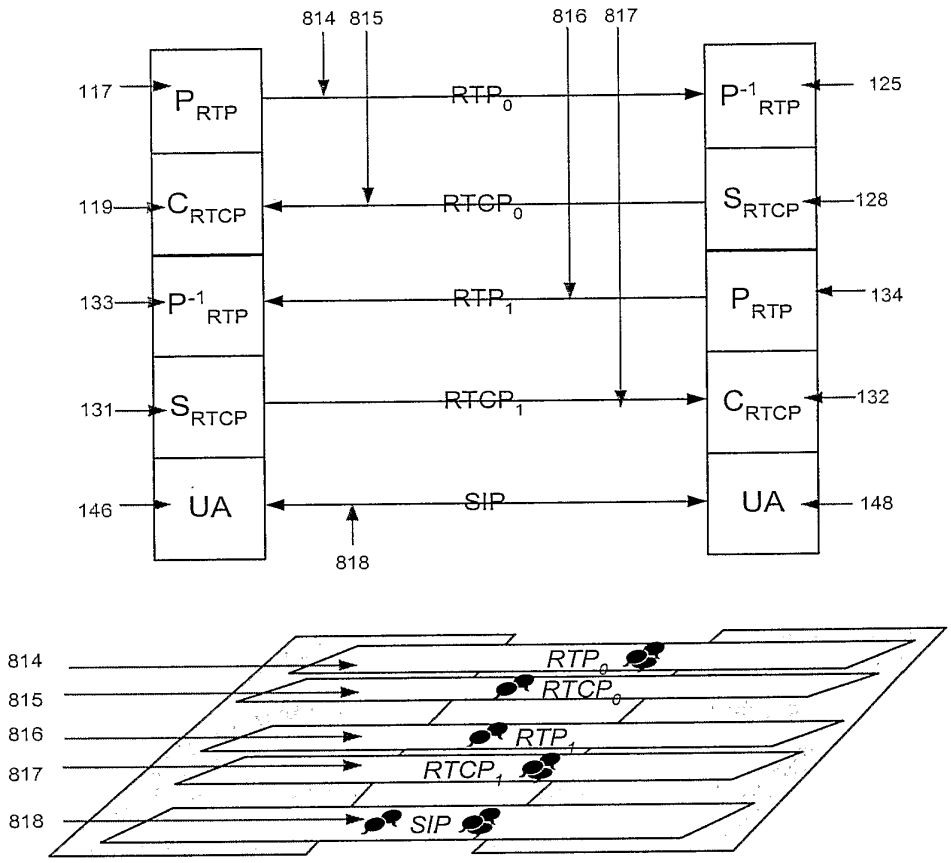

814
815
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818
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133
131
146
125
128
134
132
148
P_{RTP}
C_{RTCP}
P^{-1}_{RTP}
S_{RTCP}
UA
RTP_0
$RTCP_0$
RTP_1
$RTCP_1$
SIP

Figure 9

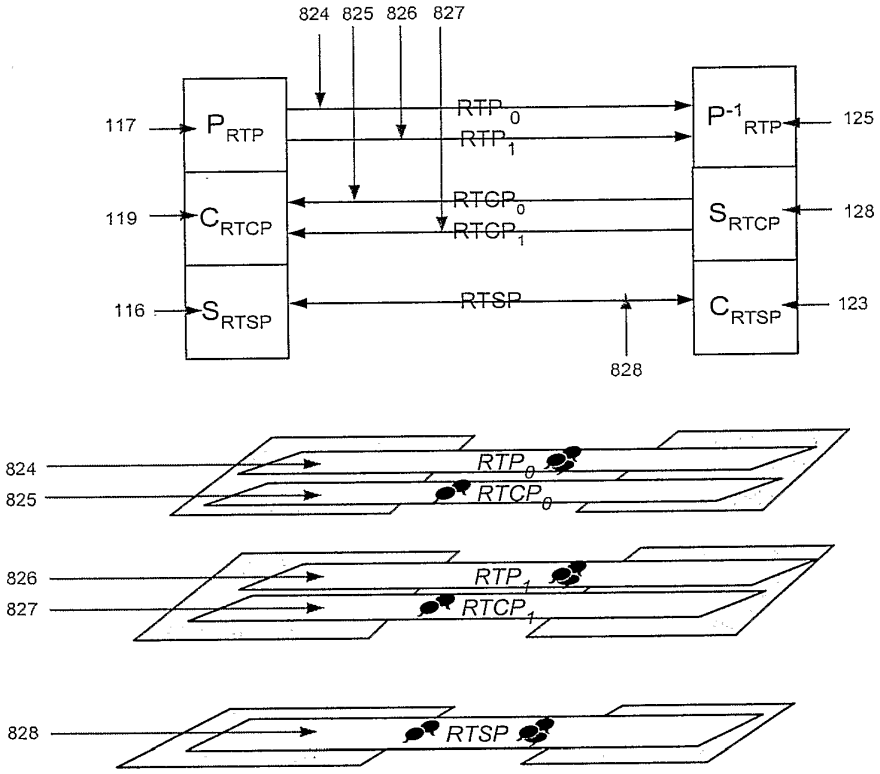

824
825
826
827
117
P_{RTP}
119
C_{RTCP}
116
S_{RTSP}
RTP_0
RTP_1
$RTCP_0$
$RTCP_1$
RTSP
P^{-1}_{RTP}
125
S_{RTCP}
128
C_{RTSP}
123
828
824
825
RTP_0
$RTCP_0$
826
827
RTP_1
$RTCP_1$
828
RTSP

Figure 10

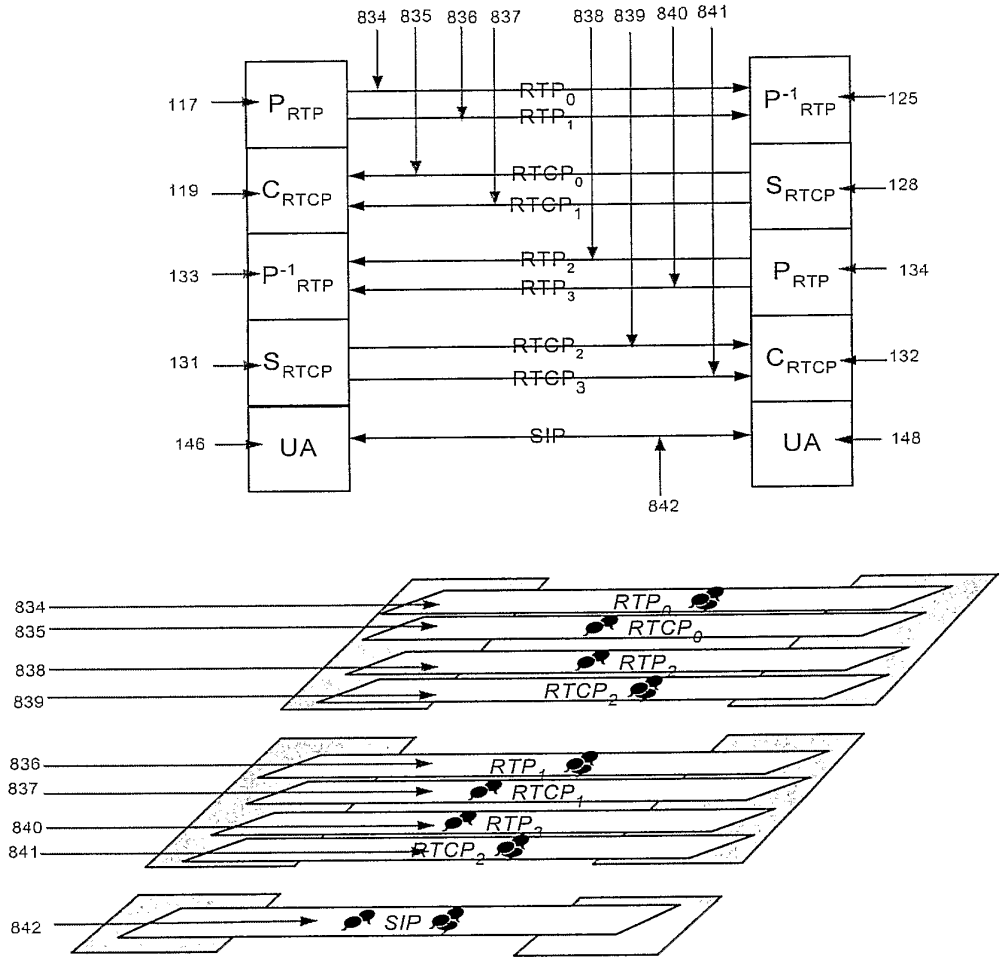

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128
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132
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842
P_{RTP}
C_{RTCP}
P^{-1}_{RTP}
S_{RTCP}
UA
P^{-1}_{RTP}
S_{RTCP}
P_{RTP}
C_{RTCP}
UA
RTP_0
RTP_1
$RTCP_0$
$RTCP_1$
RTP_2
RTP_3
$RTCP_2$
$RTCP_3$
SIP
RTP_0
$RTCP_0$
RTP_2
$RTCP_2$
RTP_1
$RTCP_1$
RTP_3
$RTCP_3$
SIP

Figure 11

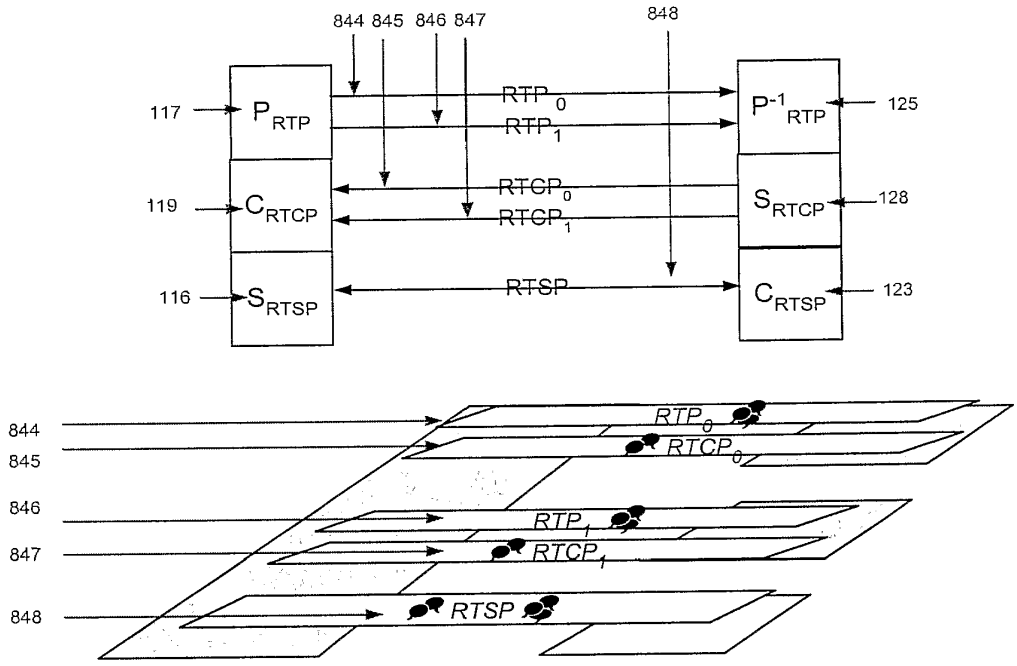

844 845 846 847
848
117
P_{RTP}
RTP_0
RTP_1
P^{-1}_{RTP}
125
119
C_{RTCP}
$RTCP_0$
$RTCP_1$
S_{RTCP}
128
116
S_{RTSP}
RTSP
C_{RTSP}
123
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847
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RTP_0
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RTP_1
$RTCP_1$
RTSP

Figure 12

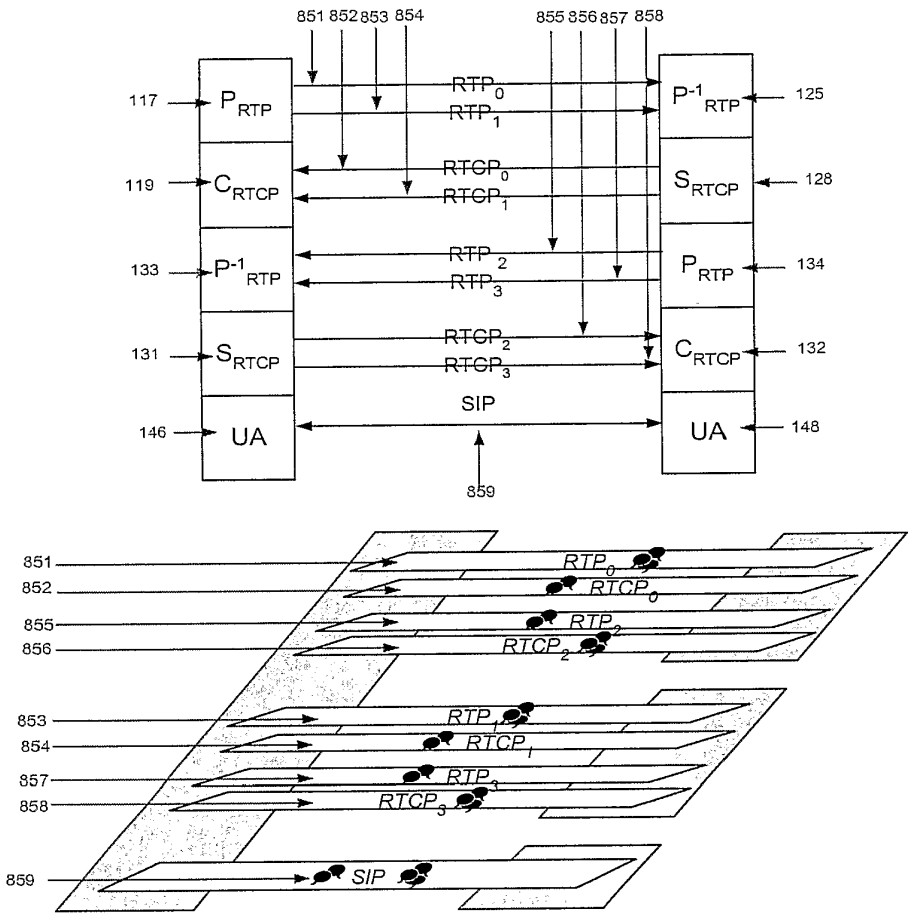

851 852 853 854
855 856 857 858
117
P_{RTP}
119
C_{RTCP}
133
P^{-1}_{RTP}
131
S_{RTCP}
146
UA
RTP_0
RTP_1
$RTCP_0$
$RTCP_1$
RTP_2
RTP_3
$RTCP_2$
$RTCP_3$
SIP
859
P^{-1}_{RTP}
125
S_{RTCP}
128
P_{RTP}
134
C_{RTCP}
132
UA
148
851
852
855
856
853
854
857
858
859
RTP_0
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RTP_2
$RTCP_2$
RTP_1
$RTCP_1$
RTP_3
$RTCP_3$
SIP

Figure 13

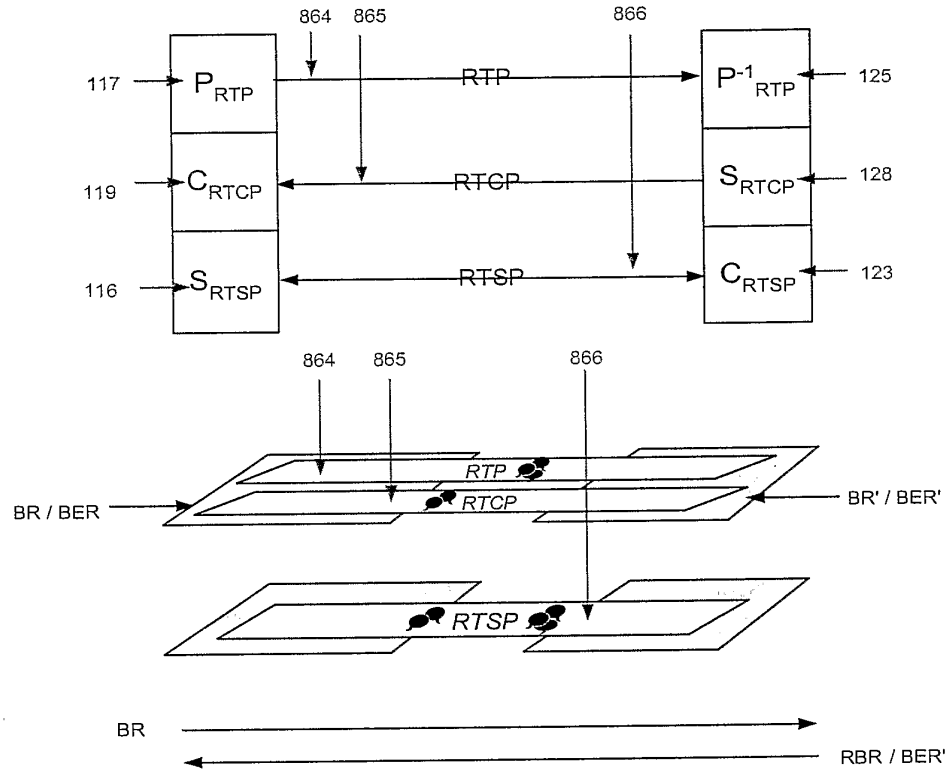

864
865
866
117
P_{RTP}
RTP
P^{-1}_{RTP}
125
119
C_{RTCP}
RTCP
S_{RTCP}
128
116
S_{RTSP}
RTSP
C_{RTSP}
123
RTP
RTCP
BR / BER
BR' / BER'
RTSP
BR
RBR / BER'

Figure 14

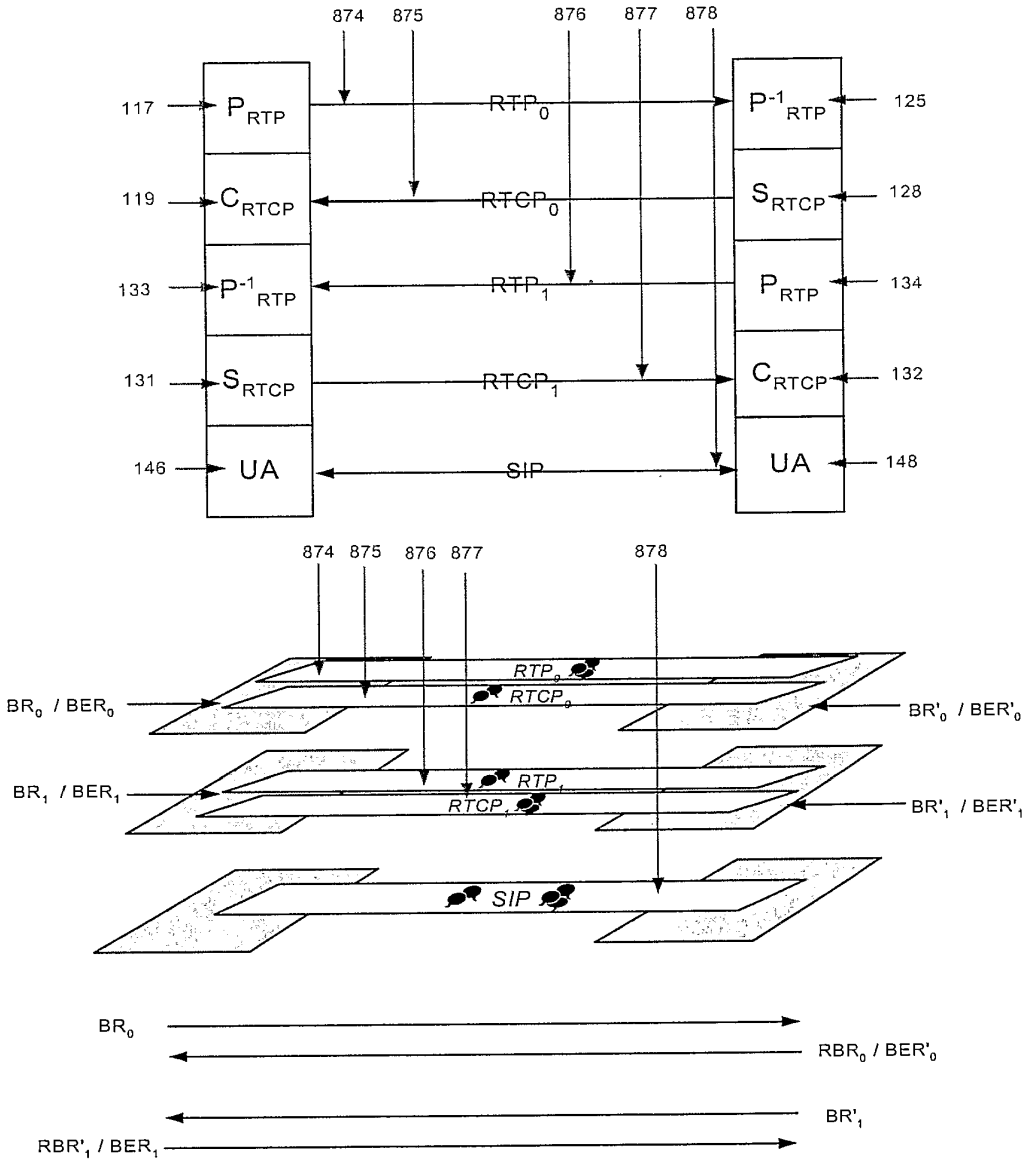

874
875
876
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878
117
P_{RTP}
RTP_0
P^{-1}_{RTP}
125
119
C_{RTCP}
$RTCP_0$
S_{RTCP}
128
133
P^{-1}_{RTP}
RTP_1
P_{RTP}
134
131
S_{RTCP}
$RTCP_1$
C_{RTCP}
132
146
UA
SIP
UA
148
BR_0 / BER_0
BR'_0 / BER'_0
BR_1 / BER_1
BR'_1 / BER'_1
BR_0
RBR_0 / BER'_0
BR'_1
RBR'_1 / BER_1

Figure 15

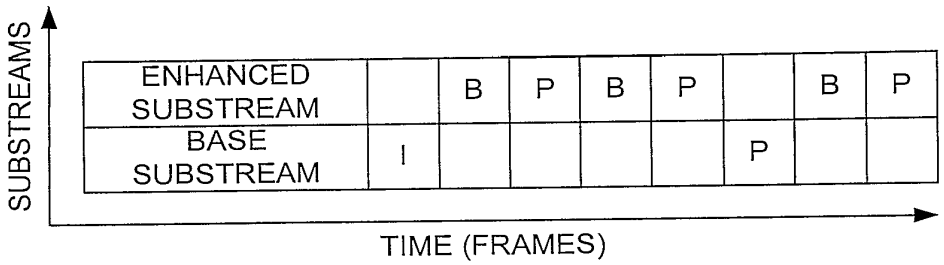


Figure 16

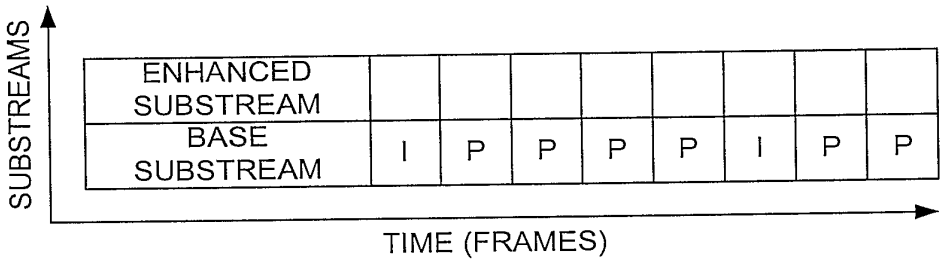


Figure 17

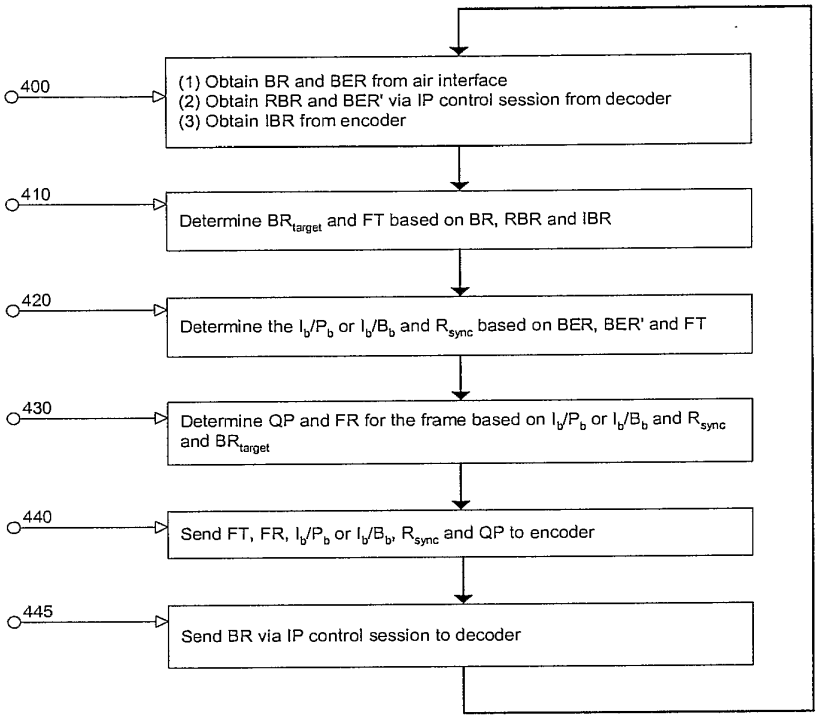


Figure 18

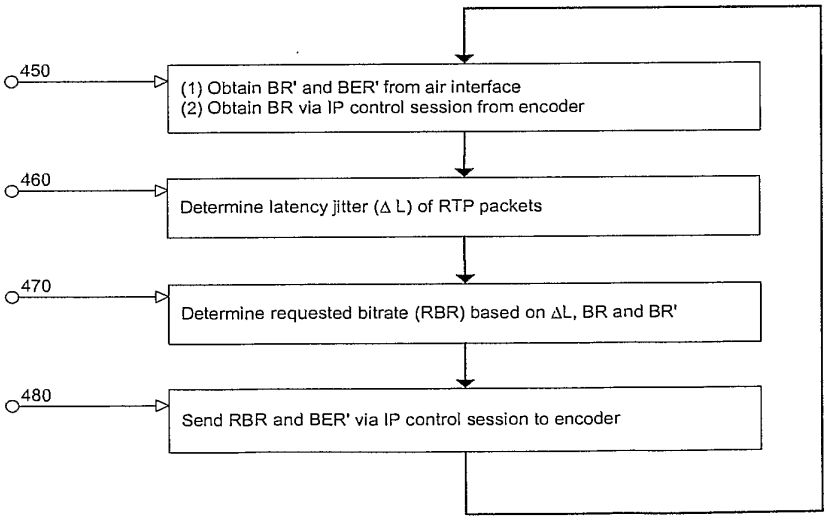


Figure 19

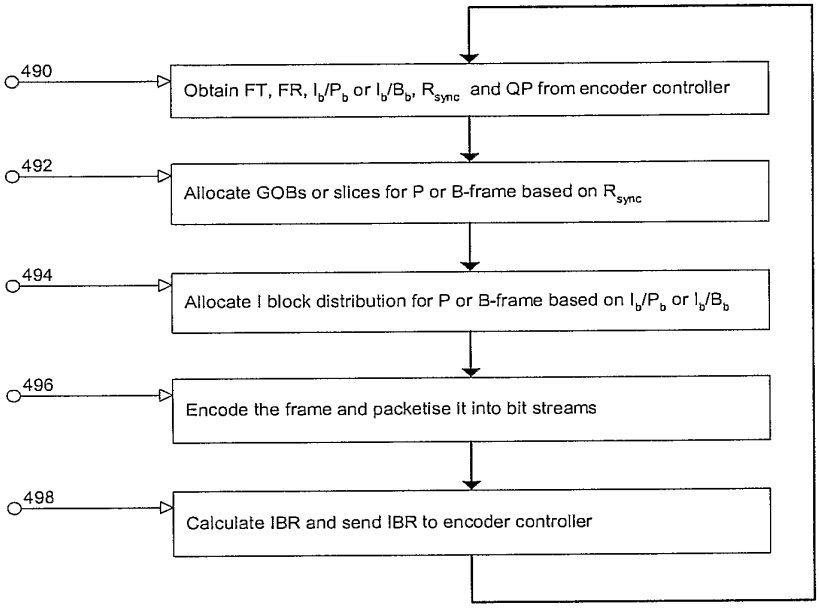

490
Obtain FT, FR, I_b/P_b or I_b/B_b, R_{sync} and QP from encoder controller
492
Allocate GOBs or slices for P or B-frame based on R_{sync}
494
Allocate I block distribution for P or B-frame based on I_b/P_b or I_b/B_b
496
Encode the frame and packetise it into bit streams
498
Calculate IBR and send IBR to encoder controller

Figure 20

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/04924

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 282 240 B1 (NAKAI TOSHIHISA ET AL) 28 August 2001 (2001-08-28) column 5, line 18 - line 49 ---	1-4, 14-16
X	GUERRI J C ET AL: "A feedback packet-level error control for real-time applications in wireless networks" VEHICULAR TECHNOLOGY CONFERENCE, 1999. VTC 1999 - FALL. IEEE VTS 50TH AMSTERDAM, NETHERLANDS 19-22 SEPT. 1999, PISCATAWAY, NJ, USA,IEEE, US, 19 September 1999 (1999-09-19), pages 879-883, XP010353105 ISBN: 0-7803-5435-4	1,2,4, 6-11,14, 15
A	paragraph '0001! paragraph '0003! --- -/--	3,5,12, 16,17

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 July 2002	19/07/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Marie-Julie, J-M

Form PCT/ISA/210 (second sheet) (July 1992)

Webgroup CZ a.s. Ex. 1002, Page 329 of 1406

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 757 490 A (MATSUSHITA ELECTRIC IND CO LTD) 5 February 1997 (1997-02-05) page 13, line 3 -page 16, line 17 page 17, line 21 - line 57	1,2,4
A	HOFFMAN D ET AL: "Hierarchical video distribution over Internet-style networks" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (ICIP) LAUSANNE, SEPT. 16 - 19, 1996, NEW YORK, IEEE, US, vol. 1, 16 September 1996 (1996-09-16), pages 5-8, XP010202065 ISBN: 0-7803-3259-8 paragraph '0001!	1,17,20
A	US 5 825 430 A (ADOLPH DIRK ET AL) 20 October 1998 (1998-10-20) abstract	1,17-20
A	KYUNGRAN KANG ET AL: "Dynamic rate control mechanism for large scale sessions" INFORMATION NETWORKING, 1998. (ICOIN-12). PROCEEDINGS., TWELFTH INTERNATIONAL CONFERENCE ON TOKYO, JAPAN 21-23 JAN. 1998, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 21 January 1998 (1998-01-21), pages 21-24, XP010265270 ISBN: 0-8186-7225-0 the whole document	1,17-20
A	RADHA H ET AL: "Scalable Internet video using MPEG-4" SIGNAL PROCESSING. IMAGE COMMUNICATION, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 15, no. 1-2, September 1999 (1999-09), pages 95-126, XP004180640 ISSN: 0923-5965 the whole document	1,17-20
A	US 6 014 694 A (AHARONI AMIR ET AL) 11 January 2000 (2000-01-11) abstract column 2, line 10 - line 53 column 3, line 61 -column 4, line 7 column 6, line 61 -column 7, line 42	1,17

-/--

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/04924

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	KASSLER A ET AL: "Support for multimedia applications in a wireless ATM system" 1998 1ST. IEEE INTERNATIONAL CONFERENCE ON ATM. ICATM'98. CONFERENCE PROCEEDINGS. COLMAR, FRANCE, JUNE 22 - 24, 1998, IEEE INTERNATIONAL CONFERENCE ON ATM, NEW YORK, NY: IEEE, US, 22 June 1998 (1998-06-22), pages 31-40, XP010290987 ISBN: 0-7803-4982-2 the whole document	1
A	RAMANUJAN R S ET AL: "Adaptive streaming of MPEG video over IP networks" LOCAL COMPUTER NETWORKS, 1997. PROCEEDINGS., 22ND ANNUAL CONFERENCE ON MINNEAPOLIS, MN, USA 2-5 NOV. 1997, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 2 November 1997 (1997-11-02), pages 398-409, XP010252445 ISBN: 0-8186-8141-1 the whole document	1

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Webgroup CZ a.s. Ex. 1002, Page 331 of 1406

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 01/04924

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6282240 B1	28-08-2001	NONE	
EP 0757490 A	05-02-1997	CN 1152242 A	18-06-1997
		EP 0757490 A2	05-02-1997
		JP 10028269 A	27-01-1998
		KR 255229 B1	01-05-2000
		SG 74565 A1	22-08-2000
		US 6356309 B1	12-03-2002
US 5825430 A	20-10-1998	DE 19547707 A1	03-07-1997
		CN 1160321 A	24-09-1997
		EP 0781051 A2	25-06-1997
		JP 9186998 A	15-07-1997
US 6014694 A	11-01-2000	AU 7928998 A	19-01-1999
		EP 0992160 A1	12-04-2000
		WO 9900984 A1	07-01-1999
		JP 2002511216 T	09-04-2002

Form PCT/ISA/210 (patent family annex) (July 1992)

Espacenet

Bibliographic data: KR20050001167 (A) — 2005-01-06

TERMINATION DEVICE OF SEMICONDUCTOR MEMORY FOR MINIMIZING THE DATA SIGNAL DISTORTION IN BOTH READING AND WRITHING MODE

Inventor(s): LEE JAE HYEONG ± (LEE, JAE HYEONG)

Applicant(s): SAMSUNG ELECTRONICS CO LTD ± (SAMSUNG ELECTRONICS CO., LTD)

Classification: - **international:** ***G11C7/00;*** (IPC1-7): G11C7/00
- **cooperative:** **G11C5/063 (KR)**; **G11C5/147 (KR)**; **G11C7/1048 (KR)**; **G11C7/1051 (KR)**; **G11C7/1078 (KR)**; G11C11/4074 (KR); G11C11/4096 (KR)

Application number: KR20030042738 20030627 Global Dossier

Priority number(s): KR20030042738 20030627

Abstract of KR20050001167 (A)

PURPOSE: A termination device of a semiconductor memory is provided to minimize the data signal distortion by selectively controlling the termination resistance of a data bus according to operation state of memory device in order to have the best termination resistance in both reading and writing mode. CONSTITUTION: A termination device of a semiconductor memory for minimizing the data signal distortion comprises the first power supply for supplying source voltage; the second power supply for supplying source voltage as reference voltage of the termination device; the first termination part connected with the first power supply and having prescribed resistance; the second termination part connected with the second power supply and having prescribed resistance; the first switching part(SWA) for connecting or disconnecting the first termination part to/from the memory data line(DQ) according to a reading or a writing mode of the memory device; the second switching part(SWB) for connecting or disconnecting the second termination part to/from the memory data line(DQ) according to the reading or the writing mode of the memory device. Wherein the first and the second termination part have variable resistances according to the reading or the writing mode of the memory device, and the first and the second switching part is disconnected in the reading and the writing mode and connected in a rest mode.

(19)대한민국특허청(KR)
(12) 공개특허공보(A)

(51) 。Int. Cl.[7]
G11C 7/00

(11) 공개번호 10-2005-0001167
(43) 공개일자 2005년01월06일

(21) 출원번호 10-2003-0042738
(22) 출원일자 2003년06월27일

(71) 출원인 삼성전자주식회사
경기도 수원시 영통구 매탄동 416

(72) 발명자 이재형
경기도성남시분당구구미동222무지개마을건영아파트1002동603호

(74) 대리인 임창현
권혁수

심사청구 : 없음

(54) 반도체 메모리 소자의 종단장치

요약

본 발명은 메모리 시스템에서 데이터의 송수신시 데이터 신호의 왜곡을 방지하기 위한 반도체 메모리 소자의 종단장치에 관한 것으로서, 특히 메모리 시스템의 동작유형 및 메모리 소자의 동작유무에 따라 데이터 버스의 종단저항값을 선택적으로 제어함으로써 송수신되는 데이터 신호의 왜곡을 최소화 할 수 있는 반도체 메모리 소자의 종단장치에 관한 것이다.

대표도

도 5

색인어

종단저항, 터미네이션, 임피던스

명세서

도면의 간단한 설명

도 1은 종래의 수동저항 소자를 종단으로 이용하는 직렬 스텁 종단 방식의 버스 구조를 보여준다.

도 2는 종래의 능동저항 소자를 종단으로 이용하는 능동 종단 스텁 방식의 버스 구조를 보여준다.

도 3A는 디램의 독출 동작시 직렬 스텁 종단 방식 및 능동 종단 스텁 방식의 버스에서 각각의 데이터 신호를 측정한 파형을 보여준다.

도 3B는 디램의 기입 동작시 직렬 스텁 종단 방식 및 능동 종단 스텁 방식의 버스에서 각각의 데이터 신호를 측정한 파형을 보여준다.

Webgroup CZ a.s. Ex. 1002, Page 334 of 1406

도 4는 3개의 메모리 슬롯을 갖는 메모리 시스템에서 동작유형에 따라 최적의 종단저항값을 찾기 위한 실시예이다.

도 5는 본 발명에서 메모리 시스템의 동작유형에 따라, 그리고 메모리 시스템에 포함된 메모리 소자의 동작유무에 따라 각기 다른 종단저항값을 갖는 종단장치의 실시예이다.

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 메모리 시스템에서 데이터의 송수신시 데이터 신호의 왜곡(distortion)을 방지하기 위한 반도체 메모리 소자의 종단장치에 관한 것으로서, 특히 메모리 시스템의 동작유형에 따라 데이터 버스의 종단저항값(Termination Resistance)을 선택적으로 제어함으로써 송수신되는 데이터 신호의 왜곡을 최소화 할 수 있는 반도체 메모리 소자의 종단장치에 관한 것이다.

반도체 메모리 소자는 데이터 버스(Data Bus)를 이용하여 메모리 컨트롤러(Memory Controller)와 데이터 신호를 주고받는다. 이 때, 사용되는 버스 동작 주파수(Bus Frequency)에 따라 송수신되는 데이터 신호의 왜곡이 발생하는 경우가 있다. 특히, 동작 주파수가 빠를수록 데이터 신호의 왜곡 가능성은 증가한다.

일반적으로 이러한 신호의 왜곡을 방지하기 위해 반도체 메모리 소자의 수신기(Receiver)및/또는 송신기(Transmitter)에 저항(Resistor)과 같은 소자를 이용하여 종단(Termination)처리를 하는데, 이는 저항과 같은 종단성분이 신호의 반사를 효과적으로 흡수하여 신호의 왜곡을 개선시켜주기 때문이다. 이때 사용되는 저항을 종단저항(Termination Resistance)이라 한다.

상대적으로 저속(약 100MHz)의 데이터 전송율을 갖는 동기식 디램 (Synchronous DRAM:이하, SDRAM)의 경우, 별도의 종단처리 없이 칩셋(Chipset)과 디램을 보드(PCB)상에서 바로 연결하는 저전압 TTL(LVTTL:Low Voltage Transistor-Transistor Logic) 방식으로도 신호의 왜곡 없이 데이터의 전달이 가능하였다. 그러나, 200MHz 이상의 데이터 전송율을 갖는 DDR(Double Data Rate) 램에서는 기존 의 LVTTL 방식으로는 신호의 왜곡을 막을 수 없다. 그래서, DDR 램에서는 수동저항 소자를 종단으로 이용하는 직렬 스텁 종단 방식(이하, SSTL :Stub Series Terminated Logic)을 이용하여 신호의 왜곡을 방지한다.

도 1은 종래의 수동저항 소자를 종단으로 이용하는 SSTL 방식의 버스 구조를 보여준다.

도 1에 보인 것처럼, SSTL 방식에서 신호의 전송을 위한 버스는 종단저항(Rt)을 통해 종단 전원(Vtt)에 접속되고, 디램과도 스텁저항(Rstub)을 통해 접속된다. SSTL 방식에서는 이러한 종단저항(Rt)과 스텁저항(Rstub)을 통해 신호의 스윙(Swing) 폭을 줄임으로서, 버스를 통해 전달되는 데이터 신호의 왜곡을 방지한다. 그러나, 데이터 전송율이 300MHz 이상이 되면, 스텁저항(Rstub)에 의해 버스의 부하가 증가하여 신호의 충실도(Signal Integrity)가 떨어지므로, 533MHz 이상의 데이터 전송율을 갖는 멀티-드롭(Multi-Drop) 버스 구조에서는 사용하기 어렵다. 따라서, 최근에는 능동저항 소자를 종단으로 이용하고 메모리의 동작유무에 따라 종단저항값을 적응적으로 조절할 수 있는 능동 종단 스텁 방식이 이용되고 있다.

도 2는 종래의 능동저항 소자를 종단으로 이용하는 능동 종단 스텁 방식의 버스 구조를 보여준다.

SSTL 방식에서는 종단을 위한 수동저항들(Rt, Rstub)이 디램 모듈(10, 15)이나 마더 보드상에 장착되는데 반하여, 능동 종단 스텁 방식에서는 도 2에 보인 것처럼, 칩셋(20) 및/또는 디램(23, 25)상에 내장되어 구현된다. 그래서, 능동 종단 스텁 방식을 온-다이 종단(이하, ODT:On-Die Termination) 방식이라 부르고, 반면에 마더 보드나 디램 모듈(10, 15)상에 종단을 위한 저항(Rt, Rstub)이 구현되는 SSTL 방식을 마더 보드 종단(이하, MBT:Mother Board Termination) 방식이라 부른다.

도 2를 참조하면, ODT 방식의 버스 구조는 디램(23, 25) 내부에 디램(23, 25)의 동작 여부에 따라 종단을 위한 저항(Rt)을 버스에 연결 또는, 차단하는 스위치들(SW1, SW2)이 포함되어 있다.

ODT 방식에서는 독출(Read) 또는 기입(Write)동작을 수행하고 있지 않는 디램의 종단저항은 스위치에 의해 연결되어 버스에 접속되고, 동작을 수행 중인 디램의 종단저항은 버스의 부하를 감소시키기 위해 스위치에 의해 차단되어

Webgroup CZ a.s. Ex. 1002, Page 335 of 1406

버스로부터 분리된다.

도 3A 내지 도 3B는 MBT 방식과 ODT 방식의 버스에서 각 동작 유형별 데이터 신호의 파형을 보여준다.

도 3A는 디램의 독출 동작시 각 방식별 데이터 신호의 파형을 측정한 것이고, 도 3B는 디램의 기입 동작시 각 방식별 데이터 신호의 파형을 측정한 것이다. 도 3A를 참조하면, 디램의 독출 동작시에는 MBT 방식에 비해 ODT 방식의 버스에서 신호의 왜곡 현상이 많이 개선된 것을 알 수 있다. 그러나, 도 3B에 보인 것처럼 디램의 기입 동작시에는 별다른 개선 효과가 없다는 것을 알 수 있다. 이는 데이터 전송율이 높아질수록 고정된 종단저항값을 갖는 종단방법으로는 독출 및 기입동작 모두에서 신호의 왜곡을 개선하기는 힘들다는 것을 보여준다.

발명이 이루고자 하는 기술적 과제

본 발명에서는 이상과 같은 문제를 해결하기 위해 메모리의 동작 유형에 따라 최적의 종단저항값을 가질 수 있도록 저항값을 선택적으로 제어할 수 있는 반도체 메모리 소자의 종단장치를 제공하고자 한다.

발명의 구성 및 작용

본 발명에서 메모리 시스템에 포함되는 반도체 메모리 소자의 종단장치는 종단장치에 전원을 공급하는 제1 전원공급장치; 종단장치의 기준전위에 해당하는 전원을 공급하는 제2 전원공급장치; 제1 전원공급장치에 연결된 제1 종단부; 제2 전원공급장치에 연결된 제2 종단부; 메모리 소자의 동작 여부에 따라 제1 종단부와 메모리 시스템의 데이터 라인을 연결시키거나, 또는 차단시키는 제1 스위치부; 및 메모리 소자의 동작 여부에 따라 제2 종단부와 메모리 시스템의 데이터 라인을 연결시키거나, 또는 차단시키는 제2 스위치부를 포함하고, 제1 및 제2 종단부는 메모리 시스템의 동작 유형에 따라 종단저항값이 달라짐을 특징으로 한다.

(실시예)

도 4는 3개의 메모리 슬롯을 갖는 메모리 시스템에서 동작유형에 따라 최적의 종단저항값을 찾기 위한 실시예이다.

도 4에 보인 것처럼, 메모리 시스템의 각 슬롯에 삽입되는 각각의 반도체 메모리 소자는 수동저항(Rstub) 및 능동저항(Rat)으로 구성된 종단장치(40)를 포함하고, 각각의 능동저항(Rat)은 두 개의 랭크저항(rank 0, rank 1)을 포함한다.

아래 [표 1]은 메모리 시스템의 동작유형에 따라 데이터 신호의 왜곡이 가장 적은 경우의 각 슬롯별 종단저항값을 보여준다. 이는 도 4의 실시예를 통해 실험적으로 획득한 저항값이다.

[표 1]

동작유형	칩셋저항	슬롯1 저항		슬롯2 저항		슬롯3 저항	
		rank 0	rank 1	rank 0	rank 1	rank 0	rank 1
독출(슬롯1)	150 ohm	OFF	OFF	120 ohm	120 ohm	120 ohm	120 ohm
독출(슬롯2)	150 ohm	120 ohm	120 ohm	OFF	OFF	120 ohm	120 ohm
독출(슬롯3)	150 ohm	120 ohm	120 ohm	120 ohm	120 ohm	OFF	OFF
기입(슬롯1)	OFF	OFF	OFF	75 ohm	75 ohm	75 ohm	75 ohm
기입(슬롯2)	OFF	75 ohm	75 ohm	OFF	OFF	75 ohm	75 ohm
기입(슬롯3)	OFF	75 ohm	75 ohm	75 ohm	75 ohm	OFF	OFF

도 4와 [표 1]을 참조하면, 메모리 시스템의 각 슬롯(Slot)에 삽입된 메모리 소자에 대한 독출 동작이 수행될 때, 데이터 신호의 왜곡이 가장 작은 경우는 칩셋의 종단저항값이 150 옴(ohm)이고, 각 슬롯에 삽입되어 있는 메모리 소자의 종단저항(rank 0, rank 1) 값이 각각 120 옴일 때이다. 그리고, 실제 독출 동작이 수행되고 있는 메모리 소자의 종단

Webgroup CZ a.s. Ex. 1002, Page 336 of 1406

저항은 데이터 버스의 부하를 줄이기 위해 데이터 버스로부터 차단된다. 즉, 슬롯 1에 삽입된 메모리 소자(40)에 대해 독출동작이 수행된다면, 슬롯 1에 삽입된 메모리 소자(40)의 저항은 데이터 버스로부터 차단되고, 독출동작을 수행하지 않는 슬롯 2 및 슬롯 3에 삽입된 메모리 소자의 종단저항(rank 0, rank 1) 값은 각각 120 옴의 저항값을 갖는다. 또한, 메모리 시스템에서 기입 동작이 수행될 때, 데이터 신호의 왜곡이 가장 작은 경우는 칩셋의 종단저항이 데이터 버스로부터 차단되고, 각 슬롯에 삽입되어 있는 메모리 소자의 종단저항(rank 0, rank 1) 값이 각각 75 옴일 때이다. 기입 동작시에도 독출 동작시와 마찬가지로 실제 동작이 수행되고 있는 메모리 소자의 종단저항은 데이터 버스의 부하를 줄이기 위해 차단된다.

이상에서 보인 바와 같이, 데이터 버스를 통한 데이터 신호의 왜곡을 최소화하기 위해서는 메모리 시스템의 동작유형에 따라, 그리고 메모리 시스템에 포함된 메모리 소자의 동작유무에 따라 종단을 위한 저항의 값이 달라져야 한다.

도 5는 본 발명에서 메모리 시스템의 동작유형에 따라, 그리고 메모리 시스템에 포함된 메모리 소자의 동작유무에 따라 각기 다른 종단저항값을 갖는 종단장치의 실시예이다.

도 5의 실시예에서 보인 바와 같이 본 발명의 종단장치는 메모리 시스템의 동작유형 및 메모리 소자의 동작유무에 따라 선택적으로 접속 또는 차단되는 다수의 스위치들을 포함한다. 이들 중 제1 스위치(SWA)와 제2 스위치(SWB)는 해당 메모리 소자의 동작유무를 나타내는 제어신호에 따라 메모리 시스템의 데이터 라인(DQ)과 종단사이의 연결을 접속 또는 차단한다. 즉, 메모리 시스템에서 해당 메모리 소자에 독출 또는 기입동작을 수행하는 경우 제1 스위치(SWA)와 제2 스위치(SWB)는 데이터 라인(DQ)의 부하를 감소시키기 위해 차단되고, 다른 메모리 소자에 독출 또는 기입동작을 수행하는 경우 제1 스위치(SWA)와 제2 스위치(SWB)는 접속되어 종단저항을 데이터 라인(DQ)에 연결한다.

제3 스위치(SW1)와 제4 스위치(SW2)는 메모리 시스템의 독출동작을 나타내는 신호에 따라 접속되고, 기입동작을 나타내는 신호에 의해 차단된다. 그리고, 각 스위치(SW1, SW2)에 연결된 종단저항들(R1, R2)은 앞서 [표 1]에 보인 바와 같이 각각 120 옴의 저항값을 갖는다.

제5 스위치(SW3)와 제6 스위치(SW4)는 메모리 시스템의 기입동작을 나타내는 신호에 따라 접속되고, 독출동작을 나타내는 신호에 의해 차단된다. 그리고, 각 스위치(SW3, SW4)에 연결된 종단저항들(R3, R4)은 각각 75 옴의 저항값을 갖는다.

결론적으로, 메모리 시스템에서 독출 또는 기입동작을 수행하는 경우, 실제 독출 또는 기입동작을 수행하고 있는 메모리 소자의 종단저항들은 제1 스위치(SWA) 및 제2 스위치(SWB)에 의해 데이터 라인(DQ)으로부터 차단되고, 현재 독출 또는 기입동작을 수행하고 있지 않는 메모리 소자의 종단저항들은 메모리 시스템의 동작유형에 따라 제어되는 제3 내지 제6 스위치(SW1 ~ SW4)에 의해 데이터 라인(DQ)과 연결된다. 즉, 메모리 시스템이 독출동작을 수행하고 있는 경우에는 제3 스위치(SW1)와 제4 스위치(SW2)는 연결되고 제5 스위치(SW3)와 제6 스위치(SW4)는 차단되어 120옴의 저항값을 갖는 저항 R1과 R2가 데이터 라인(DQ)에 연결되어 종단저항의 역할을 한다. 그리고, 메모리 시스템이 기입동작을 수행하고 있는 경우에는 제5 스위치(SW3)와 제6 스위치(SW4)가 연결되고 제3 스위치(SW1)와 제4 스위치(SW2)는 차단되어 75옴의 저항값을 갖는 저항 R3과 R4가 데이터 라인(DQ)에 연결되어 종단저항의 역할을 한다.

이상에서, 본 발명에 따른 회로의 구성 및 동작을 상기한 실시예 및 도시된 도면을 통해 설명하였지만, 이는 예시적인 것에 불과하며 본 발명의 기술적 사상을 벗어나지 않는 범위내에서 다양한 응용 및 변경이 가능하다.

발명의 효과

상술한 바와 같이, 본 발명의 종단장치는 메모리 소자의 동작유무에 따라, 그리고 동작유형에 따라 최적의 종단저항값을 갖도록 선택적으로 제어함으로써 메 모리 소자의 독출 및 기입동작 모두에 대해 데이터 신호의 왜곡을 최소화할 수 있다.

(57) 청구의 범위

청구항 1.
메모리 시스템에 포함되는 반도체 메모리 소자의 종단장치에 있어서,

상기 종단장치는 전원을 공급하는 제1 전원공급장치;

상기 종단장치의 기준전위에 해당하는 전원을 공급하는 제2 전원공급장치;

Webgroup CZ a.s. Ex. 1002, Page 337 of 1406

상기 제1 전원공급장치에 연결되고 소정의 저항값을 갖는 제1 종단부;

상기 제2 전원공급장치에 연결되고 소정의 저항값을 갖는 제2 종단부;

상기 메모리 소자의 동작 여부에 따라 상기 제1 종단부와 상기 메모리의 데이터 라인을 연결시키거나, 또는 차단시키는 제1 스위치부; 및

상기 메모리 소자의 동작 여부에 따라 상기 제2 종단부와 상기 메모리의 데이터 라인을 연결시키거나, 또는 차단시키는 제2 스위치부를 포함하되,

상기 제1 종단부 및 상기 제2 종단부는 상기 메모리 시스템의 동작 유형에 따라 저항값이 달라짐을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 2.
제 1항에 있어서,

상기 제1 스위치부 및 상기 제2 스위치부는 상기 메모리 소자가 독출 또는 기입동작을 수행할 때 차단되고, 상기 메모리 소자가 독출 또는 기입동작을 수행하지 않을 때 연결됨을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 3.
제 1항에 있어서,

상기 제1 종단부는 상기 메모리 시스템의 독출동작시 소정의 저항값을 갖는 제1 종단기; 및

상기 메모리 시스템의 기입동작시 소정의 저항값을 갖는 제2 종단기를 포함하며,

상기 제1 종단기와 상기 제2 종단기는 서로 병렬로 구성됨을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 4.
제 3항에 있어서,

상기 제1 종단기는 120 옴의 저항값을 갖는 제1 종단저항; 및

상기 제1 종단저항과 직렬로 구성되어 상기 메모리 시스템의 독출동작시 연결되고, 기입동작시 차단되는 제1 스위치를 포함함을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 5.
제 3항에 있어서,

상기 제2 종단기는 75 옴의 저항값을 갖는 제2 종단저항; 및

상기 제2 종단저항과 직렬로 구성되어 상기 메모리 시스템의 독출동작시 차단되고, 기입동작시 연결되는 제2 스위치를 포함함을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 6.
제 1항에 있어서,

상기 제2 종단부는 상기 메모리 시스템의 독출동작시 소정의 저항값을 갖는 제3 종단기; 및

상기 메모리 시스템의 기입동작시 소정의 저항값을 갖는 제4 종단기를 포함하며,

상기 제3 종단기와 상기 제4 종단기는 서로 병렬로 구성됨을 특징으로 하는 반도체 메모리 소자의 종단장치.

청구항 7.
제 6항에 있어서,

상기 제3 종단기는 120 옴의 저항값을 갖는 제3 종단저항; 및

Webgroup CZ a.s. Ex. 1002, Page 338 of 1406

상기 제3 종단저항과 직렬로 구성되어 상기 메모리 시스템의 독출동작시 연결되고, 기입동작시 차단되는 제3 스위치를 포함함을 특징으로 하는 반도체 메모리 소자의 종단장치.

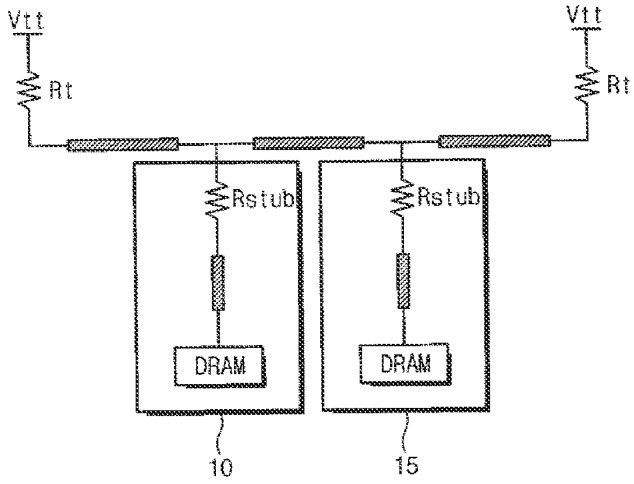
청구항 8.
제 6항에 있어서,

상기 제4 종단기는 75 옴을 갖는 제4 종단저항; 및

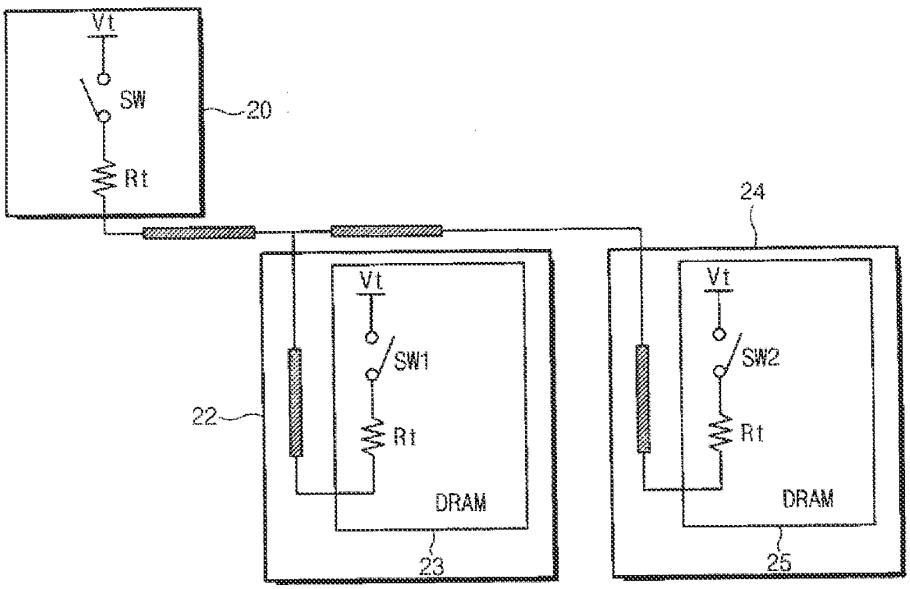
상기 제4 종단저항과 직렬로 구성되어 상기 메모리 시스템의 독출동작시 차단되고, 기입동작시 연결되는 제4 스위치를 포함함을 특징으로 하는 반도체 메모리 소자의 종단장치.

도면

도면1

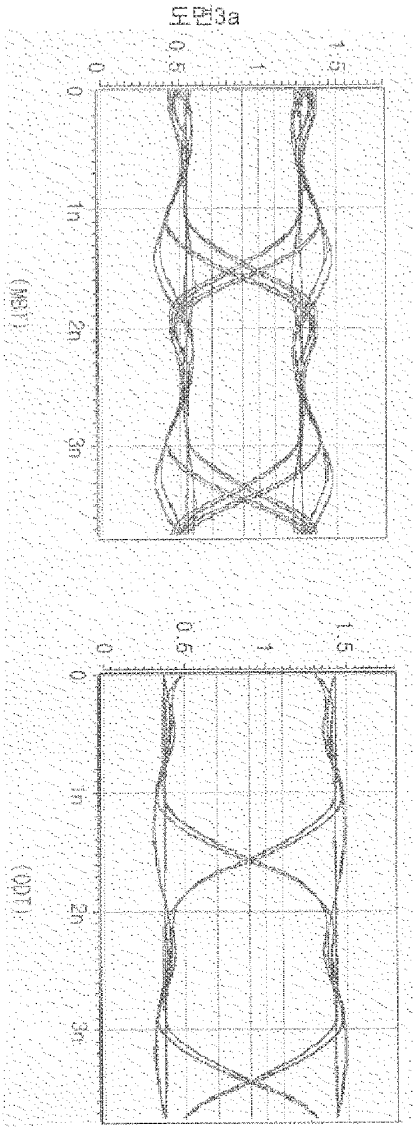


도면2



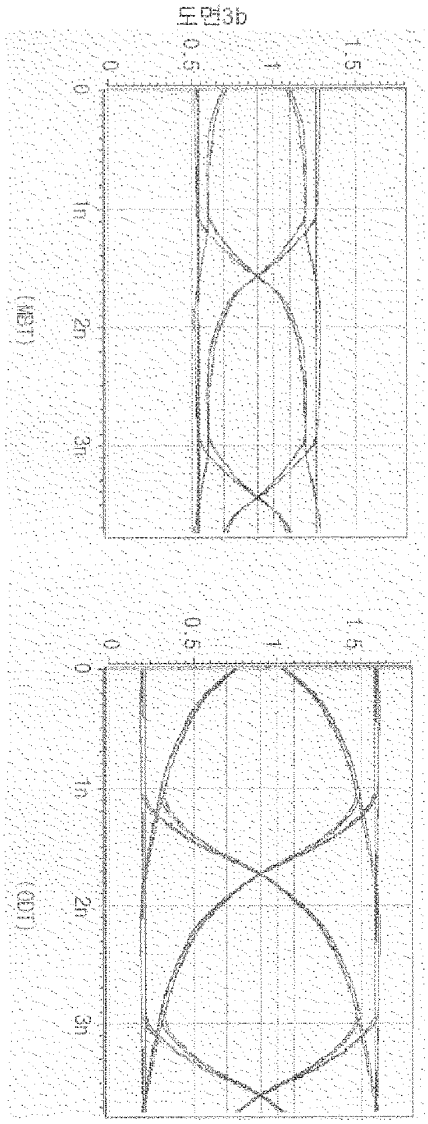
Webgroup CZ a.s. Ex. 1002, Page 339 of 1406

도면3a



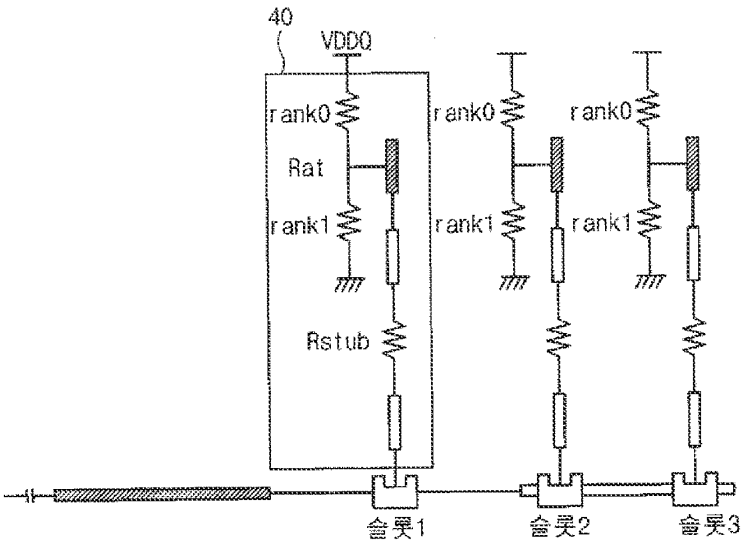
Webgroup CZ a.s. Ex. 1002, Page 340 of 1406

도면3b

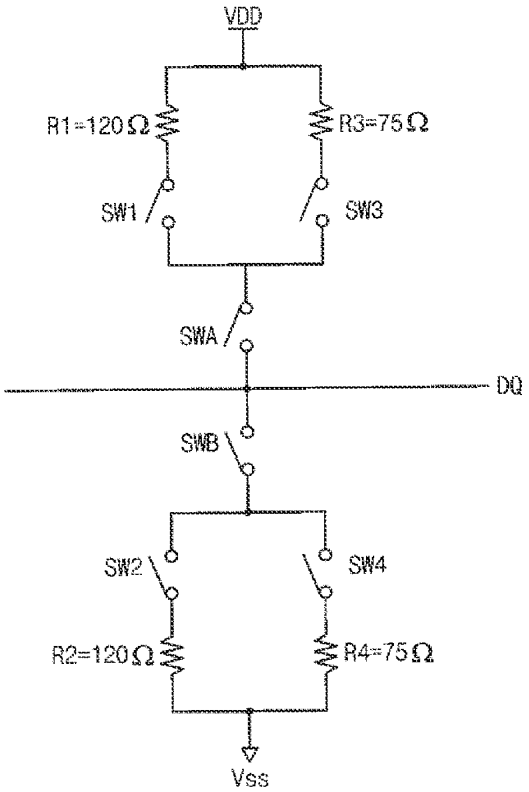


Webgroup CZ a.s. Ex. 1002, Page 341 of 1406

도면4



도면5



Webgroup CZ a.s. Ex. 1002, Page 342 of 1406

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(71) Applicant *(for all designated States except US)*: **BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY** [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **WALKER, Matthew, David** [GB/GB]; 9 Thirlmere Court, Felixstowe, Suffolk IP11 9SN (GB). **JACOBS, Richard, James** [GB/GB]; 15 Through Duncans, Woodbridge, Suffolk IP12 4EA (GB). **NILSSON, Michael, Erling** [GB/GB]; 5 Laburnum Gardens, Rushmere St. Andrew, Ipswich IP5 1BY (GB).

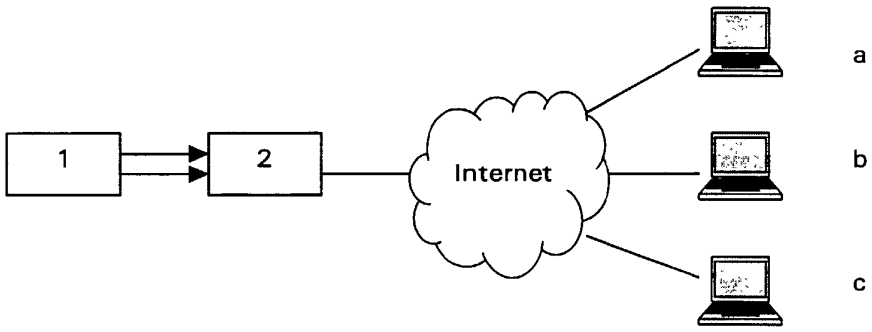
(74) Agent: **ROBINSON, Simon, Benjamin**; BT Group Legal Services, Intellectual Property Dept., Holborn Centre, 8th Floor, 120 Holborn, London EC1N 2TE (GB).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

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[Continued on next page]

(54) Title: TRANSMITTING AND RECEIVING REAL-TIME DATA



(57) Abstract: The invention concerns streaming real-time data (e.g. video) over packet networks (e.g. the Internet). Conventionally, in packet networks, in order to view streamed video data a reservoir of data is built up to reduce the effect of jitter, caused by variations in the inter-arrival times of packets of data. Consequently, a delay is experienced before the video material can be viewed as the reservoir is filled. The invention is concerned with providing streamed video without the start-up delay by transmitting data from a video streamer to the video viewer more rapidly than the video viewer consumes the data and using the excess data to build a buffer at the video viewer. When a suitable sized buffer is built the transmission rate of data to the buffer may be reduced. In order to deliver the best quality material for the available bandwidth, the supply of video data may be switched to a higher bit-rate source when the reservoir is filled. Fluctuations in network throughput may be accommodated during the transmission of data on a fine scale by adjusting the transmission rate of the data and on a coarse scale by switching between data streams encoded at different bit-rates. Fluctuations in network throughput are determined by counting the number of missing packets at the video viewer which information may then be fed back to the video streamer to adjust the flow of data accordingly.

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B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 01151 A (SARNOFF CORP) 6 January 2000 (2000-01-06) abstract	7-11,14
Y	page 2, line 30 -page 3, line 15 page 4, line 7 -page 6, line 2 page 9, line 3 -page 12, line 21 claims 1,5,9,10	12,13, 16,17
Y	US 5 822 524 A (HUANG SHIOW-LAANG ET AL) 13 October 1998 (1998-10-13)	12,13
A	column 3, line 40 -column 8, line 15 claims 1,5-21	1-11, 14-17
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2002	28/06/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Karavassilis, N

Form PCT/ISA/210 (second sheet) (July 1992)

Webgroup CZ a.s. Ex. 1002, Page 345 of 1406

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 918 020 A (HENTHORN WILLIAM JOHN ET AL) 29 June 1999 (1999-06-29)	16,17
A	column 5, line 6 -column 6, line 55 column 8, line 58 -column 11, line 32 claim 1	1-15

INTERNATIONAL SEARCH REPORT

ational Application No
PCT/GB 01/05246

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0001151	A	06-01-2000	WO	0001151 A1	06-01-2000
US 5822524	A	13-10-1998	NONE		
US 5918020	A	29-06-1999	NONE		

Form PCT/ISA/210 (patent family annex) (July 1992)

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(71) Applicant *(for all designated States except US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GENTRIC, Philippe** [FR/FR]; 156 Boulevard Haussmann, F-75008 Paris (FR). **DELAHAYE, Nicolas** [FR/FR]; 156 Bd Haussmann, F-75008 PARIS (FR). **RAMANZIN, Yves** [FR/FR]; 156 Bd Haussmann, F-75008 PARIS (FR).

(74) Agent: **CHAFFRAIX, Jean**; Société Civile SPID, 156 Boulevard Haussmann, F-75008 Paris (FR).

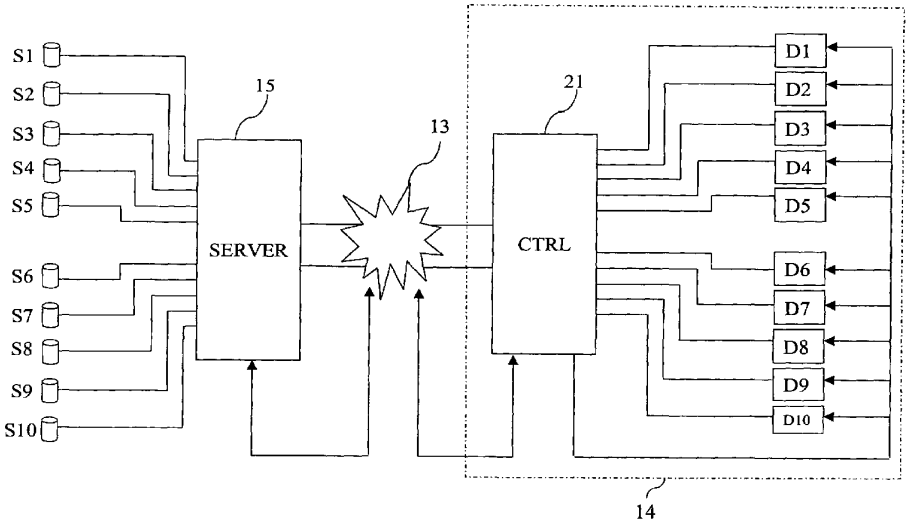
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF STREAMING MULTIMEDIA DATA



(57) Abstract: The invention relates to a method of streaming multimedia for providing seamless stream switching. The method consists in streaming multimedia data from a server (15) to a client (14) over a network (13) having a variable bandwidth. The client is intended to decode a subset of streams within a set of streams having various predetermined bit rates. The decoded subset of streams has bit rates compatible with the network bandwidth. The method comprises the steps of configuring the client so that the client can decode all the streams within the set of streams, playing all the streams within the set of streams and muting all the streams within the set of streams, except the subset of streams.

WO 2004/021668 A1

Method of streaming multimedia data.

FIELD OF THE INVENTION

The present invention relates to a method of streaming multimedia data from a server to a client over a network having a variable bandwidth, the client being intended to decode a subset of streams within a set of streams having various predetermined bit rates, said subset of streams having bit rates compatible with the network bandwidth.

The present invention also relates to a server and a client for carrying out this method, a telecommunication system implementing this method and a computer program for carrying out this method.

The present invention is particularly relevant for systems of multimedia streaming over networks whose effective instantaneous bandwidth may vary with time. For example, it applies to transmissions over mobile telephony systems using various transmission standards such as MPEG-4 (Moving Expert Picture Group – 4) or H263.

BACKGROUND OF THE INVENTION

Multimedia networks such as the GPRS (General Packet Radio System) or UMTS (Universal Mobile Telephony System) and the Internet do not provide a guaranteed quality of service. The effective instantaneous bandwidth varies with time because of congestions, transmission errors or resource sharing for instance. In the framework of multimedia streaming over such networks, adaptation mechanisms to these variations have to be provided in order to minimize data losses on the one hand and maximize the quality of the content received by the client on the other hand.

A classical approach to this problem is known as "Stream Switching". The same content is encoded by a media encoder into a set of streams at several bit rates. With respect to the currently available bandwidth, an adequate stream, i.e. having an adequate bit rate with respect to the available bandwidth, is selected to be transmitted to the client via a media server, which operates the corresponding stream switching, for selecting said adequate stream to be sent.

The way a stream switching is usually performed is described hereinafter. Based on the bit rates of the various streams and on the available bandwidth, the

server selects a stream having a bit rate compatible with the available bandwidth. The server can also select a subset of streams, when the client is intended to decode simultaneously many streams, e.g. an audio and a video stream. In the following, a "subset of streams" shall designate one stream or a few streams. If the selected subset of streams differs from the subset of streams currently decoded by the client, a stream switching is performed.

In order to perform such a stream switching, information concerning the selected subset of streams is communicated to the client, so that the client can change its configuration in order to be able to decode this selected subset of streams, with respect to the content and bit rates of this selected subset of streams.

Thus, when a server switches from one subset of streams to another one, e.g. in order to adapt the bit rate of the delivered subset of streams to the available bandwidth of the network, a new decoder configuration corresponding to the new delivered subset of streams has to be sent to the client decoder. The decoder is then reinitialised with the new decoder configuration. The stream switching is therefore not seamless for the client and may impact the service quality from the end user's point of view.

For example, suppose one wants to perform a stream switching using the IETF (Internet Engineering Task Force) standard, which is RTSP (Real Time Streaming Protocol) described in "Real Time Streaming Protocol (RTSP), RFC2326, April 1998" written by Schulzrinne H. et al. The following commands have to be sent by the client to the server :

- TEARDOWN : to stop the current subset of streams
- DESCRIBE : to get information on the new subset of streams
- SETUP : to configure the new session, ie to indicate to the server that the decoder has been reinitialised
- PLAY : to start streaming the new subset of streams in the new session.

These commands and the answer to these commands require a long time, for example a few seconds. Actually, each request from the client to the server is followed by an acknowledgment sent by the server to the client, which means that each command requires a whole round trip over the network. The service is therefore interrupted on the end user side during a few seconds, which is not acceptable.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a method of streaming multimedia data, which leads to a seamless stream switching.

To this end, a method of streaming multimedia data according to the invention, as described in the opening paragraph, is characterised in that it comprises the steps of configuring the client so that the client can decode all the streams within the set of streams, playing all the streams within the set of streams and muting all the streams within the set of streams, except the subset of streams.

According to the invention, the client decoder is first configured in order to be able to decode all streams within the set of streams. Then, all streams within the set of streams are played, but a large number of these streams are muted, i.e. they do not reach the final decoder in order to be decoded. Only the subset of streams compatible with the network bandwidth is not muted, i.e. reaches the client decoder to be decoded. When a stream switching is to be performed between a currently decoded subset of streams and a next subset of streams, the currently decoded subset of streams is muted and the next subset of streams is simply unmuted. Such a stream switching thus only requires muting and unmuting two subsets of streams, and does not require any configuration of a new session. Such a stream switching is therefore seamless.

Advantageously, the step of muting all the streams except the subset of streams is performed by the server on a request from the client in accordance with the MUTE/UNMUTE extension of the Real Time Streaming Protocol. The method uses standard IETF protocols so that servers and clients implemented by different parties can interoperate.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:

- Fig. 1 is a block diagram illustrating a telecommunication system comprising a server and a client according to the invention;
- Fig. 2 is a block diagram illustrating a telecommunication system with a client according to a first embodiment of the invention;

- Fig. 3 is a block diagram illustrating a telecommunication system with a client according to a second embodiment of the invention;
- Fig. 4 is a diagram for illustrating a method of streaming and a stream switching according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

A telecommunication system according to the invention is depicted in Fig.1. Such a telecommunication system comprises a server 15 comprising playing means 11 and muting means 12, a network 13 and a client 14. The network 13 is, for example, a mobile radiotelephony network or the Internet network.

The server 15 receives a set of streams {S1, S2, S3, S4}. These streams correspond to a multimedia content produced by a multimedia source, after encoding. For a given multimedia source, all the produced encoded streams within the set {S1, S2, S3, S4} comprise the same multimedia content, but have different predetermined bit rates. The bit rates are predetermined in order for the system to be able to provide the client 14 with a set of various qualities of services, selected on the one hand with respect to the nature of the transmitted content, each content (audio, fixed images, video, etc.) requiring a specific available bandwidth, and on the other hand with respect to the quality of service required by the end user on the client side.

The various available bit rates are also useful to enable the system to cope with variations of the available bandwidth, which often cause a reduction of the bit rate of the transmitted streams. As a matter of fact, the network's effective bandwidth may vary with time with respect to several parameters. These parameters include current traffic and radio transmission conditions, which may considerably affect the current available bandwidth. With respect to this current available bandwidth and the required quality of service, the adequate stream has to be delivered to the client 13.

The method of streaming multimedia data according to the invention is described hereinafter. When the client 14 desires to decode a multimedia content, it first asks the server 15 for information about the various streams S1 to S4 comprising this multimedia content. This information comprises the bit rates of each stream S1 to S4. Using this information, the client 13 is configured so that it can decode all the streams within the set of streams {S1, S2, S3, S4}. How such a

configuration is performed is described in Figs.2 and 3. Then, according to the available network bandwidth, a subset of streams is selected, which is to be decoded by the client 14.

The measure of the available bandwidth can be performed by the server 15. In this case, the server 15 will select the subset of streams to be decoded by the client 14. This is particularly advantageous when the server 15 has information about the client 14, for example the various decoders available in client 14. The measure of the available bandwidth can also be performed by the client 14. In this case, the client 14 will select the subset of streams to be decoded. This would be the case, for example, in a mobile radiotelephony network, where a lot of different clients are linked to a same server. Actually, in such a network, the server 15 cannot have information about all the clients in the network. The available bandwidth can also be measured by the server 15 and sent to the client 14, which will then select the subset of streams to be decoded.

Suppose the subset of streams to be decoded by the client 14 is the stream S1. Then all the streams within the set of streams {S1, S2, S3, S4} are played by the server 15, thanks to the playing means 11, but the streams S2, S3 and S4 are muted, thanks to the muting means 12. Playing and muting a stream means that the stream is virtually played by the playing means 11, but the stream does not reach the client 14 and the virtual play does not consume any resource on the server side. For example, suppose a stream comprises 10 stream elements enumerated 1 to 10, the first stream element 1 being played at a first time t1, the second stream element 2 at a time t2 and so on, and suppose the stream is muted at time t4 and unmuted at time t8. Then the client 14 receives the stream elements 1 to 3 and, after a time equal to t8-t4, the client 14 receives the stream elements 8 to 10.

As the streams S2, S3 and S4 are muted, the client 14 only receives the stream S1 and can decode this stream because it has been configured in order to be able to decode all the streams. Suppose the available bandwidth changes and a stream switching is to be performed, for example the stream S2 is selected to be decoded by the client 14. In order to perform such a stream switching, the stream S1 is muted and the stream S2 is unmuted, so that only the stream S2 reaches the client 14, which stream S2 can be decoded by the client 14 because it has been configured in order to be able to decode all the streams.

The method in accordance with the invention thus allows performing a seamless stream switching. Actually, the time required to mute a stream and unmute another stream on the server side is very small, so that there is no service interruption on the client side, which could be noticed by an end user. The end user on the client side might be aware that a stream switching has been performed, because the quality of the currently decoded stream might have changed. Compared to a stream switching in accordance with the state of the art, the stream switching performed by the method in accordance with the invention does not require configuring a new session each time a new stream is selected to be decoded by the client 14, because a session is already established for each stream within the set of streams {S1, S2, S3, S4}, as these streams are played by the playing means 11. As a consequence, the stream switching according to the invention is much more seamless than a stream switching according to the state of the art.

It is important to notice than the muting means 12 might be separated from the server 15. For example, the muting means 12 might be a separate device placed between the server 15 and the client 13, or might form part of the client 14.

Fig. 2 illustrates a telecommunication system according to a first embodiment of the invention. This telecommunication system comprises the server 15, the network 13 and the client 14. The client 14 comprises a controller 21 and ten decoders D1 to D10.

In the following example, a multimedia content to be decoded by the client 14 has been encoded into 10 streams S1 to S10, forming a set of streams {S1-S10}. The five first streams S1 to S5 contain a video content and the five last streams S6 to S10 contain an audio content. Playing the multimedia content consists in playing one video stream and one audio stream. Examples of streams S1 to S10 are given in the 2 following tables, which principally define the formats of the streams and their bit rates.

Stream	Format	Size	Profile	Frames/sec	Bit Rate
S1	H263	QCIF	Single	2	25
S2	MPEG-4 video	QCIF	Single	10	50

S3	MPEG-4 video	QCIF	Single	25	100
S4	MPEG-4 video	CIF	Single	25	200
S5	MPEG-4 video	CIF	Advanced simple	25	400

Stream	Format	Bit Rate
S6	Adaptive Multi-Rate	5
S7	Code Excited Linear Prediction	10
S8	Advanced Audio Coding mono	32
S9	Advanced Audio Coding stereo	64
S10	Advanced Audio Coding + advanced tools	128

When the client 14 desires to decode the multimedia content, the controller 21 asks for information about each stream S1 to S10. For example, the multimedia content might be contained in a file, which has an URL address (URL stands for Universal Resource Locator). Knowing the address of the content, the controller 21 asks for a description of the streams comprising this multimedia content, by sending a request to the server 15 via the network 13. For example, if the RTSP protocol is used, such a request is a "DESCRIBE" command which has the following structure:

DESCRIBE rtsp://movie RTSP/1.0
CSeq: 1.

In this command, the URL address of the multimedia content is "rtsp://movie", the protocol used is "RTSP/1.0" and the sequence number Cseq of this message is 1.

The server 15 then sends the descriptions of the streams comprising the desired multimedia content. The messages sent by the server 15 to the client 14 have the following structure:

RTSP/1.0 200 OK
CSeq: 1

```
Content-Type: application/sdp
Content-Length: xxx

a=control:rtsp://movie
t=0 0

m=video 7722 RTP/AVP 96
a=rtpmap:96 MP4V-ES/1000
a=control:rtsp://movie/video1
a=br:400

m=audio 7724 RTP/AVP 97
a=rtpmap:97 mpeg4-generic/44100/2
a=control:rtsp://movie/audio1
a=br:128

m=video 7726 RTP/AVP 98
a=rtpmap:98 MP4V-ES/1000
a=control:rtsp://movie/video2
a=br:200

m=audio 7724 RTP/AVP 99
a=rtpmap:99 mpeg4-generic/44100/2
a=control:rtsp://movie/audio2
a=br:68
```

These messages correspond to a description of the streams S5, S10, S4 and S9, respectively.

As the description of a given stream comprises the format of the stream and its bit rate, the controller can configure one of its decoders so that this decoder is able to decode the given stream. In the example of Fig.2, the decoder D1 is configured to decode the stream S1, the decoder D2 is configured to decode the stream S2 and so on.

The client 14 and the server 15 also have to agree on transport parameters, i.e. UDP port numbers. This is effected thanks to a SETUP command, which has the following structure, given for the stream S10:

```
SETUP rtsp://movie/audio1 RTSP/1.0
CSeq: 2
Transport: RTP/AVP;unicast;client_port=8000-8001
```

The server then answers this message by sending a message having the following structure :

```
RTSP/1.0 200 OK
CSeq: 2
Transport: RTP/AVP;unicast;client_port=8000-8001;
        server_port=9000-9001
Session: 12345678
```

In the following, we suppose that the measure of the bandwidth is performed by the client 14, e.g. by the controller 21, and that the client 14 selects the subset of streams compatible with the available bandwidth.

Once the decoders of the client 14 have been configured, a subset of streams to be decoded by the client 14 is selected, for example the streams S5 and S10.

Then the controller 21 requests that the streams S1 to S4 and S6 to S9 are muted. Such a request is sent via the network 13 to the server 15, which comprises muting means. If the RTSP protocol is used, such a request uses the MUTE extension of this protocol, and has the following structure, given for the streams S9 and S4 :

```
MUTE rtsp://movie/audio2 RTSP/1.0
CSeq: 8
Session: 12345678

MUTE rtsp://movie/video2 RTSP/1.0
```

CSeq: 9
Session: 12345678

The streams S1 to S10 are then played by the server 15. For example, the client 14 can request that the streams S1 to S10 are played. If the RTSP protocol is used, such a request uses the PLAY command and has the following structure :

PLAY rtsp://movie RTSP/1.0
CSeq: 12
Range: npt=0-
Session: 12345678

The server then sends an acknowledgment, which has the following structure:

RTSP/1.0 200 OK
CSeq: 12
Session: 12345678

As all streams within the set of streams {S1-S10} are muted, except the streams S5 and S10, the streams S5 and S10 reaches the controller 21, which sends them to the decoders D5 and D10, respectively. The controller might comprise switches or multiplexers in order to send the incoming streams to the right decoders. The controller 21 might also comprise a plurality of ports, each assigned to one decoder, and receive a given stream on the port corresponding to the decoder intended to decode this given stream.

Suppose a stream switching is to be performed because the available bandwidth has decreased. For example, the client 14 would like to play the streams S4 and S9, which have lower bit rates than the streams S5 and S10, respectively. The controller 21 then requests that the streams S5 and S10 are muted and that the streams S4 and S9 are unmuted. Such a request is sent via the network 13 to the server 15. If the RTSP protocol is used, such a request uses the MUTE/UNMUTE extension of this protocol, and has the following structure:

MUTE rtsp://movie/audio1 RTSP/1.0
CSeq: 13
Session: 12345678

MUTE rtsp:/movie/video1 RTSP/1.0
CSeq: 14
Session: 12345678

UNMUTE rtsp://movie/audio2 RTSP/1.0
CSeq: 15
Session: 12345678

UNMUTE rtsp://movie/video2 RTSP/1.0
CSeq: 16
Session: 12345678

The server then sends an acknowledgment, which has the following structure:

RTSP/1.0 200 OK
CSeq: 13
Session: 12345678

RTSP/1.0 200 OK
CSeq: 14
Session: 12345678

RTSP/1.0 200 OK
CSeq: 15
Session: 12345678

RTSP/1.0 200 OK
CSeq: 16
Session: 12345678

Then, when the streams S4 and S9 reach the client 14, the controller 21 sends them to the decoders D4 and D9, respectively.

Fig. 3 illustrates a telecommunication system according to a second embodiment of the invention. The client 14 comprises two decoders D1 and D2, and two memories 31 and 32. The first decoder D1 is able to decode video streams and the second decoder D2 is able to decode audio streams.

In this embodiment, the decoders D1 and D2 are configured by means of configuring parameters, which are loaded in the memories 31 and 32. When the server 15 sends a description of each stream within the set of streams {S1-S10} via the network 13 to the client 14, the controller 21 computes decoding parameters P1 to P10 and loads these parameters into the memories 31 and 32. The parameters P1 are computed in such a way that, knowing these parameters, the decoder D1 is able to decode the stream S1. The parameters P2 are computed in such a way that, knowing these parameters, the decoder D1 is able to decode the stream S2, and so on. The parameters P1 to P5 are loaded into the memory 31 and used to configure the decoder D1. The parameters P6 are computed in such a way that, knowing these parameters, the decoder D2 is able to decode the stream S6, and so on. The parameters P6 to P10 are loaded into the memory 32 and used to configure the decoder D2.

When a given subset of streams is to be decoded by the client 14, as has been described hereinbefore, the configuring parameters corresponding to this given subset of streams are sent to the decoders D1 and D2 by the controller 21, in order to configure these decoders so that they can decode the given subset of streams. Such a configuration might require a certain time. When a stream switching is effected, a new configuration has to be sent to the decoders, i.e. new configuring parameters have to be sent to the decoders.

Suppose the stream S1 is decoded by the decoder D1, and a stream switching is effected in order to decode the stream S2. The decoder D1 keeps its configuration corresponding to the parameters P1 until there is no more data from the stream S1 reaching the decoder D1. At that time, the stream S2 reaches the decoder D1, but the decoder D1 is not able to decode the stream S2 because the reconfiguration requires a certain time. This might lead to service interruptions. To

solve this problem, a buffer might be used between the decoder and a display intended to display the decoded streams. This buffer stores decoded streams, i.e. audio and/or video, corresponding to a time which is at least the time required for the reconfiguration of the decoders.

Thanks to this buffer, the end user does not detect any service interruption, because decoded streams are fetched from the buffer and displayed while the decoders are being reconfigured.

Fig.4 illustrates a method of streaming multimedia and a stream switching according to the invention. Such a method might be implemented by the client 14 of Figs. 2 and 3.

At step 401, the client 14 desires to decode a multimedia content, which is, for example, comprised in a file having an URL address. At step 402, the client 14 asks for information about the various streams comprising the multimedia content. At step 403, the client is configured in order to be able to decode all the streams comprising the desired multimedia content. Such a configuration might be performed as has been described in Fig. 2 or 3.

At step 404, the client 14 requests that the streams comprising the desired multimedia content are played and, at step 405, the client requests that the streams are muted, except a subset of streams which the client desires to decode, i.e. the subset of streams having bit rates compatible with the current available bandwidth. The steps 404 and 405 advantageously are simultaneous. At step 406, the unmuted subset of streams, which reaches the client 14, is decoded. This step 406 might require a decoder configuration if a client in accordance with the second embodiment of the invention is used, as has been described in Fig.3.

At step 407, the client 14 checks if the bandwidth has changed. If the bandwidth has not changed, the currently decoded subset of streams stays unmuted and the client 14 decodes this subset of streams. If the bandwidth has changed, a subset of streams to be decoded is selected according to the new available bandwidth, at step 408. If this subset of streams is different from the currently decoded subset of streams, the client requests, at step 409, that the currently decoded subset of streams is muted and, at step 410, that the new subset of streams to be decoded is unmuted. The steps 409 and 410 advantageously are simultaneous. Then, the new subset of streams is decoded at step 406.

The method for streaming multimedia according to the invention can be implemented in an integrated circuit, which is intended to be integrated in a server or in a client. A set of instructions that is loaded into a program memory causes the integrated circuit to carry out the method for streaming multimedia. The set of instructions may be stored on a data carrier such as, for example, a disk. The set of instructions can be read from the data carrier so as to load it into the program memory of the integrated circuit, which will then fulfil its role.

Any reference sign in the following claims should not be construed as limiting the claim. It will be obvious that the use of the verb "to comprise" and its conjugations does not exclude the presence of any other elements or steps besides those defined in any claim. The word “a” or “an” preceding an element or a step does not exclude the presence of a plurality of such elements.

Claims

1. A method of streaming multimedia data from a server (15) to a client (14) over a network (13) having a variable bandwidth, the client being intended to decode a subset of streams within a set of streams (S1, S10) having various predetermined bit rates, said subset of streams having bit rates compatible with the network bandwidth, the method being further characterised in that it comprises the steps of configuring the client so that the client can decode all the streams within the set of streams, playing all the streams within the set of streams and muting all the streams within the set of streams, except the subset of streams.

2. A method of streaming multimedia data according to claim 1, wherein the step of muting all the streams except the subset of streams is performed by the server on a request from the client in accordance with the MUTE/UNMUTE extension of the Real Time Streaming Protocol.

3. A server (15) for serving a client (14) with a subset of streams over a network (13) having a variable bandwidth, said server comprising means for selecting the subset of streams within a set of streams having various predetermined bit rates, means for playing (11) all the streams within the set of streams and means for muting (12) all the streams within the set of streams, except the subset of streams.

4. A server as claimed in claim 3, wherein the means for selecting the subset of streams comprise means for measuring the network bandwidth.

5. A server as claimed in claim 3, wherein the means for selecting the subset of streams are controlled by a request from the client.

6. A client (14) intended to decode a subset of streams within a set of streams having various predetermined bit rates, said streams being sent over a network (13) having a variable bandwidth, said client comprising configuring means (21) in order to be able to decode all the streams within the set of streams, means for selecting a subset of streams having bit rates compatible with the network bandwidth and means for muting all the streams within the set of streams, except the subset of streams.

7. A telecommunication system comprising a server for serving a client with a subset of streams, said server comprising means for selecting the subset of streams within a set of streams having various predetermined bit rates, means for playing all the streams within the set of streams and means for muting streams, a network having a variable bandwidth and a client intended to decode the subset of streams, said client comprising configuring means in order to be able to decode all the streams within the set of streams, means for selecting a subset of streams having bit rates compatible with the network bandwidth and means for requesting that all the streams within the set of streams, except the subset of streams, are muted.

8. A computer program comprising a set of instructions which, when loaded into a processor or a computer, causes the processor or the computer to carry out the method as claimed in Claim 1.

FIG. 1

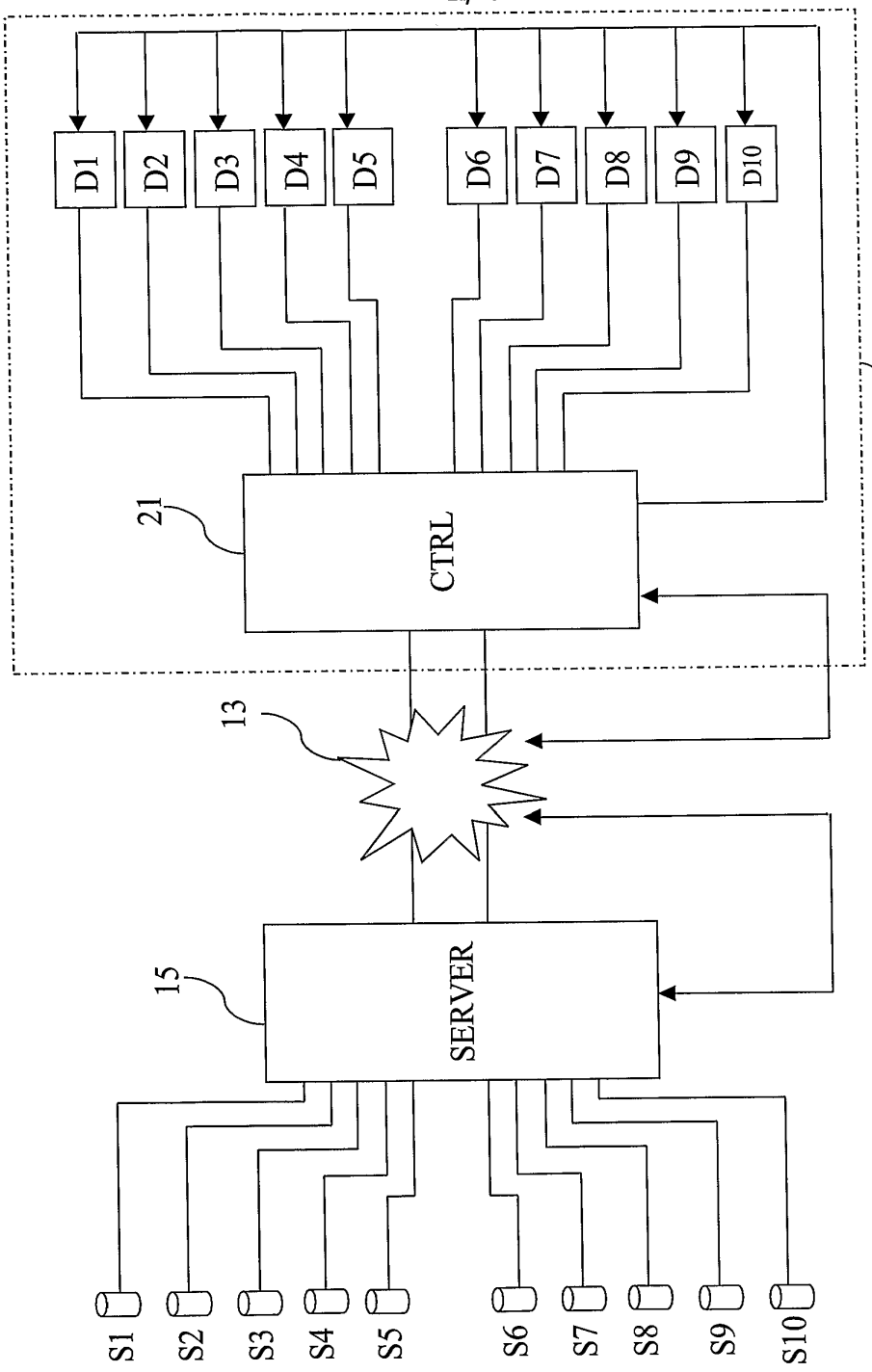

D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
14
21
CTRL
13
15
SERVER
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10

FIG. 2

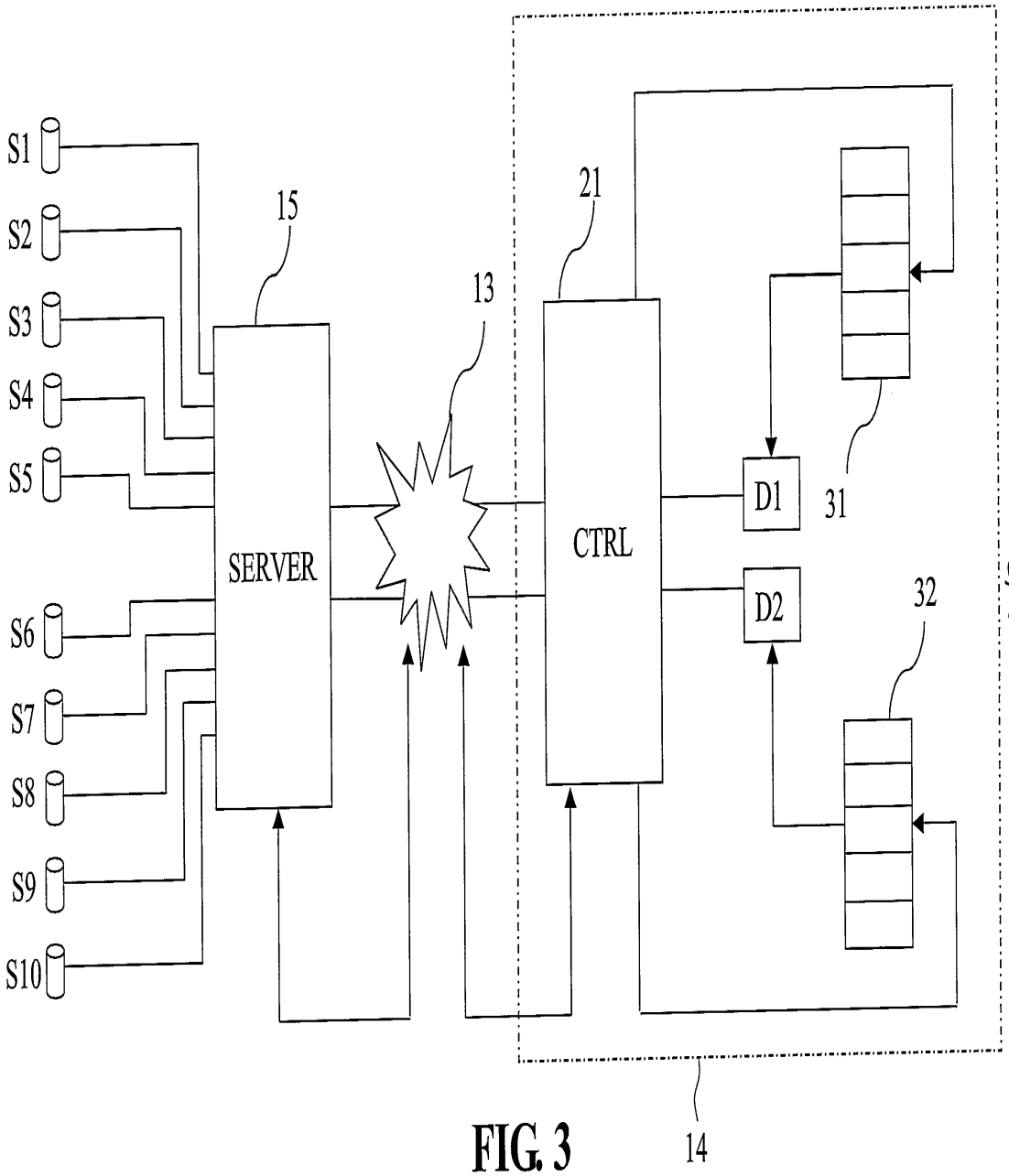


FIG. 3

DEC FILE1
401
ASK FOR INFO
402
CONFIG
403
ASK FOR PLAY
404
ASK FOR MUTE
405
DECODE SUBSET
406
BANDWID. CHANGES
407
SELECT SUBSET
408
ASK FOR MUTE
409
ASK FOR UNMUTE
410
YES
NO

FIG. 4

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/06 H04N7/24 H04N7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02 45372 A (BRITISH TELECOMM ;JACOBS RICHARD JAMES (GB); NILSSON MICHAEL ERLIN) 6 June 2002 (2002-06-06) page 5, line 4 - line 18 page 6, line 9 - line 17 page 7, line 5 - line 32 page 9, line 23 - line 33 ---	1-8
X	GB 2 367 219 A (VINTAGE GLOBAL) 27 March 2002 (2002-03-27) figures 1-5 page 4, paragraph 1 -page 5, paragraph 3 page 9, paragraph 2 - paragraph 4 page 10, paragraph 4 page 11, paragraphs 3-5 --- -/--	1-8

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 November 2003	23/12/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Megalou, M

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INTERNATIONAL SEARCH REPORT

Internatior ⁀ lication No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 986 265 A (VICTOR COMPANY OF JAPAN) 15 March 2000 (2000-03-15) paragraphs '0018!,'0019! ---	1,3,8
P,X	WO 03 065683 A (RAMANZIN YVES ;GENTRIC PHILIPPE (NL); KONINKL PHILIPS ELECTRONICS) 7 August 2003 (2003-08-07) page 3, line 19 -page 4, line 5 page 7, line 17 - line 23 figure 5 -----	1-8

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INTERNATIONAL SEARCH REPORT

Info on patent family members

Internation lication No
PCT/IB 03/03766

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 0245372	A	06-06-2002	AU	2209702 A	11-06-2002
			CA	2428325 A1	06-06-2002
			EP	1338131 A2	27-08-2003
			WO	0245372 A2	06-06-2002
GB 2367219	A	27-03-2002	NONE		
EP 0986265	A	15-03-2000	SG	77650 A1	16-01-2001
			EP	0986265 A2	15-03-2000
			JP	2000101537 A	07-04-2000
WO 03065683	A	07-08-2003	WO	03065683 A1	07-08-2003

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(71) Applicant *(for all designated States except US)*: **VIDIATOR ENTERPRISES INC.** [BS/BS]; P.O. Box CB-12751, Nassau, New Providence (BS).

(71) Applicant *(for OM only)*: **DE GUZMAN, Dennis, M.** [US/US]; 701 5th Avenue, Suite 6300, Seattle, WA 98104 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **LEE, Jaeyong** [KR/KR]; Shindong-a Apt. 707-603, Suseo-dong, Gangnam-gu, Seoul 135-782 (KR). **YOON, Jong-Sung** [KR/KR]; Sinbanpo Hanshin Apt. 29-502, Banpo 2(i)-dong, Seocho-Gu, Seoul 137-767 (KR).

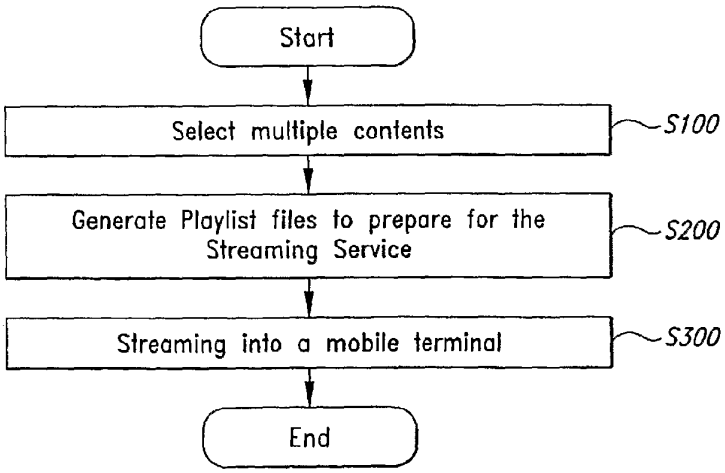
(74) Agents: **DE GUZMAN, Dennis, M.** et al.; Seed Intellectual Property Law Group PLLC, Suite 6300, 701 Fifth Avenue, Seattle, WA 98104-7092 (US).

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[Continued on next page]

(54) Title: METHOD OF MULTIPLE FILE STREAMING SERVICE THROUGH PLAYLIST IN MOBILE ENVIRONMENT AND SYSTEM THEREOF



(57) Abstract: The present disclosure pertains to a method of streaming content media files using a Portable Terminal and system thereof . More specifically, in the event of streaming multiple content files in a mobile environment, this disclosure pertains to a method of combining multiple content files into one streaming file through the Playlist Generator provided for the Streaming Server (S200) and then streaming the entire file at once to a Portable Terminal (S300) and system thereof in order to resolve problems with the existing technology, wherein after streaming for 1 content file is all completed, one must request the Streaming Server for another session again in order to stream subsequent content files.

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METHOD OF MULTIPLE FILE STREAMING SERVICE THROUGH PLAYLIST IN MOBILE ENVIRONMENT AND SYSTEM THEREOF

TECHNICAL FIELD

The present disclosure pertains to a method of streaming content media files to a Portable Terminal and system thereof.

More specifically, in the event of streaming multiple content files in a mobile environment, this disclosure pertains to a method of combining multiple content files into one streaming file through Playlist Generator provided for the Streaming Server and then streaming the entire file at once to a Portable Terminal and system thereof in order to resolve problems with the existing technology, wherein after streaming for 1 content file is all completed, one must request the Streaming Server for another session again in order to stream subsequent content files.

BACKGROUND INFORMATION

In step with the increase of Internet users and development of related technology, not only simple text-oriented data but also a variety of multimedia data are widely being processed over the web. Previously, an entire file had to be downloaded in order to replay multimedia data that is transmitted over the web, but in the case of large multimedia data, excessively long initial lag time was sited as a big problem. And although reliable transmission was guaranteed as TCP was used as the transmission protocol, there is a problem in that the time relationship among audio/video packets was being destroyed.

In order to address this problem, a streaming method and Transmission Protocol for real time data transmission were developed. The streaming method is a technique that receives transmission in small increments without downloading the entire file in order to reduce the playback lag time, but it became necessary to have a protocol that can send real time transmission even with some data loss for regular transmission. Hence, RTSP (Real Time streaming Protocol) that sets up and controls connection between the server

and the client and adds a function of transmitting multimedia data with real time characteristics to HTTP's basic functions was standardized.

Accordingly, the user, when intending to obtain multimedia data over the web, first connects to the web server to receive information about the media, and then connects to the RTSP server to receive the Streaming Service of the media.

At first, in order to perform streaming, one needs to encode media files such as AVI (*.avi), and MPEG (*.mpeg, *.mp3) files in streaming file format. To execute streaming files over the web through the user's PC, programs such as Real Player of Real Network and Windows Media Player of Microsoft must be installed first. Real Media uses RM (*.rm) and meta file RAM (*ram) as the streaming file format while Windows Media uses WMA (*.wma) and WMV (*.wmv) and meta files, ASF (*.asf) and ASX (*.asx), etc.

However, in a mobile environment, the third generation standard 3GPP (the 3rd Generation Partnership Project) (*.3gp) and 3GPP2 (the 3rd Generation Partnership Project 2) (*.3g2) for speedy mobile data transmission in the Cellular Networks are each adopted in the transmission network respectively, and a similar standard to this was established.

FIG. 1 roughly illustrates overall streaming architecture.

Original media data that are provided or manufactured by Contents Providers (CP) are converted to 3GPP and 3GPP2 formats by the encoder; these converted media files are stored in the Streaming Server; and the Streaming Server streams media files through the transmission network to the Portable Terminal.

In general, the process in FIG. 2 demonstrates the streaming process more specifically.

For example, in order to send streaming to a Portable Terminal from the viewpoint of 3GPP in a mobile environment, first, convert the abc.avi file that can be played in Window Media Player for PC using an encoder to abc.3gp with appropriate bit rate, size, codec, and file format and compress media clips during this conversion process so that the original media data that

Webgroup CZ a.s. Ex. 1002, Page 375 of 1406

require a large storage space can be easily transmitted through transmission channels such as low bit rate modem connection (S11).

Next, store converted files in media folder of the Streaming Server, for example, in the format of "C:\streaming\media\abc.3gp" (S12), generate links to applicable medias such as "rtsp://streaming.nextreaming.com/abc.3gp" (S13) so that the terminal gets connected to the Streaming Server to receive the Streaming Service, and put the applicable links on the Internet page of the website (Portal) (S14).

When the user of the Portable Terminal selects the above-referenced streaming link by visiting said website in the above using the terminal (S15), the terminal gets connected to the Streaming Server and starts the Streaming Service for abc.3gp file (S16).

But problems occur when streaming multiple contents of 2 or more, which is not the case when streaming 1 media content as described in the above.

FIG. 3 illustrates a method of streaming multiple media contents in general PC environments.

Let's assume a case where 3 streaming files (File1.3gp, File2.3gp, and File3.3gp) are streamed through a media player. First, you request a session for File1.3gp to play media of file1, but in order to play media of the file2, you need to sever the connection to File1.3gp session, and try to obtain connection to the File2.3gp file. In the same manner, in order to open the media file of file3, you need to discontinue the File2.3gp session and then try connecting to the File3.3gp file.

This problem of repetitive closing and opening does not seem to be pointed out as a huge problem in the PC environment. It doesn't take long to open and close a session; not only is it easy to implement an application that automatically resolves such issue but updates for such automatic solution can be easily done.

However, if you look at the case of FIG. 3 in a mobile environment, there is a problem where a handset player cannot automatically initialize a

Webgroup CZ a.s. Ex. 1002, Page 376 of 1406

session. In most cases, a terminal is set up so that once the streaming of 1 file is complete, another request for content needs to be made once again and furthermore, it is not easy to repeat Step S15 every time. This is also illustrated in FIG. 4.

FIG. 5 illustrates an example of Pseudo Broadcast.

In the example of Pseudo Broadcast illustrated in FIG. 5, continuous streaming takes place into multiple terminals through Pseudo Broadcaster, and it looks as if multiple files of File1.3gp, File2.3gp, and File3.3gp are being streamed all at once. But in fact, each file not only has time continuity but there is also limitation for each terminal to see the same content at the same time.

In other words, even in the case of Pseudo Broadcasting, it is not possible for a terminal user to freely receive streaming of multiple content files.

BRIEF SUMMARY OF THE INVENTION

The Inventor of the present invention, faced with problems of the existing art described in the above, set as one objective of the present invention, the provision of a streaming method that enables the user of a Portable Terminal to receive streaming of multiple contents all at once and a system for such a method.

Meanwhile, in order to achieve said objective, one is not to implement functions that achieve the objective within the terminal (it is not easy to build and inefficient since the specifications of each Portable Terminal maker are different). Rather, one should make it such a way that types and specifications of various terminals shall not pose restrictions by implementing the functions on the Streaming Server even though functions are not implemented on the terminal.

In addition, the present invention set, as another objective, the provision of various options that implement a business model by connecting advertisement methods or enable implementation of such conveniences as players used for PC in a Portable Terminal.

Webgroup CZ a.s. Ex. 1002, Page 377 of 1406

Other objectives and advantages of various embodiments of the present invention will be described below. We would like to add that the other objectives and strengths of the present invention will be accepted more widely not only by the matters described in the various embodiments and claims but also by the means and combinations that can be generated within the scope that can be easily considered, and it will correspond to the unique effect of an embodiment of the present invention.

An embodiment of the present invention, for the purpose of achieving such objectives, relates to a streaming method that enables streaming multiple content files all at once to a Portable Terminal without attempting to reconnect to each separate content, comprising:

The 1st Step wherein 2 or more content files are selected;

The 2nd Step wherein one Playlist file is generated for said content files via the Playlist Generator to prepare for Streaming Service;

And the 3rd Step wherein the above-referenced Playlist files are streamed to a Portable Terminal.

In addition, it is desirable to include another step—Step 4 wherein real time update is applied to the Playlist during streaming into the Portable Terminal.

It would be desirable for the said 1st Step of one embodiment of the present invention, wherein said content files are selected to be pre-established in Contents Provider (CP) or the web server.

And the 1st Step, wherein said content files are selected in other forms of embodiments, can progress in an Interactive Mode whereby the Portable Terminal user connects to the website and directly prepares the Playlist.

And as embodiments for the 4th Step, wherein said real time update is applied, in the event that the Portable Terminal user modifies, adds or deletes the Playlist that is being streamed through connection to the website, it would be advisable to perform an update in real time on the Playlist with the modified, added or deleted content list.

And it would be desirable for the 2nd Step wherein said Streaming Service is being prepared to include:

A step wherein Validation Check is performed on content files that are selected during Step 1 by Playlist Generator;

A step wherein the Playlist is prepared;

A step wherein Playlist files are stored in a specific media folder of the Streaming Server;

And a step wherein a streaming link for said specific media folder is generated on the Internet page of the website.

Meanwhile, regarding the step where said Validation Check is performed, it can be understood as checking validity of each file's codec and encoding parameters for each codec in order to check if each file can be streamed as one file without any stoppage through the Streaming Server. Individual Validation Check can be performed for each file, or as an alternative method, the Validation Check can be performed on all the files at once.

It would be desirable for said Playlist files of one embodiment of the present invention to include sequence number, location information and option information for each file.

And it would be desirable for the 3rd Step wherein files of the Playlist are being streamed to include the following:

A step wherein a streaming link is selected for the Playlist files by connecting to the Internet page of the website using the browser of the Portable Terminal;

A step wherein the Streaming Server streams above-referenced Playlist files as 1 file to the Portable Terminal without attempts to reconnect once the streaming link is selected.

In addition, said streaming link can be configured in such a manner that the Streaming Server includes another step that performs authentication in terms of the number of times or (and) specific time.

Webgroup CZ a.s. Ex. 1002, Page 379 of 1406

On the other hand, it is a good example of the embodiments of the present invention as a business model that said content files of one embodiment of the present invention include advertisement content files;

That the advertisement content files are combined with other content files and one Playlist file is generated through said Playlist Generator, and that advertisement content files and other content files are being streamed sequentially as one Playlist file to a Portable Terminal.

It would be desirable for the Playlist Generator that generates one Playlist during said Step 2 of one embodiment of the present invention, to be configured in a manner that sets up Random Access function which allows Random Access to content files of 1 or more contained in the Playlist.

For instance, it would be good to set up a prohibited area that prohibits Random Access in 1 or more pre-determined specific content files.

It would be desirable for the Playlist Generator that generates one Playlist during Step 2 of one embodiment of the present invention, to be configured in a manner that enables establishing of Track Move function which allows Track Move for 1 or more content file contained in the Playlist, or a prohibited area where Track Move is prohibited.

And, if said Playlist is audio, it would be considered a highly desirable execution format to display the information of the audio file on the liquid crystal of the Portable Terminal by generating video files that contain information about applicable audio files in advance and streaming corresponding video files while streaming the audio files.

The unique system of one embodiment of the present invention that makes it possible to implement the method of one embodiment of the present invention described so far relates to a streaming system that allows streaming multiple content files all at once without making attempts to reconnect for each content and has the following features;

Above-referenced content files are converted to streaming files by an encoder and the Streaming Server transmits the streamed files to a Portable Terminal;

In the event that above-referenced content files of N or more (N is an integer greater than 1) are selected, the Playlist Generator generates one Playlist for content files C_1, C_2, ..., C_N (C refers to a content file, and its subscript is a random serial number, an integer greater than 1) targeted for streaming, puts information contained in each content file in the Playlist files and transmits them to a media folder of said Streaming Server and then links the media folder to an Internet website;

A Portable Terminal receives streaming of content files specified in said Playlist through a transmission network from said Streaming Service, after which it considers content files of N or more as one content file and completes the selection of a streaming link of said Internet website at one (1) time.

And the system of one embodiment of the present invention furthermore includes an Advertisement Server that provides advertisement contents;

Said Playlist Generator can combine advertisement contents that are provided by said Advertisement Server and stored in the Streaming Server with content files provided by said content server to generate Playlist files.

On the other hand, the Streaming Server includes Random Access Module and Track Move Module which allow Random Access to 2 or more content files and Track Move respectively, and it would be desirable to pre-establish Random Access Prohibition Area and (or) Track Move Prohibition Area depending on the types of said content files through the Playlist Generator.

And it is desirable for the system of one embodiment of the present invention to set an area where the bill payment processing is prohibited for certain contents with 1 or more content.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a drawing that shows overall streaming architecture.

FIG. 2 is a flow chart that illustrates an existing mobile streaming procedure.

FIG. 3 is a drawing that illustrates composition of the Playlist in general PC players.

FIG. 4 is a drawing that illustrates problems in case of streaming multiple content files in a mobile environment.

FIG. 5 is a drawing that illustrates an example of existing Pseudo Broadcasting.

FIG. 6 is a drawing that illustrates overall system configuration in accordance with one embodiment of the present invention.

FIG. 7 is a drawing that shows functions of an embodiment of a Playlist Generator.

FIG. 8 is a flow chart that illustrates a method of streaming in accordance with one embodiment of the present invention.

FIG. 9 is a drawing demonstrating a case where the server selected contents at Step S100 of FIG. 8.

FIG. 10 is a drawing demonstrating a case where the user selected contents at Step S100 of FIG. 8 using a portal site.

FIG. 11 is a flow chart that illustrates detailed processes at Step S200 of FIG. 8 (In this drawing, Steps S210 and S220 can be performed at Step S100 of FIG. 8).

FIG. 12 is a flow chart that illustrates detailed processes of Step S300 of FIG. 8.

FIG. 13 is a drawing that illustrates an overall process of one embodiment of the present invention.

FIG. 14 is a drawing that illustrates an embodiment wherein advertisement contents are included in the Playlist.

FIG. 15 is a drawing that illustrates an example of billing strategy in the case of FIG. 14.

FIG. 16 is a drawing that shows functions of Random Access Module.

Webgroup CZ a.s. Ex. 1002, Page 382 of 1406

FIG. 17 is a drawing that shows setting of areas where Random Access to certain contents (for example, advertisement contents) is prohibited in the above-referenced case of FIG. 16.

FIG. 18 is a drawing that shows functions of Track Mobile Module.

FIG. 19 is a drawing that shows the setting of areas where Track Movement for certain contents (for example, advertisement contents) is prohibited in the above-referenced case of Fig. 18.

<We'd like to clarify that the above-referenced drawings are drawings for reference to an embodiment and as such are not to be considered as limiting.>

DETAILED DESCRIPTION

We shall describe below in detail one or more embodiments in accordance with the present invention by making reference to attached drawings. In describing one embodiment of the present invention, in case any matter, such as a publicly disclosed function or construction that is obviously clear to whoever is familiar with this field, is mentioned, a detailed description of the matter shall be omitted.

In the following description, numerous specific details are given to provide a thorough understanding of embodiments. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular

features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

FIG. 6 concisely illustrates the system configuration of one embodiment of the present invention.

Encoder (2) converts original media data (1) of contents into streaming files and stores them in the Streaming Server (4). Playlist Generator (3) generates one (1) Playlist once checking codec type of each file is done, and then stores the Playlist in the Streaming Server (4) in preparation for streaming multiple contents all at once. Such preparation becomes complete as connection takes place through the wireless portal (6) that provides mobile pages that can be linked to the Streaming Server (4) and the wireless data network (10). On the other hand, the user of the Portable Terminal (8) selects a streaming link by connecting to the wireless portal (6), and streaming into the Portable Terminal (8) takes place through the wireless data network (for example, CDMA 2000 1x, EV-DO, GPRS, EDGE, etc.). The user of the Portable Terminal (8), before selecting the streaming link or while receiving the Streaming Service, can add or delete the Playlist in Interactive Mode by accessing the web server (7) that is connected to the Mobile Portal (6) through Internet (5) in the user's PC (12).

Meanwhile, conditions of the encoding profile that are used in order to put multiple content files (1) (11) into one Playlist are shown in the following table.

Type of codec contained in each content file are the same.	
MPEG-4 Visual	Decoder Specific Info. (Frame Size, Profile–level–id), Timescale, H, 263, Frame Size, Profile, Level, Timescale etc. are identical.
H.264	PPS/SPS (Frame Size), Profile–level–id etc. are identical.
AAC-LC	Decoder Specific Info. (Sampling rate, Bit per sample, Channel Number) etc. are identical.

Webgroup CZ a.s. Ex. 1002, Page 384 of 1406

AMR, QCELP, EVRC	Sampling rate, Bit per sample, Channel Number, etc. are identical.

And FIG. 7 shows the function of said Playlist Generator (3). According to FIG. 7, each separate content file (File1.3gp, File2.3gp, and File3.3gp) is placed in one Playlist through said Playlist Generator (3) and then these Playlist files are transmitted to the Portable Terminal (8) as one streaming file (Files.3gp), after which the Portable Terminal (8) recognizes this as one file and receives streaming as such.

The system of one embodiment of the present invention includes the Playlist Generator in the Streaming Server (4) and FIG. 8 roughly illustrates the streaming method of one embodiment of the present invention utilizing the Playlist Generator.

To begin with, multiple content files will be selected (S100).

The selection of content files is either pre-determined in the web server of the Internet website (Portal) that provides contents or in the content server that provides contents to Internet websites, or pre-selected among the list of contents files that are placed on the website server as the user of the Portable Terminal connects to the website or in Interactive Mode. At this time, types and sequence of files shall be considered as well.

Next, it leads to a step where one Playlist file is generated for content files that are selected through the Playlist Generator in preparation for the Streaming Service (S200). For example, if we assume a scenario where the server selects File1.3gp and File 5.3gp; File1.3gp, File2.3gp, and File4.3gp; File2.3gp, File3.3gp and File5.3gp; File5.3gp, File3.3gp and File1.3gp from individual content files of File1.3gp, File2.3gp, File3.3gp,

File4.3gp, and File5.3gp, Playlist Generator generates one Playlist file respectively from each selected group of files which are File1 and File5; File1, File2 and File4; File2, File3 and File5; and File5, File3 and File1. This individual group of Playlist files shall be recognized as one content and

Webgroup CZ a.s. Ex. 1002, Page 385 of 1406

streamed as such. This step is illustrated in FIG. 7 and FIG. 9 that are already described above.

FIG. 10 illustrates a case where multiple contents are pre-selected by the user of the Portable Terminal using a portal site. If the user of the Portable Terminal selects, for example, File1.3gp, File2.3gp and File3.3gp, among multiple files that are linked, after connecting to the portal site using the Internet, the three files shall be designated as one Playlist and streamed as if they were one streaming file.

More specific processes of said Step S200 are illustrated in FIG. 11. Of these processes, Steps S210 and S220 were added for the sake of convenient explanation, and can be regarded as having already been carried out in the above Step S100.

To begin with, convert content files using an encoder into a streaming file format with appropriate bit rate and size and codec, etc. (S210). For instance, File1.avi, File2.wmv, and File3.asf are converted into File1.3gp, File2.3gp, and File3.3gp respectively. Next, streaming files are stored in the respective folder of the Streaming Server (S220). For instance, said converted files are designated as "C:\tempmedia\File1.3gp", "C:\tempmedia\File2.3gp", and "C:\tempmedia\File3.3gp", and stored in the folder of the Streaming Server.

Above-referenced Steps S210 and S220 in this example of implementation do not need to be carried out from the beginning each time in order to perform Step S230 shown below and shall be understood as steps that were already performed in the past. It is because when the encoding process is inserted every time, the time taken to process the encoding becomes too long, which is not desirable for the system operation. In other words, Step S230 shown below shall be understood as being performed for files that are already encoded in the streaming format, and said Steps S210 and S220 should be regarded as having already been carried out in said Step S100 that selects 2 or more content files.

When content files are selected, Validation Check is performed on the selected files (S230).

In order to transmit multiple files continuously, files contained in the Playlist have the same codec, and the encoding parameter for each codec are similar. Hence, in case a Playlist is prepared, every time a file is added, one compares the applicable file to previous files to check if they have the same codec as well as encoding parameters within the allowed range and check the validity of the added files.

In other words, parameters for Validation Check for files are as follows.

1. The type of codec to be stored is identical for images and sounds.

2. When images are encoded in MPEC-4 Visual codec, the following parameters are identical:

Decoder Specific info. (Frame Size, profile–Level–id), Timescale, H.263, Frame Size, Profile, Level, Timescale

3. When images are encoded in H.264 codec, the following parameters are identical:

PPS/SPS (Frame Size)

Profile–Level–id

4. When voices are encoded in AAC codec, the following parameters are identical:

Decoder Specific info. (Sampling rate, bit per sample, Channel Number)

5. When voices are encoded in AMR, QCELP or EVRC codec, the following parameters are identical:

Sampling rate, Bit per sample, Channel Number

- 2 or more files that meet said parameters above can exist in one Playlist.

Although the above-referenced Validation Check is a check-up that is done every time a file is uploaded, there are special cases where it is necessary to perform overall Validation Check en masse on all files contained in the prepared Playlist. In such a case, by checking all files in the Playlist, you

check the validity of files to see if the Playlist can be used. For example, in the above Interactive mode, if the subscriber selects one Playlist of the content file list, it would be desirable to perform Validation Check on the entire file list at once.

As described in the above, after performing Validation Check, in order to tie File1, File2 and File3 as one streaming file, a Playlist such as File1File2File3playlist.3gp shall be prepared and generated (S240). The Playlist file contains information such as location for each file etc., within the file.

When the Playlist is generated, for instance, it can have the following formats.

File Extension: 3gp

File contents

Nextreamer playlist

[SequenceNumber] | [File Location] [Option]

[SequenceNumber] | [File Location] [Option]

[SequenceNumber] | [File Location] [Option]

...

For example, the following examples can be prepared.

Playlist.3gp

Nextreamer playlist

1|D:\Development\Media\file1.3gp|11

2|D:\Development\Media\file2.3gp|0

3|D:\Development\Media\file3.3gp|110

4|D:\Development\Media\file4.3gp|110

Playlist files can be composed of a header part that shows applicable files are Playlist files, and a part that shows sequence number and location of each file, and a part to which usage option about the applicable file can be added. The name of the extension of the Playlist shall be made identical with the name of the extension of regular content files in order to support existing standard terminals.

Webgroup CZ a.s. Ex. 1002, Page 388 of 1406

Through above-referenced options, various usage methods can be set up such as whether the Track Move function will be supported or prohibited and whether billing information will be stored or prohibited.

Next, the prepared Playlist file shall be stored in a specific media folder (S250). For example, it shall be stored as "C:\streaming\Media\Playlist\File1File2File3playlist.3gp" and uploaded onto the applicable link of the website as rtsp://streaming.nextreaming.com/File1File2File3playlist.3gp" to generate a streaming link (S260).

FIG. 12 illustrates more detailed processes of the above Step S300. The user of a Portable Terminal connects to the Internet page of the website through a wireless portal by using a browser (S310), and selects the streaming link linked to the Internet page, that is, "rtsp://streaming.nextreaming.com/File1File2File3playlist.3gp" (S320), so that the terminal connects to the Streaming Server, after which the Streaming Service commences accordingly (S330).

At this time, the Streaming Server automatically streams File1.3gp, File2.3gp, File3.3gp successively, and the terminal decompresses codec compression and play back the clips. Since the terminal recognizes the above-referenced files as one streaming file, it becomes impossible to tell if multiple files are streamed or a single file is streamed. Hence, this embodiment resolves a problem of having to connect to the web server several times in order to receive the streaming of all the content files.

FIG. 13 roughly illustrates, once again, the entire processes of FIG. 8, FIG. 11, and FIG. 12. The streaming that takes place in the order of File1.3gp, File2.3gp, File3.3gp removes the inconvenience of restarting a session since a session request for the Playlist stops after one time and the Portable Terminal recognizes all the files as one file. The Streaming Server automatically conducts streaming and only after streaming of all files contained in the Playlist is complete, does the session of the Playlist stop.

Webgroup CZ a.s. Ex. 1002, Page 389 of 1406

Meanwhile, it is also possible to apply real time update to the Playlist during the streaming into the Portable Terminal.

As already explained in the above, according to one embodiment of the present invention, it is possible for a service user to generate or modify the Playlist in Interactive Mode through a portal page and receive streaming of the user's Playlist in real time. In case of generating or modifying the Playlist, Validation Check mentioned in the above shall be performed.

In case a specific Playlist file is streamed, the Streaming Server reads the Playlist, every time the content is transitioned into the next content, and checks the location and option information before starting streaming. Therefore, if a specific content of the Playlist is being played, subsequent contents may be deleted from the list or other contents can be added during the play. In such a case, the Streaming Server can stream subsequent contents based on the modified Playlist.

The Streaming Server does not take into consideration change in a file that has already been played and takes the sequence number contained in the Playlist as the criteria for judging if a file that is already played has been modified. For instance, when there is the following Playlist,

Nextreamer playlist
1|D:\Development\Media\file1.3gp|11
2|D:\Development\Media\file2.3gp|0
3|D:\Development\Media\file3.3gp|110
4|D:\Development\Media\file4.3gp|110

Assuming the Streaming Server is playing #2, if the contents are modified as follows during the play,

Nextreamer playlist
1|D:\Development\Media\file1.3gp|11
2|D:\Development\Media\file2.3gp|0
3|D:\Development\Media\file5.3gp|10
4|D:\Development\Media\file6.3gp|110
5|D:\Development\Media\file7.3gp|110

Webgroup CZ a.s. Ex. 1002, Page 390 of 1406

afterwards, the Streaming Server streams file5.3gp. If the Playlist is modified as follows while #3 is being played,

Nextreamer playlist

1|D:\Development\Media\file2.3gp|0

2|D:\Development\Media\file5.3gp|10

3|D:\Development\Media\file6.3gp|110

4|D:\Development\Media\file7.3gp|110

the Streaming Server is not concerned about the modification of #1, 2, and 3 and streams the content of #4.

The process during which such real time update takes place can be understood in Interactive Mode wherein if the user of the Portable Terminal, in the middle of receiving streamed files, modifies, adds or deletes the content list of the Playlist which is being streamed after the user is connected to the website, and while the user is in the process of receiving streaming, events of modification, addition, and deletion occur; and the modified, added and deleted content list is streamed in accordance with such events.

And, even in the case where the content list of the Playlist, the target of real time update, is modified or added, said Validation Check procedure shall be performed separately on the newly updated content.

On the other hand, in the embodiment of FIG. 14, said content files include advertisement content files. In such a case, selection of the advertisement content shall be determined in the web server or the Streaming Server rather than by the selection of the terminal. Playlist Generator combines File1.3gp, File2.3gp, and File3.3gp that contain general contents with commercial.3gp that contains advertisement contents respectively to form CommercialFile1, CommercialFile2 and CommercialFile3 respectively. In the event that the Streaming Server streams such files by transmitting them to a Portable Terminal, in the case of CommercialFile1, Commercial.3gp is streamed first and then File1.3gp; in case of CommercialFile2, Commercial.3gp is streamed first and then File2.3gp; and in case of CommercialFile3, File3.3gp is automatically streamed after streaming of Commercial.3gp is all complete. In

Webgroup CZ a.s. Ex. 1002, Page 391 of 1406

other words, in the above embodiment, advertisement effects of the advertiser can be maximized by making streaming of advertisement contents mandatory in order to receive streaming of any one of File1, File2, and File 3. In such a case, it would be desirable to process bill payment only when general content files are being streamed as shown in FIG. 15, and in case of advertisement contents, it is advised that the streaming time should be excluded from the total billing, because they are not selected by the user of the terminal.

Of course, advertisement DB and a server for bill processing for such an embodiment shall be provided on the system level.

As shown in the above, in terms of specific contents within the Playlist, a portion corresponding to applicable contents can be omitted when data for billing is stored depending on the intention of the service provider. Data for billing can include, for instance, the number of packets transmitted, names of content files for billing, or playback time of a played file.

We believe that the idea of one embodiment of the present invention should not be limited to the Playlist Generator combining and streaming multiple streaming files as one Playlist but it should also create a streaming solution that is more suitable to the user's usage. Multiple streaming files for each separate content exists within one Playlist and since they are streamed as if they were one file, the user's terminal does not recognize them as multiple streaming files but as one single streaming file. However, since Playlist files are distinguished as separate multiple streaming files in reality, there is a necessity for a module that enables the user of a Portable Terminal to have access to an individual streaming file.

To this end, as shown in FIG. 16, above-referenced Playlist Generator is configured with Random Access Module that enables random access to contents files (File1.3gp, File2.3gp, and File3.3gp) contained in the Playlist. Hence, for instance, while playing back the content of File1.3gp, the user can access File3.3gp (Fast Forward), or while playing back content of File3.3gp, you can access in reverse (Rewind) and play back the content of File2.3gp.

On the other hand, specific contents can be set aside in an area where random access is prohibited. For example, in case the function of Random Access Module is applied to the embodiment of FIG. 13, since it is desirable to set advertisement contents to be force streamed into the user's Portable Terminal, it is recommended that random access to advertisement contents be prohibited. As such, when storing and managing the Playlist, it can be set up in a way that multiple tracks to which random access is banned are added to random positions. The Streaming Server prohibits the user from using the function of Track Move when encountering a track prohibited for random access while streaming the contents in the Playlist one by one. This is identical to the Track Move Module mentioned below.

In other words, as illustrated in FIG. 17, the system shall be set up in a way that prohibits random access to Commercial contents and makes sure to stream the commercial contents without fail. We shall add that of course, such prohibited areas are not limited to advertisement contents and can be pre-determined in various ways; said Random Access module is modulized with software within said Streaming Server and use of applicable options can be set up in Playlist Generator, which is also applied to the Track Move module below.

In addition, FIG. 18 illustrates an embodiment wherein the Track Move function is set up in said Playlist Generator. This function works in a way that while streaming File1.3gp content, the Playlist jumps forward to stream File2.3gp or while streaming File3.3gp, it jumps backwards to stream File1.3gp by allowing Track Move for 2 or more content files contained in the Playlist. In short, when the Playlist jumps forward while streaming File2.3gp, it should move to the starting point for File1.3gp of the previous step, not the starting point where File2.3gp starts. If there is no file in the previous step, the Track Move function can be configured in a way that the Playlist can move to the starting point of File2.3gp that is being streamed.

For example, it allows Track Move for content files of 1 or more contained in the Playlist by recognizing Forward or Backward button selection implemented in the Streaming Player of the Portable Terminal as Move to the

Previous Track or Move to the Next Track. This is to technologically overcome situations where UI for Track Move does not exist in standard terminals, and this function is implemented in the Streaming Server in a way that when Move Forward or Move Backward button is selected in the terminal, this command is recognized as Move One Track Forward or Move One Track Backward. In other words, despite the fact that there is no UI for Track Move, it is possible to implement to use Forward and Backward buttons as UI for Track Move.

And in the case of the embodiment of FIG. 18, prohibited areas can be established for specific contents. Such an embodiment is illustrated in FIG. 19 and this corresponds to the case of FIG. 17. In other words, Commercial contents are configured in a way that they are streamed to the Portable Terminal, and while Commercial contents are being streamed, Track Move to the next content is prohibited.

And, in the event that said Playlist is Audio, one can display the information about the audio files in the liquid crystal display of the Portable Terminal by generating video files recorded with corresponding audio files in advance, and streaming the corresponding video files while the audio files are being streamed. In other words, if content files are Audio, each meta information is displayed as video, and audio is streamed to the Portable Terminal, in which case, it is necessary to manage the video separately. For example, you can store video files that contain information about each audio file in the Playlist, or let the Playlist decide the location of the video files; in case the Streaming Server performs streaming of applicable audio files, you can have corresponding video files streamed at the same time in order to display the information about the audio simultaneously through the screen of the Portable Terminal. To do this, the Streaming Server is able to open and stream both image and sound simultaneously for one streaming, and the Streaming Server repeats the playback by providing the standard for the playtime of a sound file regardless of the length of the image file or provides a function whereby streaming can be stopped halfway.

Webgroup CZ a.s. Ex. 1002, Page 394 of 1406

Meanwhile, in case of a standard mobile terminal, there is no way to receive the transmission of user authentication information through the standard streaming protocol. In such a case, the Streaming Server can protect the streaming link for the Playlist so that only the user can use it. The portal server receives a streaming link that is valid for a specific duration of time and a specific number of times from the Streaming Server before showing the Streaming Server to the user.

The user connects to the Streaming Server through the applicable streaming link while the Streaming Server checks the validity of the Playlist link and starts or denies streaming. Once the pre-defined specific number of times or specific time period passes, the corresponding Playlist link becomes no longer valid (Authentication of the Playlist).

In one embodiment, server side duration control is provided. That is, with some embodiments, playing duration is not able to be set in the playlist. The streaming server of these embodiments streams the entire duration of every content file in a playlist.

However, in other embodiments, playing duration can be set in the playlist file. If duration is set in a content file in the playlist, the streaming server will stream only the specified duration of a content file in a playlist and will skip the rest part. This concept is illustrated in FIG. 20.

For this change, the playlist format is changed to indicate the streaming duration of each content file as in the below example:

```
# XenonStreamer playlist
[SequenceNumber] | [File location] | [Option] | [Duration]
[SequenceNumber] | [File location] | [Option] | [Duration]
[SequenceNumber] | [File location] | [Option] | [Duration]
```

In this format, duration can be set as in the below example:

```
[Duration]: [start_time]-[end_time]
```


Webgroup CZ a.s. Ex. 1002, Page 395 of 1406

```
The unit of start_time and end_time is second.
If start_time is equal to zero, it can be omitted.
If end-time is omitted, it means 'the end of the content'.
If [Duration] is omitted, it means 'entire content'.
```

There are various uses for this duration control feature. For instance, the feature can be used to provide a preview in the streaming service: an existing piece of content can be used if a selected part can be streamed in the playlist. The example below shows how the first 30 seconds of a song can be streamed for preview purposes:

```
preview_song.3gp
# XenonStreamer playlist
1 | c:\media\song1.3gp | 1 | -30
```

The example below shows how 00:30-00:40 + 1:10-1:20 + 1:50-2:00 (total 30 seconds) can be streamed for preview:

```
preview_song.3gp
preview_video.3gp
# XenonStreamer playlist
1 | c:\media\video.3gp | 1 | 30-40
2 | c:\media\video.3gp | 1 | 70-80
3 | c:\media\video.3gp | 1 | 110-120
```

As another use of the duration control feature, if a content file is very long, its content can be divided into multiple links by specifying duration. The following example shows how a 7-minute content can be divided into two 2-minute content links and one 3-minute content link:

Webgroup CZ a.s. Ex. 1002, Page 396 of 1406

```
long_part1.3gp (2 mins)
# XenonStreamer playlist
1 | c:\media\long.3gp | 1 | 0-120

long_part2.3gp (2 mins)
# XenonStreamer playlist
1 | c:\media\long.3gp | 1 | 120-240

long_part3.3gp (the rest)
# XenonStreamer playlist
1 | c:\media\long.3gp | 1 | 240-
```

Yet another possible use of the duration control feature is to add an advertising clip in the middle of a content using playlist. The following example shows how an advertising content file is added after a one-minute playing of a content file, and the rest of the content file is played after the advertising content:

```
ad_inserted.3gp (the rest)
# XenonStreamer playlist
1 | c:\media\content.3gp | 1 | -60
2 | c:\media\ad.3gp | 1|
3 | c:\media\content.3gp | 1 | 60-
```

Another embodiment provides a live channel change feature. That is, in some embodiments, live streaming session cannot inserted. However, in other embodiments, multiple live streaming sessions can be inserted without duration information.

In this case, the track move function will works as "channel change" function. On request of this kind of playlist, the streaming server will stream the first live channel in a playlist. And if a random access request is

Webgroup CZ a.s. Ex. 1002, Page 397 of 1406

detected, the streaming server streams the previous or the next live channel in the playlist as it works for the "track move" function. This concept is illustrated in FIG. 21.

If the streaming server streams a live session, the random access buttons can be disabled in a handset player. To activate the random access buttons in the handset player, the streaming server can stream a live channel in a playlist as a very long file.

The example below shows a playlist for live channel change:

```
multi-channels.3gp
# XenonStreamer playlist
1 | rtsp://1.1.1.1/live_channel1.3gp
2 | rtsp://1.1.1.1/live_channel2.3gp
3 | rtsp://1.1.1.1/live_channel3.3gp
```

On request of this kind of playlist, the streaming server starts streaming live channel1 at first. And, if a user selects 'Fast forward', the streaming server will stream live channel2 in the same RTSP session.

The live channel change feature can increase users' satisfaction because of the improved speed and convenience. A user can also configure his/her own channel list.

Once again, we would like to add that those embodiments are mere examples of the present invention. The scope of protection of the present invention shall not be limited by these embodiments. Various technical standards are available for the methods and system of embodiments of the present invention and it is easy to substitute and change the technical means to provide yet other embodiments. In addition, the scope of protection of the present invention cannot be limited by such obvious change or substitution.

According to one embodiment of the invention that has been described so far, Playlist Generator generates one Playlist and streams it to a Portable Terminal so that the user of the Portable Terminal can receive multiple

Webgroup CZ a.s. Ex. 1002, Page 398 of 1406

contents all at once, thereby technologically promoting convenience of the user of a Portable Terminal. Through this, we can expect that supply and consumption of contents by the Portable Terminal will increase.

In addition, there is an advantage of increasing the effects of the advertisement that comes from generating the Playlist by combining various advertisement contents and general contents.

Moreover, special modules as options were added as embodiments to enable Random Access and Track Move, etc.

Furthermore, the effects of one embodiment of the present invention are not provided within the terminal but implemented on the Streaming Server, thereby optimizing the function of the Playlist files regardless of the specification and type of terminal. In another embodiment, components or other functionality may be provided within the terminal of the user.

We would like to add that the effect of one embodiment of the present invention will be accepted more widely not only by the matters described in the embodiment and claims, but also by the effect that can be generated within the scope that can be easily considered and the possibility of the advantages that contribute to the development of the industry.

The above description of illustrated embodiments, including what is described in the Abstract, is not intended to be exhaustive or to limit the invention to the precise forms disclosed. While specific embodiments and examples are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the invention and can be made without deviating from the spirit and scope of the invention.

These and other modifications can be made to the invention in light of the above detailed description. The terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification and the claims. Rather, the scope of the invention is to be determined entirely by the following claims, which are to be construed in accordance with established doctrines of claim interpretation.

Webgroup CZ a.s. Ex. 1002, Page 399 of 1406

CLAIMS

What is claimed is:

1. A streaming method that can be implemented on a streaming server and that allows streaming of multiple content files at once without attempting to reconnect each content file to a portable terminal when multiple files are transmitted to the portable terminal from the streaming server, the method being for streaming of multiple files through a playlist file in a mobile environment, the method comprising:

a 1st step, wherein 2 or more content files are selected;

a 2nd step wherein one playlist file is generated for said content files via a playlist generator to prepare a streaming service; and

a 3rd step wherein said content files on the playlist file are streamed to the portable terminal as one file.

2. The method of claim 1 for streaming multiple files through a playlist file in a mobile environment, further comprising a 4th step wherein real time update is applied to the playlist file during streaming to the portable terminal.

3. The method of claim 1 wherein the 1st step wherein said content files are selected, relates to a method of streaming multiple files through the playlist file in a mobile environment that is already set up in a content provider (CP) or web server that provides content files.

4. The method of claim 1 wherein the 1st step wherein said content files are selected, pertains to a method of streaming multiple files through the playlist file in a mobile environment, which takes place in an

Webgroup CZ a.s. Ex. 1002, Page 400 of 1406

interactive mode where a user of the portable terminal selects at least one file among the content files after connecting to a website.

5. The method of claim 2 wherein the 4th step wherein said real time update is applied, pertains to a method of streaming multiple files through the playlist file in a mobile environment, wherein in an event that a user of the portable terminal, in a middle of receiving streamed files, modifies, adds or deletes a content list of the playlist file which is being streamed after the user connects to a website, the modified, added, and deleted content list is streamed.

6. The method of claim 1 wherein the 2nd step wherein said streaming service is prepared comprises:

a step wherein a validation check is performed on content files that are selected by the playlist generator;

a step wherein the playlist file is prepared;

a step wherein playlist files are stored in a specific media folder of the streaming server; and

a step wherein a streaming link for said specific media folder is generated on an Internet page of a website, all pertaining to a method of streaming multiple files through the playlist in a mobile environment.

7. The method of claim 6 wherein the step wherein said validation check is performed, pertains to a method of streaming multiple files through the playlist file in a mobile environment, wherein validating a codec of each file and encoding parameter of each codec is performed.

8. The method of claim 7 wherein the step wherein said validation check is performed, pertains to a method of streaming multiple files through the playlist file in a mobile environment, wherein a validation check on each file is performed individually or collectively.

Webgroup CZ a.s. Ex. 1002, Page 401 of 1406

9. The method of claim 6 wherein said playlist file pertains to a method of streaming multiple files through the playlist file in a mobile environment, wherein sequence number, location information, and option information are included.

10. The method of claim 1 wherein the 3rd Step wherein the Playlist is streamed includes:

a step wherein a streaming link is selected for the playlist file by connecting to an Internet page of a website using a browser of the portable terminal; and

a step wherein said playlist file is streamed as one file to the portable terminal without attempts of reconnection as a streaming link is selected, in a mobile environment.

11. The method of claim 10 for streaming multiple files through the playlist file in the mobile environment, further including another step wherein the streaming server provides authentication for said streaming link in terms of a specific number of times and/or specific duration of time.

12. The method of claim 1 wherein said content files include advertisement content files, wherein the advertisement content files are combined with other content files to generate said playlist file through said playlist generator, and wherein advertisement content files and other content files are streamed sequentially as one playlist file to the portable terminal, in a mobile environment.

13. The method of claim 1 wherein the playlist generator that generates one playlist in said 2nd Step, in a mobile environment, and can set up a random access function that allows random access to content files of 1 or more contained in the playlist file.

Webgroup CZ a.s. Ex. 1002, Page 402 of 1406

14. The method of claim 13, further comprising in the mobile environment, a step of setting up a prohibited area that bars random access in pre-determined, content files of 1 or more.

15. The method of claim 1 wherein the playlist generator that generates one playlist file in said 2nd step, pertains to a method of streaming multiple files through playlist in a mobile environment, wherein the playlist generator can set up a track move function that allows a track move for content files of 1 or more contained in the playlist file.

16. The method of claim 15 wherein the playlist generator sets up a prohibited area that prohibits track move in content files of 1 or more contained in the playlist file.

17. The method of claim 1 wherein information about audio files is displayed on a display screen of the portable terminal, in an event that said playlist file is audio, by generating video files recorded with information about the corresponding audio files in advance, the method further including streaming corresponding video files while streaming the audio files.

18. The method of claim 1, further comprising:
providing duration control feature; and
providing a live channel change feature.

19. A streaming system that streams multiple content files at once without attempting to reconnect for each individual content file, the system comprising:
an encoder that converts said content files to streaming files;
a streaming server that transmits the streaming files converted by said encoder to a portable terminal;

a playlist generator, in an event that said content files of N or more (N is an integer greater than 1) are selected, that generates one playlist file for content files C_1, C_2, ..., C_N (C refers to a content file, and its subscript is a random serial number, an integer greater than 1) targeted for streaming, and puts information contained in each content file in the playlist file, transmits the playlist file to a media folder of said streaming server and then links the media folder to an Internet website; and

a portable terminal that receives streaming of content files that are displayed in said playlist file through a transmission network from said streaming server, wherein content files of N or more are transmitted as one playlist file in a manner that completes selection of a streaming link of said Internet website after one time, thereby allowing streaming multiple files through the playlist file in a mobile environment.

20. The system of claim 19 to stream multiple files through the playlist file in a mobile environment, further comprising an additional advertisement server that provides advertisement content files, wherein said playlist generator combines advertisement content files that are provided from said advertisement server and stored in the streaming server with content files provided from a content server in order to generate the playlist file.

21. The system of claim 19 wherein said streaming server includes a random access module and track move module that allow random access and track move for content files of 1 or more contained in the playlist file respectively, the streaming server being adapted to pre-establish a random access prohibition area and/or a track move prohibition area through playlist file depending on types of said content files.

22. The system of claim 19 wherein the system prohibits bill payment processing for certain contents of 1 or more.

Webgroup CZ a.s. Ex. 1002, Page 404 of 1406

23. The system of claim 19 wherein the playlist generator further includes a duration control feature and a live channel change feature.

Webgroup CZ a.s. Ex. 1002, Page 405 of 1406

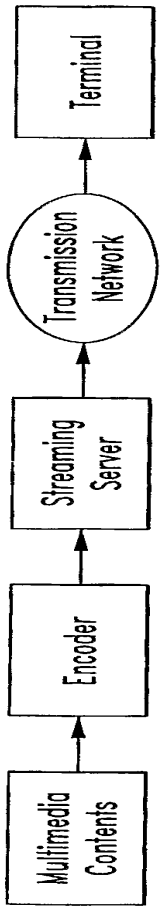


FIG. 1

Webgroup CZ a.s. Ex. 1002, Page 406 of 1406

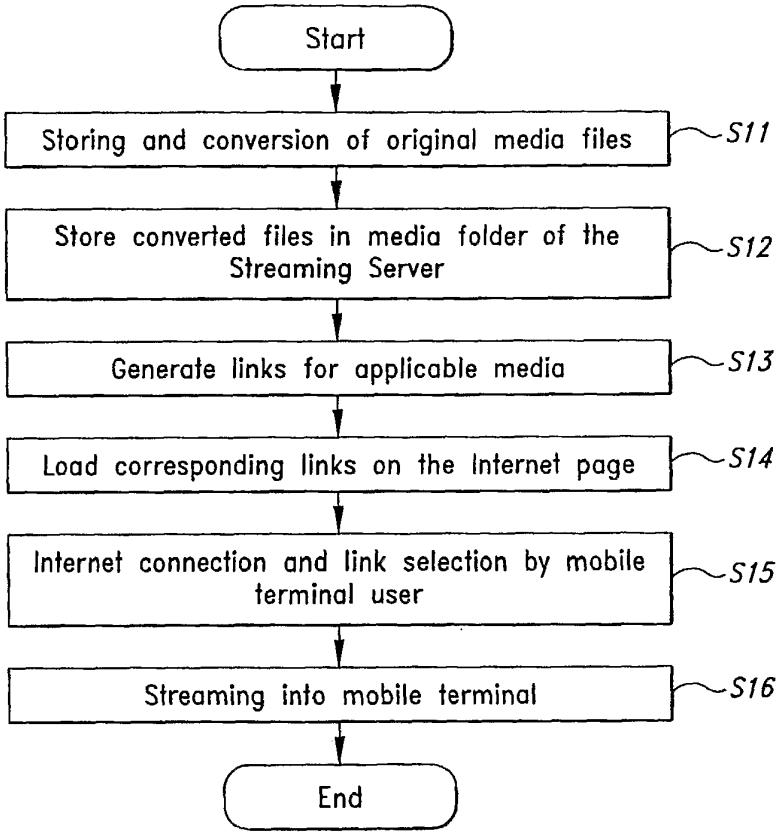

Start
Storing and conversion of original media files
S11
Store converted files in media folder of the Streaming Server
S12
Generate links for applicable media
S13
Load corresponding links on the Internet page
S14
Internet connection and link selection by mobile terminal user
S15
Streaming into mobile terminal
S16
End

FIG. 2

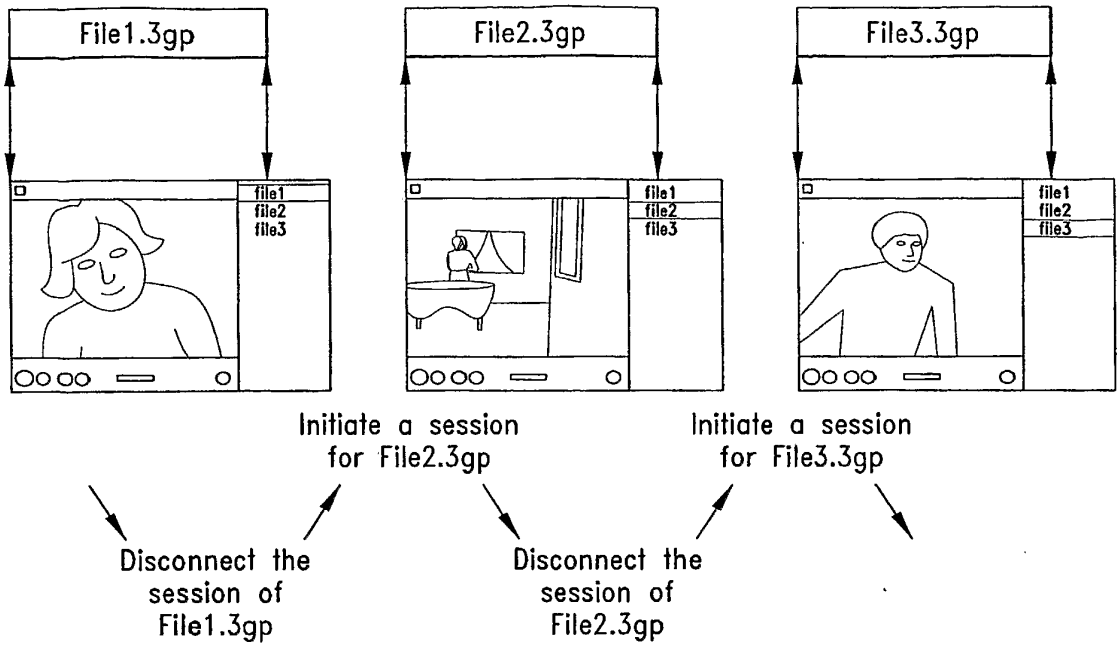

File1.3gp
File2.3gp
File3.3gp
file1
file2
file3
Initiate a session for File2.3gp
Initiate a session for File3.3gp
Disconnect the session of File1.3gp
Disconnect the session of File2.3gp

FIG. 3

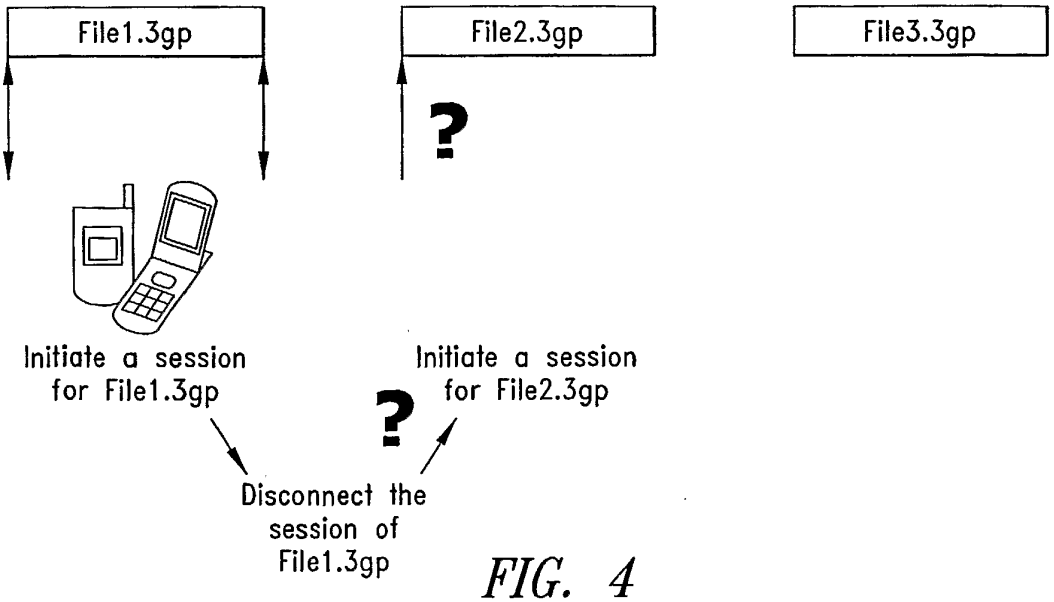

File1.3gp
File2.3gp
File3.3gp
?
Initiate a session for File1.3gp
Initiate a session for File2.3gp
?
Disconnect the session of File1.3gp

FIG. 4

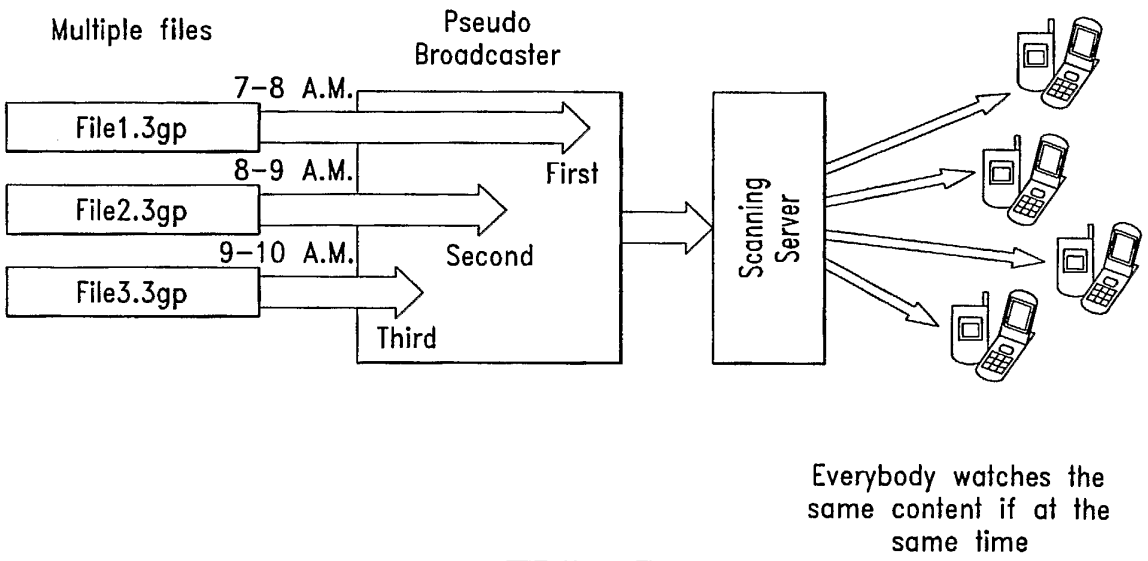

Multiple files
Pseudo Broadcaster
7-8 A.M.
File1.3gp
8-9 A.M.
File2.3gp
9-10 A.M.
File3.3gp
First
Second
Third
Scanning Server
Everybody watches the same content if at the same time

FIG. 5

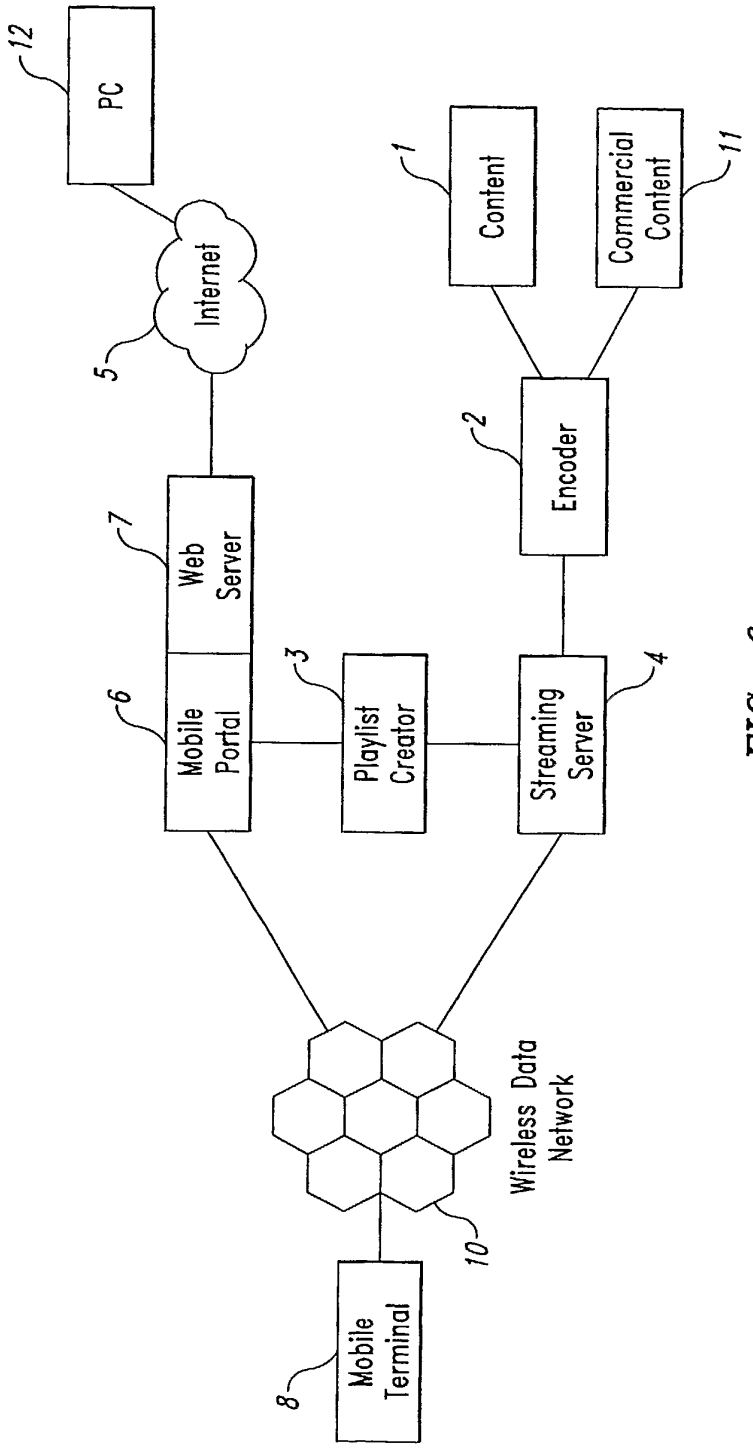

12
PC
Internet
5
1
Content
Commercial Content
11
2
Encoder
7
Web Server
6
Mobile Portal
3
Playlist Creator
Streaming Server
4
Wireless Data Network
10
8
Mobile Terminal

FIG. 6

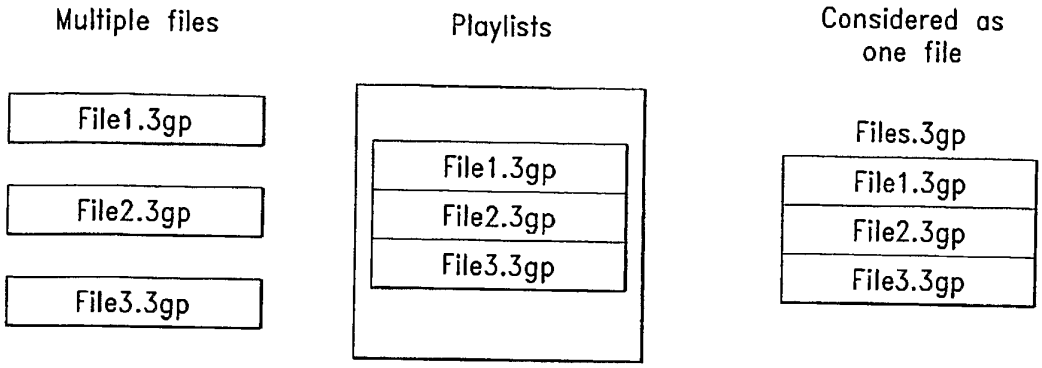

Multiple files
Playlists
Considered as one file
File1.3gp
File2.3gp
File3.3gp
File1.3gp
File2.3gp
File3.3gp
Files.3gp
File1.3gp
File2.3gp
File3.3gp

FIG. 7

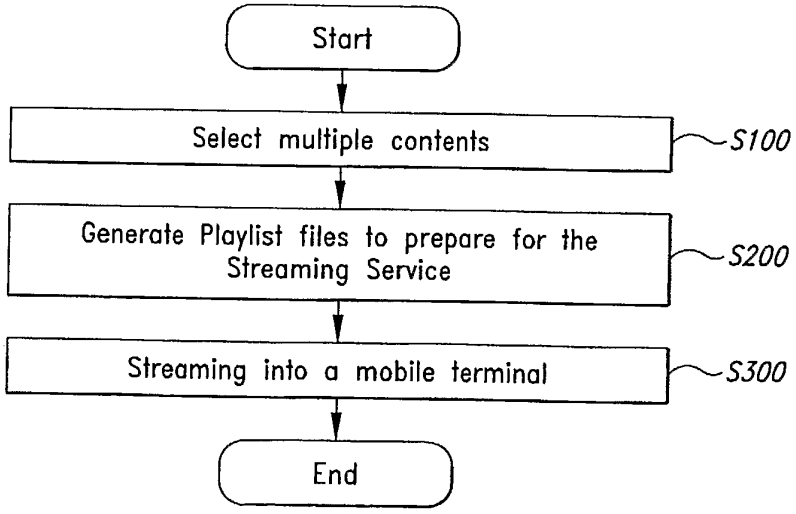

Start
Select multiple contents
S100
Generate Playlist files to prepare for the Streaming Service
S200
Streaming into a mobile terminal
S300
End

FIG. 8

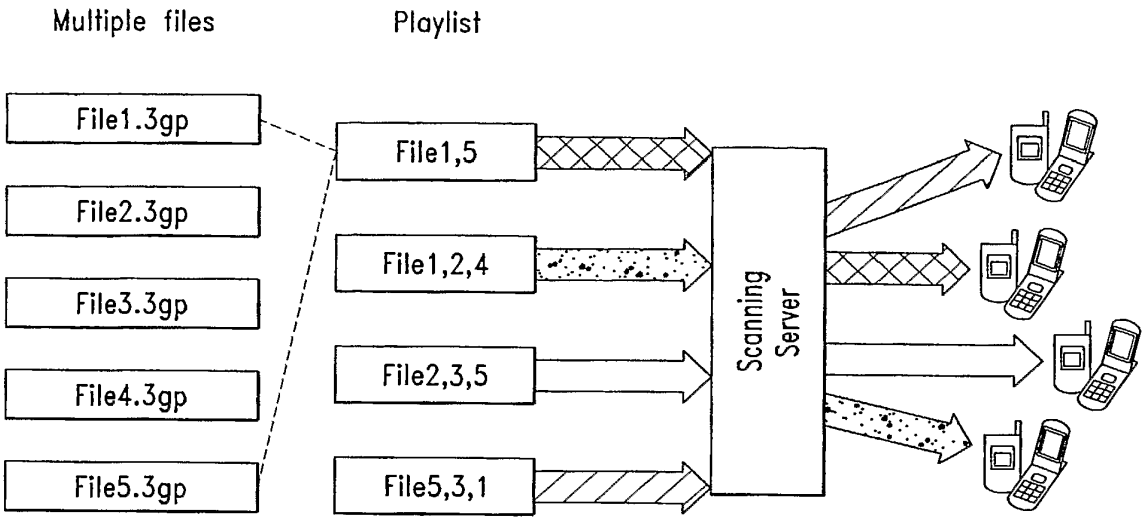

Multiple files
Playlist
File1.3gp
File2.3gp
File3.3gp
File4.3gp
File5.3gp
File1,5
File1,2,4
File2,3,5
File5,3,1
Scanning Server

FIG. 9

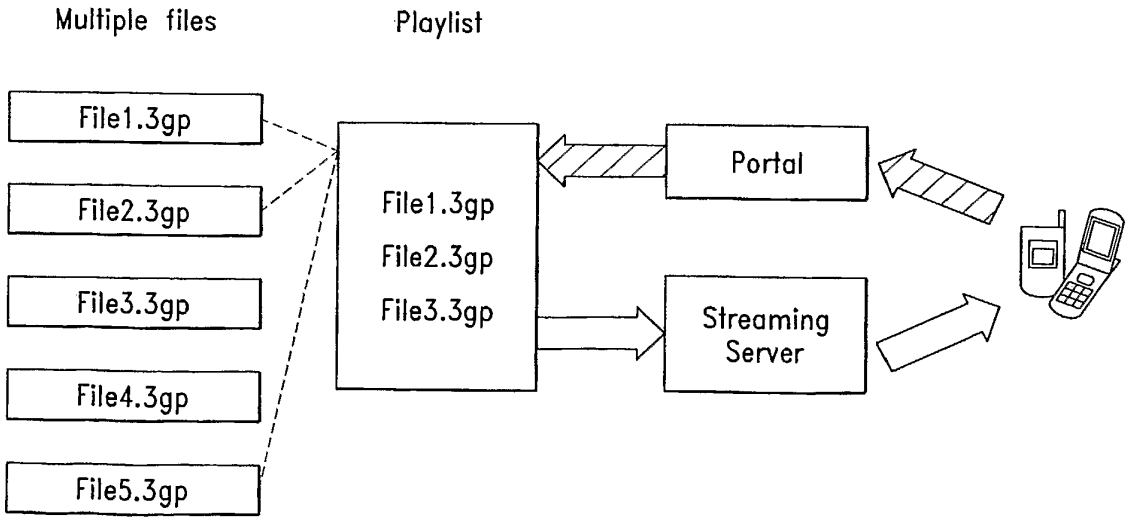

Multiple files
Playlist
File1.3gp
File2.3gp
File3.3gp
File4.3gp
File5.3gp
File1.3gp
File2.3gp
File3.3gp
Portal
Streaming Server

FIG. 10

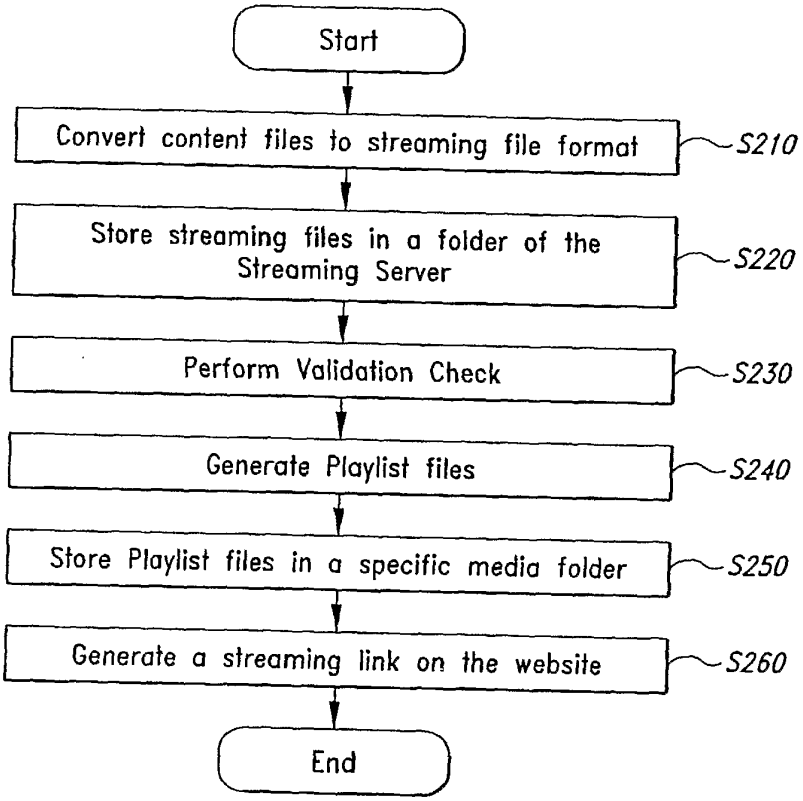

Start
Convert content files to streaming file format
S210
Store streaming files in a folder of the Streaming Server
S220
Perform Validation Check
S230
Generate Playlist files
S240
Store Playlist files in a specific media folder
S250
Generate a streaming link on the website
S260
End

FIG. 11

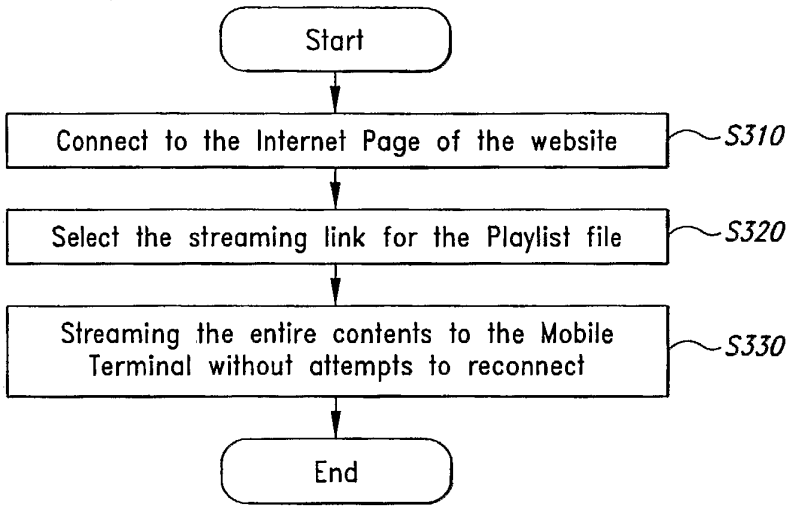

Start
Connect to the Internet Page of the website
S310
Select the streaming link for the Playlist file
S320
Streaming the entire contents to the Mobile Terminal without attempts to reconnect
S330
End

FIG. 12

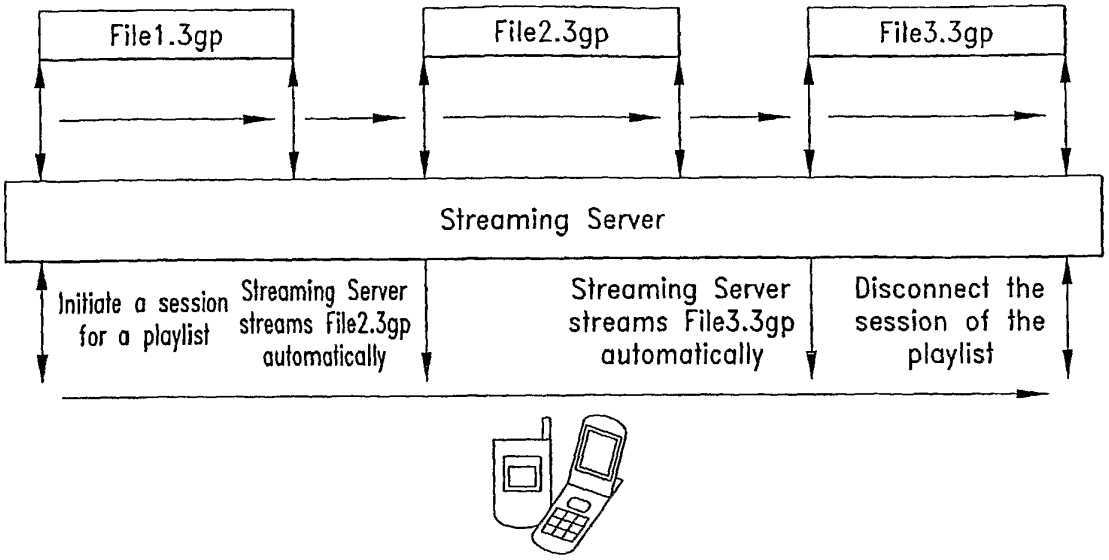

File1.3gp
File2.3gp
File3.3gp
Streaming Server
Initiate a session for a playlist
Streaming Server streams File2.3gp automatically
Streaming Server streams File3.3gp automatically
Disconnect the session of the playlist

FIG. 13

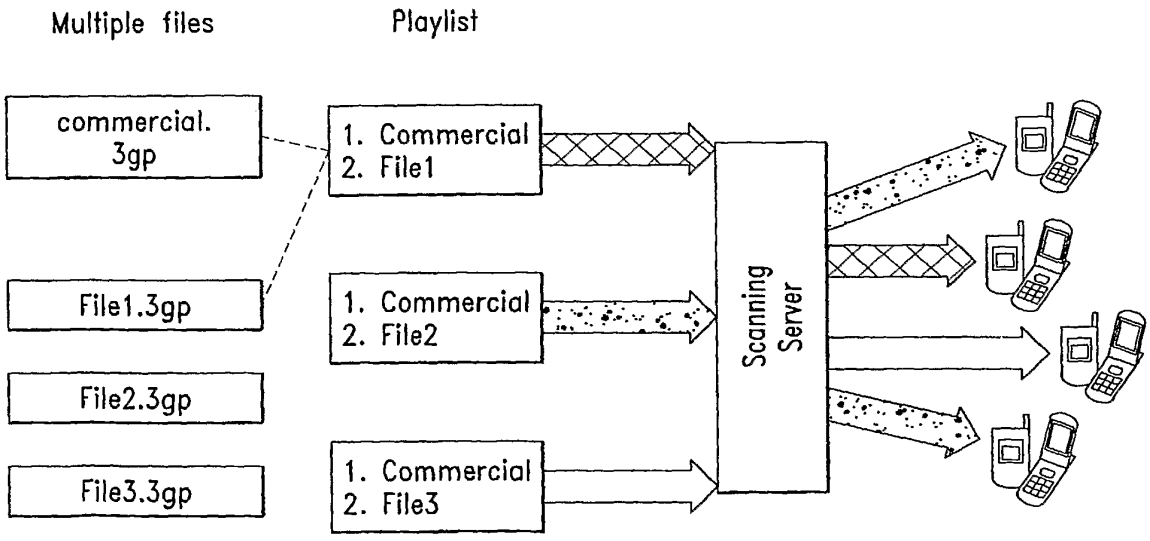

Multiple files
Playlist
commercial. 3gp
File1.3gp
File2.3gp
File3.3gp
1. Commercial
2. File1
1. Commercial
2. File2
1. Commercial
2. File3
Scanning Server

FIG. 14

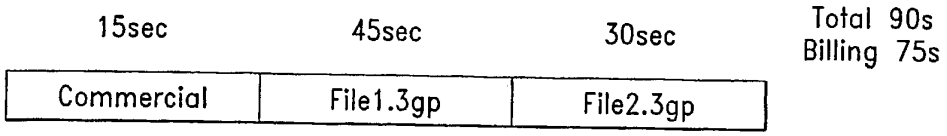
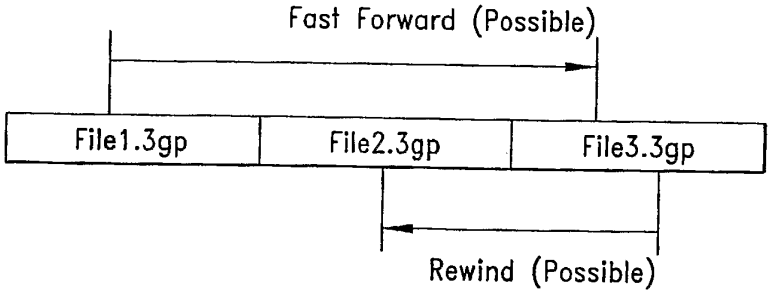
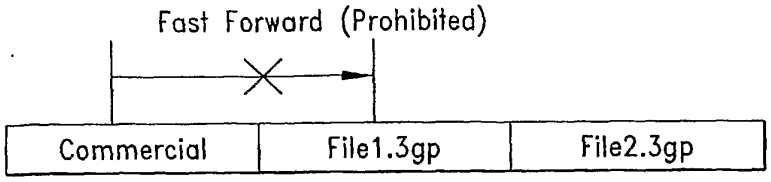


FIG. 15



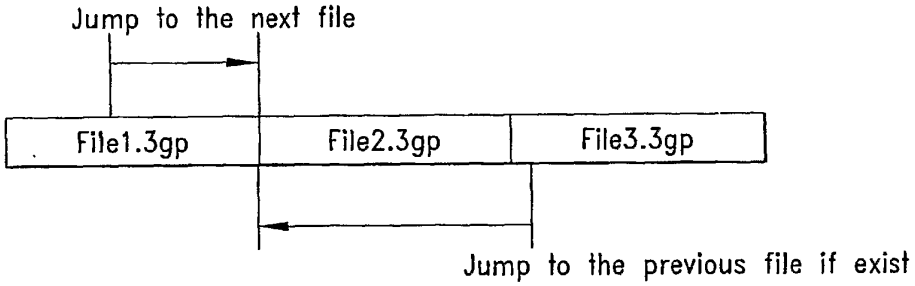
Random Access among multiple files is possible

FIG. 16



Or can be prohibited selectively as well
(Configurable in the playlist using the creation tool)

FIG. 17



FF/REW buttons can be used for content selection

FIG. 18

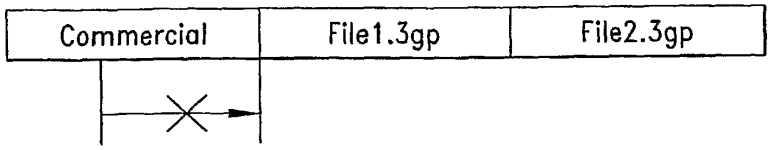


FIG. 19

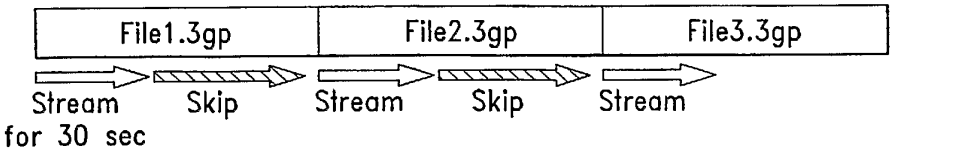

File1.3gp
File2.3gp
File3.3gp
Stream
Skip
Stream
Skip
Stream
for 30 sec
Streams the files for only the specified duration

FIG. 20

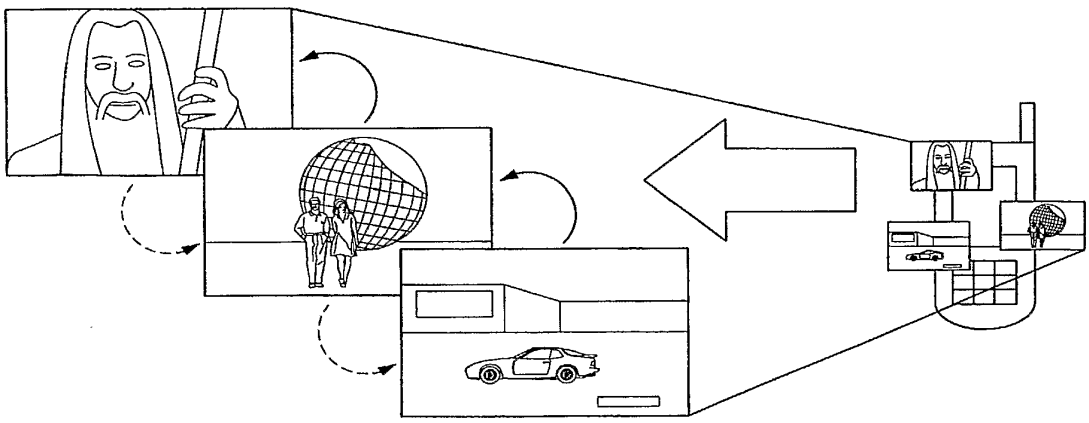


FIG. 21

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/004896

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MICROSOFT: "Windows Media Services 9 Series in Windows Server 2003. Reviewer's Guide" INTERNET ARTICLE, [Online] 22 April 2003 (2003-04-22), pages 1-25, XP002384215 Retrieved from the Internet: URL:http://download.microsoft.com/download/7/8/0/7800026e-3785-4cd8-be29-ac20371d12f8/Server_2003_RG_Final.pdf> [retrieved on 2006-06-07] page 7 - page 9	1-23
X	WO 02/39718 A (LOUDEYE TECHNOLOGIES, INC.) 16 May 2002 (2002-05-16) page 4 - page 19	1-23

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 June 2006	28/06/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Jurca, A

2

Form PCT/ISA/210 (second sheet) (April 2005)

Webgroup CZ a.s. Ex. 1002, Page 419 of 1406

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/004896

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 996 015 A (DAY ET AL.) 30 November 1999 (1999-11-30) column 1 - column 6	1-23
X	KRISHNAN V. ET AL.: "Customized Internet radio" COMPUTER NETWORKS, ELSEVIER SCIENCE PUBLISHERS B.V., AMSTERDAM, NL, vol. 33, no. 1-6, June 2000 (2000-06), pages 609-618, XP004304795 ISSN: 1389-1286 page 613 - page 618	1-23
P,X	WO 2005/084381 A (PACKETVIDEO NETWORK SOLUTIONS, INC; ZENG, THOMAS; FOSTER, MICHAEL; SEV) 15 September 2005 (2005-09-15) page 2 - page 16	1-23

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/004896

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0239718 A	16-05-2002	AU 3774802 A	21-05-2002
US 5996015 A	30-11-1999	NONE	
WO 2005084381 A	15-09-2005	WO 2005086016 A1	15-09-2005

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Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	**11/17/2021 12:11:47 PM ET**	**066.0141X1C9**

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60403474	FILING DATE	05/18/2020
CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 53

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
20211117_RCE_06-0141X1C9.pdf	3	Request for Continued Examination (RCE)	681 KB
20211117_IDSCertStmnt_066-0141.pdf	1	Transmittal Letter	123 KB
20211117_IDS-For_066-0141.pdf	7	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
WO03041413A1.pdf	47	Non Patent Literature	1913 KB
WO2004021668A1.pdf	24	Non Patent Literature	906 KB
WO2004057832A1.pdf	23	Non Patent Literature	802 KB

WO2006086717A1.pdf	50	Non Patent Literature	1844 KB
EP1394973A2.pdf	31	Non Patent Literature	1571 KB
KR20050001167A.pdf	10	Non Patent Literature	772 KB
WO0245372A3.pdf	5	Non Patent Literature	143 KB
20211117_IDS-NPLsList1_066-0141.pdf	8	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
ExhibitA-4_DISH_564_156ClaimChart-Chou031.pdf	47	Non Patent Literature	489 KB
ExhibitA-5_DISH_564_156ClaimChart-Durrant.pdf	37	Non Patent Literature	382 KB
ExhibitA-6_DISH_564_156ClaimChart-Gentric.pdf	49	Non Patent Literature	534 KB
ExhibitA-1_DISH_564_156ClaimChart-Akiyama.pdf	41	Non Patent Literature	509 KB
ExhibitA-2_DISH_564_56ClaimChart-AryeUS20020002708A1.pdf	44	Non Patent Literature	737 KB
ExhibitA-3_DISH_564_156ClaimChart-Carmel.pdf	52	Non Patent Literature	481 KB
ExhibitA-12_DISH_564_156ClaimChart-Quicktime.pdf	24	Non Patent Literature	236 KB
ExhibitA-	43	Non Patent Literature	559 KB

13_DISH_564_156ClaimChart-RaviUS6292834.pdf			
ExhibitA-14_DISH_564_156ClaimChart-RealOnePlayer.pdf	59	Non Patent Literature	7125 KB
ExhibitA-7_DISH_564_156ClaimChart-Kitamura.pdf	43	Non Patent Literature	1401 KB
ExhibitA-8_DISH_564_156ClaimChart-Klemets.pdf	50	Non Patent Literature	489 KB
ExhibitA-9_DISH_564_156ClaimChart-OplayoEP1298931.pdf	37	Non Patent Literature	379 KB
ExhibitA-10_DISH_564_156ClaimChart-QOAS.pdf	35	Non Patent Literature	9048 KB
ExhibitA-11_DISH_564_156ClaimChart-QuickTimeChanges.pdf	25	Non Patent Literature	258 KB
ExhibitA-18_DISH_564_156ClaimChart_G2.pdf	61	Non Patent Literature	1232 KB
ExhibitB-1_DISH_554_680_555ClaimChart-Akiyama.pdf	60	Non Patent Literature	444 KB
ExhibitA-15_DISH_564_156ClaimChart-Walker.pdf	60	Non Patent Literature	573 KB
ExhibitA-	33	Non Patent Literature	348 KB

16_DISH_564_156ClaimChart-Wang230.pdf			
ExhibitA-17_DISH_564_156ClaimChart-Wu.pdf	41	Non Patent Literature	407 KB
ExhibitB-4_DISH_554_680_555ClaimChart-Chou031.pdf	64	Non Patent Literature	532 KB
ExhibitB-5_DISH_554_680_555ClaimChart-Durrant.pdf	57	Non Patent Literature	409 KB
ExhibitB-6_DISH_554_680_555ClaimChart-Gentric.pdf	56	Non Patent Literature	425 KB
ExhibitB-7_DISH_554_680_555ClaimChart-Kitamura.pdf	54	Non Patent Literature	383 KB
ExhibitB-2_DISH_554_680_555ClaimChart-AryeUS20020002708.pdf	61	Non Patent Literature	503 KB
ExhibitB-3_DISH_554_680_555ClaimChart-Carmel.pdf	61	Non Patent Literature	534 KB
ExhibitB-10_DISH_554_680_555ClaimChart-QOAS.pdf	60	Non Patent Literature	3298 KB
ExhibitB-11_DISH_554_680_555ClaimChart-QuickTimeChanges.pdf	56	Non Patent Literature	394 KB

ExhibitB-12_DISH_554_680_555Claim Chart-Quicktime.pdf	55	Non Patent Literature	371 KB
ExhibitB-8_DISH_554_680_555Claim Chart-Klemets.pdf	67	Non Patent Literature	549 KB
ExhibitB-9_DISH_554_680_555Claim Chart-OplayoEP1298931.pdf	57	Non Patent Literature	397 KB
ExhibitB-16_DISH_554_680_555Claim Chart-Wang230.pdf	56	Non Patent Literature	407 KB
ExhibitB-17_DISH_554_680_555Claim Chart-Wu.pdf	60	Non Patent Literature	438 KB
ExhibitB-13_DISH_554_680_555Claim Chart-RaviUS6292834.pdf	60	Non Patent Literature	492 KB
ExhibitB-14_DISH_554_680_555Claim Chart-RealOnePlayer.pdf	79	Non Patent Literature	4618 KB
ExhibitB-15_DISH_554_680_555Claim Chart-Walker.pdf	70	Non Patent Literature	538 KB
ExhibitB-19_DISH_554_680_555Claim Chart-Dey.pdf	63	Non Patent Literature	478 KB
ExhibitB-20_DISH_554_680_555Claim Chart-Microsoft.pdf	503	Non Patent Literature	2312 KB

DISH-RespondentsJointDisclosure-Oct22-2021.pdf	193	Non Patent Literature	2110 KB
RespondentsNoticeOf PriorArt-Sept10-2021.pdf	63	Non Patent Literature	560 KB
VerifiedResponse-ICON-Jun18-2021.pdf	78	Non Patent Literature	669 KB
RespondentJointDisclosureAug6-2021.pdf	183	Non Patent Literature	3158 KB
PelotonAmendedResponseToComplaint-Aug26-2021.pdf	137	Non Patent Literature	18184 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
20211117_RCE_06-0141X1C9.pdf	B52D1AB20B7479A1905822B266AEB0C7D125AD376583DD575CA55881FFBCE9562721E516EC2F1B8BB1EE49872C2207A0874D25137BDD81E0B63B283628F64150
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WO2004021668A1.pdf	175CFF80CDD4C9F4BA4D9B7F0C5A968B070DFFCB4EE0E7EB9B023342BE701A13D07A36C2CFAC5BDCBEDD04EE8B9C0B

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WO2006086717A1.pdf	525BF77FAB5B4759421BBCF452747B130AB2AA4BBBA184DED81C8B0A0B66F82FAB2DCCA28C65C33280C4E6C170ACCF674E30E483D2B3BEB2B4B3479B07E4CC3C
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WO0245372A3.pdf	D7D251E15CEA12C996504D64725FDBC245F6036541D47E432ECF60EE62CAA0AD0CC34E1102C5078F20591C7FC3E4871F7F76C6C667D954E0E448E7E597D763EC
20211117_IDS-NPLsList1_066-0141.pdf	015D1AF817EB519728706FBEDADA815A85FAA6A6CF38EF975FCC2857A0B0EE3C6AD5B3F2963CB1A77890813B8C657EDA8D84B542FDA0A7B0FF8C2FB8E90DC7AF
ExhibitA-4_DISH_564_156ClaimChart-Chou031.pdf	7C231F3580EE0AF092B46C02ABEBDA78A366EAA3A44CC93AFD53427F3B21BD646FC60180364FDCB5ACF6DC930A1C9C4A8CD4771FE302A3F5014F8F25375B6FF9
ExhibitA-5_DISH_564_156ClaimChart-Durrant.pdf	4BD832D4E904CFC95F254A7B38B44AFDA910735CDC5BB2B3E5F2E2C03EFC5461CA9EABE04B5BD5AEF55BC4A0D7CE55B30EB0DB513C326DBE0BA359A2C58A33A3
ExhibitA-6_DISH_564_156ClaimChart-Gentric.pdf	CE86611BE49A214D3D91491386DCCE9FE92CB517F5EEB7F84B776D413FCA3D79AE178BBF950C57B52F30D6894B9F0D03A175AE1BD50163FAE3B8B104956FE502
ExhibitA-1_DISH_564_156ClaimChart-	EB2F83E61D5EED0560122F603757FBB0C4EA15F16DC8E483555AC7DB117A9EB50EA1A5E2667C1A4C1F0952DA4FD083F82F

Akiyama.pdf	E0EC60AE4E5F12C9DAED9BCE4B4FA7
ExhibitA-2_DISH_564_56ClaimChart-AryeUS20020002708A1.pdf	1D8994E761EC41AC5473044429BABA6EED18E5C80E4FD27D6786FB9D8EE4B066AB3D42A5CC0148A34CCDAE3FEB327E89661F3AE4F95DBFD8AEE205C452BFDEF1
ExhibitA-3_DISH_564_156ClaimChart-Carmel.pdf	608A1E10EB60C336BE9E150AA91091E1087A884E73B9EA87F0BC879A3D41ECE7DB74B848D937AC81D93926594E5521FB7F66CF82F57644F26C3D692FAD516A0A
ExhibitA-12_DISH_564_156ClaimChart-Quicktime.pdf	B9A8668B4B98782A9DFCC10378F5C14A5C4B4C57EBC9F4C8400FFE3C2CE6BF2154EA289BF1FA331915D5CFF533F77EC42DAF972CBFB7E9347287597E1128924F
ExhibitA-13_DISH_564_156ClaimChart-RaviUS6292834.pdf	8CC3FDE10CDBB340B3D5B957AAF89A2865078EAF569E500142F3D8E744F14B2BC1EED3370E0A697CDD733058AC8ABA0FB55C6D888EB16AF18760F101D2C7B44A
ExhibitA-14_DISH_564_156ClaimChart-RealOnePlayer.pdf	DE408B933D46A286E0CD4688D7BE63C33FD937C7FE239221D5FD021C29AD3FB3381A5FDBE9BC1135D11285906062B6E9953CE1B97BBFF8B34AE8D3158817F11D
ExhibitA-7_DISH_564_156ClaimChart-Kitamura.pdf	CFD585E11C1E372F3AE55153DE568FD30F51957C33E907E1BA4D07A3E06C669052E5F2BD7A860261B41D30BFE8B2F270AA72F1199282D914AC631D792B6D7A4F
ExhibitA-8_DISH_564_156ClaimChart-Klemets.pdf	9D9A3E5568DBB8A3449A6ED47407CD12A4C0E2802DFE979DB2FB49BD6110321C4C215EDD7725F09EF5FBBFD4FCA733157FA1410525C03B173CD8668843EF55AA
ExhibitA-9_DISH_564_156ClaimChart-OplayoEP1298931.pdf	AEC7056DC44EAC935C57E1931A61CAB09217176C0BC7D656DCAB67AA8207C05E41A0A4435A45408B765B51F97B81234BD5942D5C7943D7BCEE3E265B661AB31B
ExhibitA-10_DISH_564_156ClaimChart-QOAS.pdf	CE8ECBFCC8F0863578A994CED6E9F18C997905B82A672611EA92666311563CE7F4D9C8DBEC78DA2983E5AC29AC2DF3718803EA63BFE5DB5516362798F281C21F
ExhibitA-11_DISH_564_156 ClaimChart-	54214D853A4732666E9185442C8E6114649D5C699E3CD6284EBCE755248B2DA952A7DD6ED6D95871D7D773AA9F058EB68C

QuickTimeChanges.pdf	79C948CD83C973E956DFFE5D5D5ABA
ExhibitA-18_DISH_564_156ClaimChart_G2.pdf	111A47E51D2EF6599A26AADAF61FC7BA147B2F9356DCF8E7C89C23A4CEC294DCE93841DE9A55EF33DFA1C2858ABD707C98468C3D91B9E0F0007A8602CD681628
ExhibitB-1_DISH_554_680_555ClaimChart-Akiyama.pdf	ABB55707E24ADE355A7D5BE89731E6691AA42F311E1780E19ABB2AEBF8614D5BEBC1CACDF0200C0A57301D400A378EE753956152A9D0AD16C2316E848E0C852F
ExhibitA-15_DISH_564_156ClaimChart-Walker.pdf	94A81D8BDA4720C160C621BE3A62CB836EE80CFFFA4AFD12EBD5183FD3229E8BD98927584B6B7659602FB1D812EAF51C17B5CFD0CA07169ECDF403BE8FC77B27
ExhibitA-16_DISH_564_156ClaimChart-Wang230.pdf	74FB7B8B43226623B1A5E4E328CC1108929699687476E005CFF55B426920C7D3F12DDDE267E542C051FEB447BCB70F41BD437478086D3CFC92A8FAEFC9EC3616
ExhibitA-17_DISH_564_156ClaimChart-Wu.pdf	8D739DEAECB57DD608A5BB564FA25D5BC6E7C87915C060AE2F296CECC4828A77473E7178E4C81B4A4E3C7AD24F3AF7436844E8F1FC85605B9698C6617D66E1AB
ExhibitB-4_DISH_554_680_555ClaimChart-Chou031.pdf	CFA99EF5A20803B777ED88CD9EF45105D7622A6BCE722D1A5B3D1A7C465A22FDD4BF6F26C157D05E54183D30E0E174AB5EF35BB715E49D303B83D2664C378BC1
ExhibitB-5_DISH_554_680_555ClaimChart-Durrant.pdf	6330A56CF5352E3A06578D3BA558245B3DB4795286B08E779EBA52FE882E46C6831D1527392078C015844FDCA00D7F9ED78CD911F956EADF8885CE6865F2DD78
ExhibitB-6_DISH_554_680_555ClaimChart-Gentric.pdf	25E33F2E7245917E69BD481A94F60F67AA5C431D44F9CD01D8E0F3DD2018D29FCFA2A012A67607115555D412C57BCF6B8BE3CD897DE4D850E2D88FFD5D2235FB
ExhibitB-7_DISH_554_680_555ClaimChart-Kitamura.pdf	D50C930AEA491B985A1CE2CD5C5851A81C8ADA2E2F7426B5B4D30875C48D62536972687DE7E23536C5BD7AEFA7D060B4F5AB1C9F207CF38741B2A4132ABFE744
ExhibitB-2_DISH_554_680_555ClaimCh	045BC4CF0C58820D10B7662221AB6EF9183A7CA75BD41AB6EB780034948F60FFF3F15CFE8C4D0E6C408C2DF4482D6026BB

art-AryeUS20020002708.pdf	BF8A47AE48F77C9AB2AFBA708C47CF
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ExhibitB-10_DISH_554_680_555ClaimChart-QOAS.pdf	6C6C1F2E171B37914BBCBE41C1826C7A70B26D55678A5FD6084415DC3C323675A67F5907568105A08AB7AB9DDD750B575B038359C810057FB5823618E67A64DD
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ExhibitB-12_DISH_554_680_555ClaimChart-Quicktime.pdf	F0691602D2EB964146C4DC8E29D2A4B6609DC17F9EF53375A505F3C53994E2334C7940D8CDB1FE70E50C4C85E5E12B487345ED7D1B3AAC0D9C87E0BF206AB1CC
ExhibitB-8_DISH_554_680_555ClaimChart-Klemets.pdf	D8EF0C52DD5BBF0753B1F1C16D81F9269A7CE0181CAE5C79FE2F76B1FCEDD54EC9AEF1BFF09D76295494D32C7E6648C8D40BE94DAAAB5FC8ABD0F97E0C62EB00
ExhibitB-9_DISH_554_680_555ClaimChart-OplayoEP1298931.pdf	605BA0875882A584CCD07F07B78062E07333041890D620BA6E9497FF1263A6C0965C6CBB3073B273E954ACD9AEB8FB31FCFCC250EB1ED42C281919EB3EF22DEDA
ExhibitB-16_DISH_554_680_555ClaimChart-Wang230.pdf	B041B4A4E8014D8CA063DFC10927485926E4DB9940CA8A4C7A2D562237325492555C5939C2E8DED1B9D073DCA5FE1D6745C29D424F333F0C9D58390E152163C36
ExhibitB-17_DISH_554_680_555ClaimChart-Wu.pdf	AD1B9FFAA63D7546EBE4B76ADD0EC96E1D6BF392015C68799B347D16D2C84E7D8DF2A91DEA2A0DD7F93C7689A95ED6810047E7A5334F144C8C195693A4F97AF8
ExhibitB-13_DISH_554_680_555ClaimChart-RaviUS6292834.pdf	95576BC140C0A52B5D70B89A053EDB0D9D4E22B348E0E29D37FE18BA8D8FC56D72B3E6018C02503F5C5467226D26AE013F2CAF9D67FA9BC483801ECA86BADD46
ExhibitB-14_DISH_554_680_555ClaimC	AA9DBFE61B331E023A38942B4E552DDE0C867B9B5D669715ECEA1239088BCCDAA5B5DB15DEC00D4A545089A40FD7D7FA

hart-RealOnePlayer.pdf	C1694FC8F2486622CE0384D6DDC1E84F
ExhibitB-15_DISH_554_680_555ClaimChart-Walker.pdf	75CD7EB172A62D5373153E77B7A62DDE912966EFEB51406217ED251CAFEC3E3620E038F65DEB15751BBC4DD77F176A8FAFF23BC055BD9AEF44BE8DD4EDDB2F8F
ExhibitB-19_DISH_554_680_555ClaimChart-Dey.pdf	A7E01AA372D9E42E4B7E1DCF2FBDD26AAB1DC2A4DCE0276A7AA8BDD7909DB90FB036651A76B3FA633698169BBD032BF3BA6AD02525630B4E0507A48D68A27B81
ExhibitB-20_DISH_554_680_555ClaimChart-Microsoft.pdf	3779D8EFEFE0BA07061DD5B4DD519D4E08C1305DA8D27AADA702B728B32F68998EDC01B862F85744004C830E8EBF95818F47397CA7FA8DB4FD56B3E64D84AE06
DISH-RespondentsJointDisclosure-Oct22-2021.pdf	04A257E5C2EDE867A3320152D5F5CA5716CB9A9108DC33A0B5FFDA4794D88BE445CAFD88CC53EDD43C152F0E90CB3DE9982C1F73AF6E3AE86AC3CA1D7A942234
RespondentsNoticeOf PriorArt-Sept10-2021.pdf	BE1860A401284C3C5622B6AB03CBC261CC27DD1BF0F34088A41C1A69EA0DB2ABA7FDB0FE29E0A638880F87F540A14CE50D1EB66B71BB00DE9BCA86B78E222076
VerifiedResponse-ICON-Jun18-2021.pdf	AC0C4BBAC8F4505CC03105444CD5397A94BE2BE68C18F5EC37CC7C94D73DFA59ACC13E371BA3B3BBA1FF9FE4B394FC18F88590D5BB3E1A818DCB5E8216194C20
RespondentJointDisclosureAug6-2021.pdf	311862C8E989F7AC88F0BC5AE5BFAC8BE3B100A3B20ADC2359F5E9645BD52544433EFF26293698F8470D9AFC44BF857459541865C6E7D05A7831D9FE50256EEC
PelotonAmendedResponseToComplaint-Aug26-2021.pdf	1040BE17AFBB8E7A7820EABE7E3400A8DACAEF1C11C3466FF47BF4EEAC0077FECBCBB8E437AB2239B53DF51A63EBAF9C418689FAFDA95D0BE47B7FB008638651

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New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

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	1	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Akiyama et al	
	2	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Arye et al.	
	3	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Carmel et al.	
	4	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Chou et al.	
	5	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Durrant et al.	
	6	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Gentric	
	7	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Kitamura	
	8	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Klemets et al.	
	9	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Oplayo et al.	
	10	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QOAS	
	11	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QuickTime Changes	

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	Attorney Docket Number	066.0141X1C9

	12	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") QuickTime	
	13	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Ravi	
	14	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") RealOne Player	
	15	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Walker	
	16	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Wang	
	17	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") Wu	
	18	Claim Chart Against U.S. Patent No. 9,407,564 ("'564 patent") RealSystem G2	
	19	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Akiyama et al.	
	20	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Ayre	
	21	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Carmel et. al.	
	22	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Chou et. al.	

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	29	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") QuickTime Changes	
	30	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") QuickTime	
	31	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Ravi	
	32	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") RealOne Player	
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	34	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Wang	
	35	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Wu	
	36	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Dey	
	37	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Microsoft	
	38	DISH - Respondent's Joint Disclosure of Supplemental Invalidity Contentions in Response to Individual Interrogatories.	
	39	MIRROR - RESPONDENTS LULULEMON ATHLETICA INC. and CURIOUSER PRODUCTS INC. d/b/a MIRROR FIRST AMENDED RESPONSE TO COMPLAINT UNDER SECTION 337 OF THE TARIFF ACT OF 1930, AS AMENDED, STATEMENT OF PUBLIC INTEREST AND NOTICE OF INSTITUTION OF INVESTIGATION.	
	40	PELOTON - RESPONDENT PELOTON INTERACTIVE, INC.'S FIRST AMENDED RESPONSE TO COMPLAINT AND TO NOTICE OF INVESTIGATION	
	41	ICON - RESPONDENTS' JOINT DISCLOSURE OF INITIAL INVALIDITY CONTENTIONS IN RESPONSE TO INDIVIDUAL INTERROGATORIES	
	42	RESPONDENTS' NOTICE OF PRIOR ART	
	43	ICON and Free Motion Fitness, Inc. VERIFIED RESPONSE OF ICON HEALTH & FITNESS, INC., FREE MOTION FITNESS, INC., AND NORDICTRACK, INC. TO COMPLAINT OF DISH DBS CORPORATION, DISH TECHNOLOGIES L.L.C., AND SLING TV L.L.C. AND TO NOTICE OF INVESTIGATION	

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	DAVID F. BRUECK
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name/Print	Brett A. Carslson	Registration Number	39,928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/876,579	11/17/2021 12:11:47 PM ET	066.0141X1C9

Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
PATENT CENTER #	60403474	AUTHORIZED BY	Brett Carlson
CUSTOMER #	70560	FILING DATE	05/18/2020
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	DAVID F. BRUECK

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 1269	E2021AGC13051478	Francene Stewart

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
502091	37 CFR 1.17 (Patent application and reexamination processing fees)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1820	REQUEST FOR CONTINUED EXAMINATION (RCE)- 2ND AND SUBSEQUENT REQUEST (SEE 37 CFR 1.114)	2000.00	1	2000.00

TOTAL AMOUNT:	$2,000.00

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and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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New International Application Filed with the USPTO as a Receiving Office

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Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16876579	Filing Date	2020-05-18	Docket Number (if applicable)	066.0141x1c9	Art Unit	2454
First Named Inventor	David F. Brueck			Examiner Name	Chirag R. Patel		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
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Signature of Registered U.S. Patent Practitioner			
Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-11-17
Name	Brett A. Carlson	Registration Number	39928

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Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IDS CERTIFICATION STATEMENTS

I. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(b): (check one box)**

☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

☐ Within three months of the date of entry of the national stage as set forth in 1.491 in an international application.

☐ Before the mailing date of a first Office Action on the merits. In the event that a first Office Action on the merits has been mailed, please consider this IDS under 37 C.F.R. 1.97(c) and see the statement under 1.97(e) or charge deposit account 50-2091 the fee specified by 37 C.F.R. 1.17(p) if such statement is not selected in Section IV.

☑ Before the mailing of a first Office Action after the filing of a request for continued examination under 1.114.

II. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(c):**

☐ After the period specified in 37 C.F.R. 1.97(b) and before the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, and accompanied by:

- ☐ a statement specified in 1.97(e) as subsequently provided in this IDS; or
- ☐ the fee set forth in 1.17(p).

III. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(d):**

☐ After the period specified in 37 C.F.R. 1.97(c) and on or after the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, but before or simultaneous with payment of the issue fee, and accompanied by a statement specified in 1.97(e) as subsequently provided in this IDS **and** the fee set forth in 1.17(p).

IV. **Statement under 37 C.F.R. 1.97(e) (check only one box)**

The undersigned hereby states that:

☐ Each item of information contained in the IDS was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS.

☐ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this IDS.

V. **Statement under 37 C.F.R. §1.704(d)**:

☐ The undersigned hereby states that each item of information contained in the information disclosure statement: (i) was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement; or (ii) is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement..

VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

If the Examiner has any questions concerning this IDS, the Examiner is requested to contact the undersigned at the telephone number associated with Customer No. 70560 . If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule, with a petition if necessary, and charge the appropriate fee to Deposit Account No. 50-2091.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70560 7590 09/21/2021

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 09/21/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/21/2021

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

70560 7590 09/21/2021

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

TITLE OF INVENTION: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	12/21/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, CHIRAG R	2454	709-219000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Webgroup CZ a.s. Ex. 1002, Page 449 of 1406

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 09/21/2021

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER	
PATEL, CHIRAG R	
ART UNIT	PAPER NUMBER
2454	

DATE MAILED: 09/21/2021

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the amendments filed on August 5, 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 8/19/21.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/CHIRAG R PATEL/
Primary Examiner, Art Unit 2454

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance: Applicants have filed a terminal disclaimer to overcome the obvious double patent rejections with respect to US 10,469,555. A relevant prior art, Grigorovitch et al. (US 2005/0066063) teaches that a single file stores a portion of a video stream and audio stream in multiple bit-rates as performing multi-bit-rate encoding and are selected based on a bandwidth. It also teaches that the media cache will create a segment for each portion of the received stream that is not immediately adjacent in time, when the user uses a seek bar to forward or rewind the playback media. Srivara (US 2003/0204519) stores the entire song in multiple bit-rate encoding files and transmit the entire file in a single bit-rate in accordance with the quality selection. The prior art are different from the claimed invention in that the each streamlet correspond to a portion of a video, and is encoded at a response one of the plurality of different bitrate and refers to the same portion of the video in the low stream, medium quality and high quality stream and transmit only that portion which has the same duration at the at the requested bitrate for playback as requested, as claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

/Chirag R Patel/
Primary Examiner, Art Unit 2454

Notice of References Cited	Application/Control No. 16/876,579	Applicant(s)/Patent Under Reexamination BRUECK et al.	
	Examiner CHIRAG R PATEL	Art Unit 2454	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20050066063-A1	03-2005	Grigorovitch, Alexandre V.	H04N21/6125	710/1
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

CPC						
Symbol					**Type**	**Version**
H04L	/	65	/	607	F	2013-01-01
H04L	/	47	/	801	I	2013-01-01
H04L	/	47	/	12	I	2013-01-01
H04L	/	65	/	4069	I	2013-01-01
G06F	/	16	/	71	I	2019-01-01
G06F	/	16	/	183	I	2019-01-01
H04L	/	29	/	06027	I	2013-01-01
H04N	/	7	/	24	I	2013-01-01
H04N	/	21	/	23439	I	2013-01-01
H04N	/	21	/	4331	I	2013-01-01
H04N	/	21	/	84	I	2013-01-01
H04N	/	21	/	8456	I	2013-01-01
H04L	/	65	/	80	I	2013-01-01
H04L	/	65	/	608	I	2013-01-01
H04L	/	67	/	02	I	2013-01-01
H04L	/	65	/	1069	I	2013-01-01
H04L	/	67	/	2842	I	2013-01-01
H04L	/	67	/	32	I	2013-01-01
H04N	/	21	/	2662	I	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	10 September 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

U.S. Patent and Trademark Office — Part of Paper No.: 20210910

Webgroup CZ a.s. Ex. 1002, Page 456 of 1406

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	29	/	06

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	10 September 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

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	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19		28								
	2		11		20		29								
	3		12		21		30								
	4		13		22										
	5		14		23										
	6		15		24										
	7		16		25										
	8		17		26										
	9		18		27										

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454 (Primary Examiner)	10 September 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

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Part of Paper No.: 20210910

Webgroup CZ a.s. Ex. 1002, Page 458 of 1406

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2020	09/10/2021							
	1	✓	=							
	2	✓	=							
	3	✓	=							
	4	✓	=							
	5	✓	=							
	6	✓	=							
	7	✓	=							
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	28	✓	=							
	29	✓	=							
	30	✓	=							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.
EAST	09/10/2021	C.P.
Google Patents / Scholar	09/10/2021	C.P.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04N	H04N21/2662, H04N21/8456,	09/10/2021	C.P.
H04L	H04L65/607,H04L65/608, H04L67/02	09/10/2021	C.P.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5424455		1995-06-13	Yamamoto et al.	
	2	5544318		1996-08-06	Schmitz et al.	
	3	5867230		1999-02-02	Wang et al.	
	4	5933603		1999-08-03	Vahalia et al.	
	5	5941951		1999-08-24	Day et al.	
	6	5966015		1999-10-12	Horii	
	7	5966025		1999-10-12	Beffa	
	8	6003030		1999-12-14	Kenner et al.	

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	9	6112239		2000-08-29	Kenner et al.	
	10	6154744		2000-11-28	Kenner et al.	
	11	6181867	B1	2001-01-30	Kenner et al.	
	12	6292383	B1	2001-09-18	Worley	
	13	6498897	B1	2002-12-24	Nelson et al.	
	14	6625643	B1	2003-09-23	Colby et al.	
	15	6637031	B1	2003-10-21	Chou	
	16	6665726	B1	2003-12-16	Leighton et al.	
	17	6766407	B1	2004-07-20	Lisitsa et al.	
	18	6795863	B1	2004-09-21	Doty, Jr.	
	19	7047307	B2	2006-05-16	Li	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	20	7386627	B1	2008-06-10	Lango et al.	
	21	7974200	B2	2011-07-05	Walker et al.	

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	1	20030072376	A1	2003-04-17	Krishnamachari et al.	
	2	20030061305	A1	2003-03-27	Copley et al.	
	3	20020170062	A1	2002-11-14	Chen et al.	
	4	20020044528	A1	2002-04-18	Pogrebinsky et al.	
	5	20020002708	A1	2002-01-03	Arye	
	6	20030009578	A1	2003-01-09	Apostolopoulos et al.	
	7	20030236906	A1	2003-12-25	Klemets et al.	

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	8	20040136327	A1	2004-07-15	Sitaraman et al.	
	9	20040260827	A1	2004-12-23	Wang	
	10	20040202109	A1	2004-10-14	Akiyama et al.	
	11	20050177618	A1	2005-08-11	Zimler et al.	
	12	20050207569	A1	2005-09-22	Zhang et al.	
	13	20080022343	A1	2008-01-24	Hodzic et al.	
	14	20080086570	A1	2008-04-10	Dey et al.	

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	1	2002045372	WO	A1	2002-06-06	BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY		
	2	2003009581	WO	A1	2003-01-30	BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY		

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	3	2003041413	WO	A1	2003-05-15	PA CONSULTING SERVICES LIMITED		
	4	2003042856	WO	A1	2003-05-22	AEROCAST.COM, INC.		
	5	2004021668	WO	A1	2004-03-11	KONINKLIJKE PHILIPS ELECTRONICS N.V.		
	6	2004057832	WO	A1	2004-07-08	KONINKLIJKE PHILIPS ELECTRONICS N.V.		
	7	2006086717	WO	A1	2006-08-17	VIDIATOR ENTERPRISES INC.		
	8	2004295569	JP	A	2004-10-21	SONY CORP		
	9	139497	EP	A2	2004-03-03	MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.		

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	1	RealPlayer Plus™ G2 Manual", RealNetworks Inc., Seattle, WA (1998-1999), pp. 1-77	
	2	Kontothanassis, L. et al., "A Transport Layer for Live Streaming in a Content Delivery Network," Proceedings of the IEEE, 2004. pp.1408 - 1419. (Retrieved August 18, 2021 from https://www.akamai.com/it/it/multimedia/documents/technical-publication/a-transport-layer-forlive-streaming-in-a-content-delivery-network-technical-publication.pdf).	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	3	Dawson, F. "Improving Quality May Help to Boost Streaming Media," Multichannel News, December 19, 1999. pp. 1-17 (retrieved August 18, 2021 from https://www.nexttv.com/news/improving-quality-may-help-boost-streaming-media-143325).
	4	"InterVu Granted Key Internet Patent," Bloomberg Business, December 16, 1999 pp. 1-3 (retrieved August 18, 2021 from https://www.bloomberg.com/press-releases/1999-12-16/intervu-granted-key-internet-patent).
	5	"InterVu Streams Ahead Behind the Scenes", Paul Festa, cnet, January 2, 2002 (retrieved August 18, 2021 from https://www.cnet.com/news/intervu-streams-ahead-behind-the-scenes/).
	6	"Microsoft Announces Beta Release of Windows Media Technologies 4.0," April 13, 1999, pp. 1-5 (retrieved August 18, 2021 from https://news.microsoft.com/1999/04/13/microsoft-announcesbeta-release-of-windows-media-technologies-4-0/).
	7	"Sandpiper Adds RealSystem G2 to its Content Delivery Network," CBR Staff, August 4, 1999, pp. 1-4 (retrieved August 18, 2021 from https://techmonitor.ai/techonology/sandpiper_adds_realsystem_g2_to_its_content_delivery_nnetwork.
	8	"Speedera Posts Another Record Fiscal Year, Revenue Jumps 60 Percent," BusinessWire Digital Commerce 360, July 14, 2004, pp. 1-5 (retrieved August 18, 2021 from https://www.digitalcommerce360.com/2004/07/14/speedera-posts-another-record-fiscal-yearrevenue-jumps-60-perc/)
	9	"Developer Documentation QuickTime 6", Apple Computer Inc., Cupertino, CA (2002), pp. 1-240.
	10	"IBM Digital Library Version 2 Expands Its Comprehensive Solution Framework", Software Announcement, August 12, 1997, pp. 1-26 (retrieved August 18, 2021 from https://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_ca/2/897/ENUS297-312/index.html&request_locale=en).
	11	"Fresh Approach: Axient founder finds another way to make networking pay off", Y. Tara Teichgraeber, Phoenix Business Journal, January 13, 2002, pp. 1-6 (retrieved August 18, 2021 from https://www.bizjournals.com/phoenix/stories/2002/01/14/story6.html).
	12	Mac OS X Server QuickTime Streaming Server 5.0 Administration, Apple Computer Inc., Cupertino, CA (2003), pp. 1-65. no date
	13	RESPONDENTS LULULEMON ATHLETICA INC. AND CURIOUSER PRODUCTS INC. RESPONSE TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265. no date

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	14	RESPONDENT PELOTON INTERACTIVE, INC.'S RESPONSE TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265. no date
	15	VERIFIED RESPONSE OF ICON HEALTH & FITNESS, INC., FREE MOTION FITNESS, INC., AND NORDICTRACK, INC. TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265. no date

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	09/10/2021

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2021-08-19
Name/Print	Brett A. Carlson	Registration Number	39928

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Patents streamlets multiple bitrates same duration

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Http adaptive streaming server with automatic rate shaping



WO EP US CN BR CA · EP2748721281 · Kevin Mchugh · Ericsson AB

Priority 2011-10-07 · Filed 2012-09-03 · Granted 2017-03-29 · Published 2017-03-29

An adaptive streaming server (206) for transmitting a content stream through a network to a client, the adaptive streaming server comprising: a server (212) comprising an input interface (216) configured to receive a request from the client to play the content stream; a segmenting unit (210) ...

Http adaptive streaming in practice

Google Scholar · www.sigmm.org · Watson M · Proceedings of the ACM Multimedia Systems Conference (MMSys)--Keynote, San Jose, CA, USA, Febrary

Published 2011

... Millions of hours of content every day -- **Bitrates** up to 4.8Mbit/s -- Almost no dedicated infrastructure • Control servers in AWS ... Small media chunks (**"streamlets"**) Chunks created at ... Tractable representations of future choices -- Including scalability, **multiple** streams ...

Systems and methods for controlling the encoding of a segmented media stream ...



WO EP US BR CA MX · US10588766482 · Conrad Savio Jude Gomes · Sling Media Pvt Ltd

Priority 2011-08-29 · Filed 2017-01-27 · Granted 2020-03-10 · Published 2020-03-10

Systems and methods are described for providing a media stream transmitted from an encoding system to a remotely-located media player that requests segments of the media stream. The media stream is encoded into segments according to an encoding parameter. Data is gathered about current conditions ...

Audio splitting at codec applicable frame size

WO EP US CN JP KR AU BR CA IL MX SG · JP5728736B2 · ライアンオーウェン、カルバン・エコスター テクノロジーズエル、エル、シー、Ｅｃｈｏｓｔａｒ Ｔｅｃｈｎｏｌｏｇｉｅｓ Ｌ．Ｌ．Ｃ．

Priority 2009-12-21 · Filed 2010-12-21 · Granted 2015-06-03 · Published 2015-06-03

Receiving media content including audio and video by a computing system; Encoding the video into a plurality of video frames by the computing system according to a predetermined video encoding frame rate; Encoding the speech by the computing system into a plurality of uninterrupted speech frames ...

Playback stall avoidance in adaptive media streaming

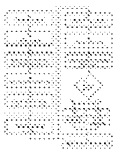
WO EP US CA · CA2888218C · Mark B. Huret · Echostar Technologies Llc

Priority 2013-03-15 · Filed 2014-03-13 · Granted 2018-10-02 · Published 2018-10-02

Methods, systems and devices are described to avoid stalling during playback of an adaptive media stream delivered to a media player device over a network. The media device requests segments of the media stream that are received in a buffer. Buffer utilization is monitored over time to determine a ...

Determining a time budget for transcoding of video

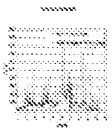
US · US10531134482 · Thomas George · Akamai Technologies, Inc.



Priority 2017-11-10 • Filed 2017-11-10 • Granted 2020-01-07 • Published 2020-01-07

This document describes systems, methods, and apparatus for determining a time budget for transcoding a video. By calculating and/or monitoring the time budget in accordance with the teachings hereof, a transcoder can assess the effect its transcode duration will have on a client buffer. As a ...

Content delivery



WO EP US • US20130185399A1 • Stephen Clifford Appleby • British Telecommunications Public Limited Company

Priority 2010-09-30 • Filed 2011-09-30 • Published 2013-07-18

A method for providing equitable media streaming between an HTTP server and a number of receivers via shared network. The streaming data is processed to split the data across a number of sub-streams. Each sub-stream contains non-contiguous data. A receiver requesting the streaming media ...

Frame-rate conversion in a distributed computing system



US • US9609049B2 • Kourosh Soroushian • Akamai Technologies, Inc.

Priority 2013-12-30 • Filed 2016-09-30 • Granted 2017-03-28 • Published 2017-03-28

Described herein are, among other things, distributed processing methods and systems for frame rate conversion. In an embodiment, a transcoding management machine manages a distributed transcoding process, creating a plurality of video segments and assigning the video segments across a set of ...

Apparatus, system, and method for multi-bitrate content streaming



US • US9071668B2 • David F. Brueck • Echostar Technologies L.L.C.

Priority 2004-04-30 • Filed 2013-12-13 • Granted 2015-06-30 • Published 2015-06-30

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system ...

Adaptive multicast delivery of media streams



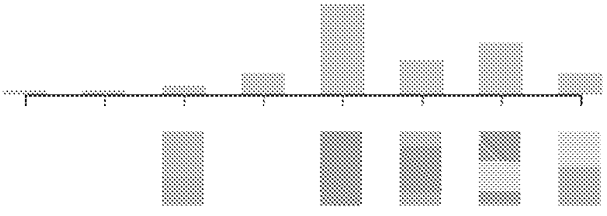
WO US • US9716918B2 • Robert Drew Major • Echostar Technologies L.L.C.

Priority 2012-12-28 • Filed 2013-12-30 • Granted 2017-07-25 • Published 2017-07-25

Various systems, methods and devices adaptively manage the multicast delivery of multiple media programs. Each of the media programs is encoded into multiple media streams, each stream having a different bitrate, frame rate, resolution or other encoding parameter. A computer receives feedback ...

Next › » About 335 results

Top 1000 results by filing date



Relative count of top 5 values

Assignees	Inventors	CPCs
DISH Technologies L.L.C.		14.2%
Echostar Technologies L.L.C.		12.5%
Sling Media Pvt Ltd		8.9%
Akamai Technologies, Inc.		5.3%
Echostar Technologies Llc		3.5%

Expand

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ Examiner's Signature | Initials

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	066.0141X1C9
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK, SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST, CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

LKGLOBAL (Dish Technologies L.L.C.)

7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253
UNITED STATES

FILING FEE RECEIVED

$7,320

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4	streamlet near3 bit$2rates with duration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/09/10 09:45
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		"20061068295" | "20070024705" | "20070030833" | "20070067480" | "20070079325" | "20070094405" | "20070204310" | "20070280255" | "20080028428" | "20080037527" | "20080046939" | "20080056373" | "20080104647" | "20080120330" | "20080120342" | "20080133766" | "20080162713" | "20080184688" | "20080195744" | "20080205291" | "20080219151" | "20080222235" | "20080263180" | "20080281803" | "20090043906" | "20090055471" | "20090055547" | "20090210549" | "20100098103" | "20100262711" | "20110307545" | "20150058496" | "4535355" | "5168356" | "5267334" | "5404446" | "5687095" | "5732183" | "57685627" | "5841432" | "5953506" | "6091775" | "6091777" | "6122660" | "6172672" | "6185736" | "6195680" | "6366614" | "6374289" | "6389473" | "6449719" | "6486803" | "6490627" | "6510553" | "6574591" | "6604118" | "6618752" | "6708213" | "6721723" | "6731600" | "6757796" | "6760772" | "6795863" | "6845107" | "6850965" | "6859839" | "6874015" | "6968387" | "6976090" | "7054365" | "7054774" | "7054911" | "7075986" | "7093001" | "7096271" | "7099954" | "7116894" | "7174385" | "7194549" | "7240100" | "7260640" | "7274740" | "7295520" | "7310678" | "7325073" | "7328243" | "7330908" | "7334044" | "7349358" | "7349976" | "7369610" | "7376747" | "7391717" | "7408984" | "7412531" | "7477688" | "7523181" | "7536469" | "7546355" | "7558869" | "7577750" | "7593333" | "7599307" | "7609652" | "7653735" | "7707303" | "7719985" | "7760801" | "7779135" | "7788395" | "7797439" | "7817985" | "7818444" | "7925781" | "8036265" | "8370514" | "8402156" | "8521836" | "8612624" | "8683066" | "8686066" | "8868772" | "8880721" | "9344496" | "9462074").PN.				
S29	0	(S25 S26 S27 S28) and streamlet with "same" near2 duration	US-PGPUB; USPAT	OR	ON	2021/02/01 17:05

S30	7	(S25 S26 S27 S28) and streamlet with duration	US-PGPUB; USPAT	OR	ON	2021/02/01 17:06
S31	46	(("8521836") or ("7558869") or ("7707303") or ("7925781") or ("8880721") or ("9344496") or ("8683066") or ("8686066") or ("6708213") or ("6757796") or ("9462074") or ("20050033855") or ("20030093790") or ("20030195977") or ("20040199655") or ("20040267956") or ("20040220926") or ("20060010003") or ("20060277564") or ("20150058496") or ("20100262711") or ("20050251832") or ("20040221088") or ("20040179032") or ("20020161908") or ("20030021282") or ("20080120330") or ("20080120342") or ("20110307545") or ("20050262257") or ("20030236904")).PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	OFF	2021/02/01 17:13
S32	0	(S27 S28 S31) and streamlet with multiple near2 bitrates with duration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/02/01 17:14
S33	0	streamlet with multiple near2 bitrates with duration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/02/01 17:14
S34	27	streamlet with multiple near2 bitrates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/02/01 17:15
S35	27	streamlet with multiple near2 bitrates and duration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/02/01 17:15

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp

L9	84	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple)	US-PGPUB; USPAT	OR	ON	2021/09/10 11:31
L10	42	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate) (multiple near2 bit$2rate))	US-PGPUB; USPAT	OR	ON	2021/09/10 11:32
L11	69	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration	US-PGPUB; USPAT	OR	ON	2021/09/10 12:08
L12	22	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 duration with bit$2rate	US-PGPUB; USPAT	OR	ON	2021/09/10 12:08
L13	0	file with portion near2 stream near3 duration with bit$2rate	US-PGPUB; USPAT	OR	ON	2021/09/10 12:14
L14	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and ((multi near bit$2rate)multiple) and @rlad<"20040205"	US-PGPUB; USPAT	OR	ON	2021/09/10 12:15

9/10/2021 12:42:02 PM
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Patents | streamlets multiple bitrates same duration

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Http adaptive streaming server with automatic rate shaping



WO EP US CN BR CA · EP2748721281 · Kevin Mchugh · Ericsson AB

Priority 2011-10-07 · Filed 2012-09-03 · Granted 2017-03-29 · Published 2017-03-29

An adaptive streaming server (206) for transmitting a content stream through a network to a client, the adaptive streaming server comprising: a server (212) comprising an input interface (216) configured to receive a request from the client to play the content stream; a segmenting unit (210) …

Http adaptive streaming in practice

Google Scholar · www.sigmm.org · Watson M · Proceedings of the ACM Multimedia Systems Conference (MMSys)--Keynote, San Jose, CA, USA, Febrary

Published 2011

… Millions of hours of content every day -- **Bitrates** up to 4.8Mbit/s -- Almost no dedicated infrastructure • Control servers in AWS … Small media chunks (**"streamlets"**) Chunks created at … Tractable representations of future choices -- Including scalability, **multiple** streams …

Systems and methods for controlling the encoding of a segmented media stream …



WO EP US BR CA MX · US10588766482 · Conrad Savio Jude Gomes · Sling Media Pvt Ltd

Priority 2011-08-29 · Filed 2017-01-27 · Granted 2020-03-10 · Published 2020-03-10

Systems and methods are described for providing a media stream transmitted from an encoding system to a remotely-located media player that requests segments of the media stream. The media stream is encoded into segments according to an encoding parameter. Data is gathered about current conditions …

Audio splitting at codec applicable frame size

WO EP US CN JP KR AU BR CA IL MX SG · JP5772873682 · ライアンオーウェン、カルバン・エコスター テクノロジーズエル、エル、シー、Ｅｃｈｏｓｔａｒ Ｔｅｃｈｎｏｌｏｇｉｅｓ Ｌ．Ｌ．Ｃ．

Priority 2009-12-21 · Filed 2010-12-21 · Granted 2015-06-03 · Published 2015-06-03

Receiving media content including audio and video by a computing system; Encoding the video into a plurality of video frames by the computing system according to a predetermined video encoding frame rate; Encoding the speech by the computing system into a plurality of uninterrupted speech frames …

Playback stall avoidance in adaptive media streaming

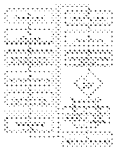
WO EP US CA · CA2888218C · Mark B. Huret · Echostar Technologies Llc

Priority 2013-03-15 · Filed 2014-03-13 · Granted 2018-10-02 · Published 2018-10-02

Methods, systems and devices are described to avoid stalling during playback of an adaptive media stream delivered to a media player device over a network. The media device requests segments of the media stream that are received in a buffer. Buffer utilization is monitored over time to determine a …

Determining a time budget for transcoding of video

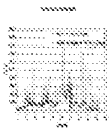
US · US10531134482 · Thomas George · Akamai Technologies, Inc.



Priority 2017-11-10 • Filed 2017-11-10 • Granted 2020-01-07 • Published 2020-01-07

This document describes systems, methods, and apparatus for determining a time budget for transcoding a video. By calculating and/or monitoring the time budget in accordance with the teachings hereof, a transcoder can assess the effect its transcode duration will have on a client buffer. As a ...

Content delivery



WO EP US • US20130185399A1 • Stephen Clifford Appleby • British Telecommunications Public Limited Company

Priority 2010-09-30 • Filed 2011-09-30 • Published 2013-07-18

A method for providing equitable media streaming between an HTTP server and a number of receivers via shared network. The streaming data is processed to split the data across a number of sub-streams. Each sub-stream contains non-contiguous data. A receiver requesting the streaming media ...

Frame-rate conversion in a distributed computing system



US • US9609049B2 • Kourosh Soroushian • Akamai Technologies, Inc.

Priority 2013-12-30 • Filed 2016-09-30 • Granted 2017-03-28 • Published 2017-03-28

Described herein are, among other things, distributed processing methods and systems for frame rate conversion. In an embodiment, a transcoding management machine manages a distributed transcoding process, creating a plurality of video segments and assigning the video segments across a set of ...

Apparatus, system, and method for multi-bitrate content streaming



US • US9071668B2 • David F. Brueck • Echostar Technologies L.L.C.

Priority 2004-04-30 • Filed 2013-12-13 • Granted 2015-06-30 • Published 2015-06-30

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system ...

Adaptive multicast delivery of media streams



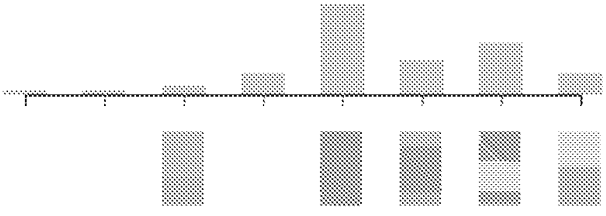
WO US • US9716918B2 • Robert Drew Major • Echostar Technologies L.L.C.

Priority 2012-12-28 • Filed 2013-12-30 • Granted 2017-07-25 • Published 2017-07-25

Various systems, methods and devices adaptively manage the multicast delivery of multiple media programs. Each of the media programs is encoded into multiple media streams, each stream having a different bitrate, frame rate, resolution or other encoding parameter. A computer receives feedback ...

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Top 1000 results by filing date



Relative count of top 5 values

Assignees	Inventors	CPCs
DISH Technologies L.L.C.		14.2%
Echostar Technologies L.L.C.		12.5%
Sling Media Pvt Ltd		8.9%
Akamai Technologies, Inc.		5.3%
Echostar Technologies Llc		3.5%

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PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	DAVID F. BRUECK
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5424455		1995-06-13	Yamamoto et al.	
	2	5544318		1996-08-06	Schmitz et al.	
	3	5867230		1999-02-02	Wang et al.	
	4	5933603		1999-08-03	Vahalia et al.	
	5	5941951		1999-08-24	Day et al.	
	6	5966015		1999-10-12	Horii	
	7	5966025		1999-10-12	Beffa	
	8	6003030		1999-12-14	Kenner et al.	

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	9	6112239		2000-08-29	Kenner et al.	
	10	6154744		2000-11-28	Kenner et al.	
	11	6181867	B1	2001-01-30	Kenner et al.	
	12	6292383	B1	2001-09-18	Worley	
	13	6498897	B1	2002-12-24	Nelson et al.	
	14	6625643	B1	2003-09-23	Colby et al.	
	15	6637031	B1	2003-10-21	Chou	
	16	6665726	B1	2003-12-16	Leighton et al.	
	17	6766407	B1	2004-07-20	Lisitsa et al.	
	18	6795863	B1	2004-09-21	Doty, Jr.	
	19	7047307	B2	2006-05-16	Li	

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	20	7386627	B1	2008-06-10	Lango et al.	
	21	7974200	B2	2011-07-05	Walker et al.	

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	1	20030072376	A1	2003-04-17	Krishnamachari et al.	
	2	20030061305	A1	2003-03-27	Copley et al.	
	3	20020170062	A1	2002-11-14	Chen et al.	
	4	20020044528	A1	2002-04-18	Pogrebinsky et al.	
	5	20020002708	A1	2002-01-03	Arye	
	6	20030009578	A1	2003-01-09	Apostolopoulos et al.	
	7	20030236906	A1	2003-12-25	Klemets et al.	

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	8	20040136327	A1	2004-07-15	Sitaraman et al.	
	9	20040260827	A1	2004-12-23	Wang	
	10	20040202109	A1	2004-10-14	Akiyama et al.	
	11	20050177618	A1	2005-08-11	Zimler et al.	
	12	20050207569	A1	2005-09-22	Zhang et al.	
	13	20080022343	A1	2008-01-24	Hodzic et al.	
	14	20080086570	A1	2008-04-10	Dey et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2002045372	WO	A1	2002-06-06	BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY		
	2	2003009581	WO	A1	2003-01-30	BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY		

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	3	2003041413	WO	A1	2003-05-15	PA CONSULTING SERVICES LIMITED		
	4	2003042856	WO	A1	2003-05-22	AEROCAST.COM, INC.		
	5	2004021668	WO	A1	2004-03-11	KONINKLIJKE PHILIPS ELECTRONICS N.V.		
	6	2004057832	WO	A1	2004-07-08	KONINKLIJKE PHILIPS ELECTRONICS N.V.		
	7	2006086717	WO	A1	2006-08-17	VIDIATOR ENTERPRISES INC.		
	8	2004295569	JP	A	2004-10-21	SONY CORP		
	9	139497	EP	A2	2004-03-03	MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.		

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	RealPlayer Plus™ G2 Manual", RealNetworks Inc., Seattle, WA (1998-1999), pp. 1-77	
	2	Kontothanassis, L. et al., "A Transport Layer for Live Streaming in a Content Delivery Network," Proceedings of the IEEE, 2004. pp.1408 - 1419. (Retrieved August 18, 2021 from https://www.akamai.com/it/it/multimedia/documents/technical-publication/a-transport-layer-forlive-streaming-in-a-content-delivery-network-technical-publication.pdf).	

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	3	Dawson, F. "Improving Quality May Help to Boost Streaming Media," Multichannel News, December 19, 1999. pp. 1-17 (retrieved August 18, 2021 from https://www.nexttv.com/news/improving-quality-may-help-boost-streaming-media-143325).	
	4	"InterVu Granted Key Internet Patent," Bloomberg Business, December 16, 1999 pp. 1-3 (retrieved August 18, 2021 from https://www.bloomberg.com/press-releases/1999-12-16/intervu-granted-key-internet-patent).	
	5	"InterVu Streams Ahead Behind the Scenes", Paul Festa, cnet, January 2, 2002 (retrieved August 18, 2021 from https://www.cnet.com/news/intervu-streams-ahead-behind-the-scenes/).	
	6	"Microsoft Announces Beta Release of Windows Media Technologies 4.0," April 13, 1999, pp. 1-5 (retrieved August 18, 2021 from https://news.microsoft.com/1999/04/13/microsoft-announcesbeta-release-of-windows-media-technologies-4-0/).	
	7	"Sandpiper Adds RealSystem G2 to its Content Delivery Network," CBR Staff, August 4, 1999, pp. 1-4 (retrieved August 18, 2021 from https://techmonitor.ai/techonology/sandpiper_adds_realsystem_g2_to_its_content_delivery_nnetwork.	
	8	"Speedera Posts Another Record Fiscal Year, Revenue Jumps 60 Percent," BusinessWire Digital Commerce 360, July 14, 2004, pp. 1-5 (retrieved August 18, 2021 from https://www.digitalcommerce360.com/2004/07/14/speedera-posts-another-record-fiscal-yearrevenue-jumps-60-perc/)	
	9	"Developer Documentation QuickTime 6", Apple Computer Inc., Cupertino, CA (2002), pp. 1-240.	
	10	"IBM Digital Library Version 2 Expands Its Comprehensive Solution Framework", Software Announcement, August 12, 1997, pp. 1-26 (retrieved August 18, 2021 from https://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_ca/2/897/ENUS297-312/index.html&request_locale=en).	
	11	"Fresh Approach: Axient founder finds another way to make networking pay off", Y. Tara Teichgraeber, Phoenix Business Journal, January 13, 2002, pp. 1-6 (retrieved August 18, 2021 from https://www.bizjournals.com/phoenix/stories/2002/01/14/story6.html).	
	12	Mac OS X Server QuickTime Streaming Server 5.0 Administration, Apple Computer Inc., Cupertino, CA (2003), pp. 1-65.	
	13	RESPONDENTS LULULEMON ATHLETICA INC. AND CURIOUSER PRODUCTS INC. RESPONSE TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265.	

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	14	RESPONDENT PELOTON INTERACTIVE, INC.'S RESPONSE TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265.	
	15	VERIFIED RESPONSE OF ICON HEALTH & FITNESS, INC., FREE MOTION FITNESS, INC., AND NORDICTRACK, INC. TO COMPLAINT US Int'l Trade Commission Investigation. No. 337-TA-1265.	

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(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Kadoma-shi, Osaka 571-8501 (JP)

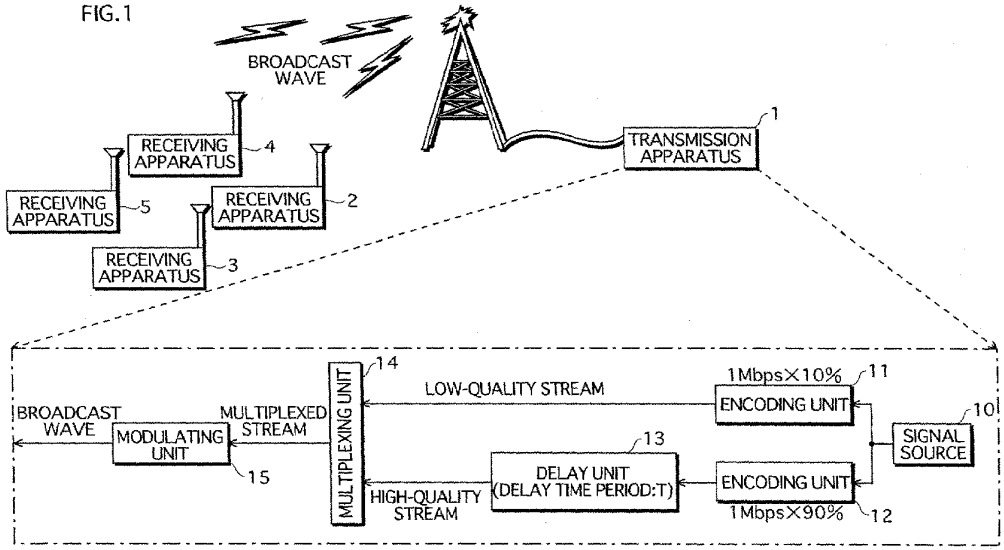
(72) Inventor: **Kitamura, Tomohiko**
Hirakata-shi Osaka 573-0034 (JP)

(74) Representative: **Crawford, Andrew Birkby**
A.A. Thornton & Co.
235 High Holborn
London WC1V 7LE (GB)

(54) Broadcast system having a transmitter and a receiver for low quality and high quality streams based on the same content, the receiver and program

(57) A broadcast system has digital receiving apparatuses that imitate deteriorated reproduction that is observed in analog receiving apparatuses when a transmission path failure occurs, thus preventing the audiences, who are accustomed to the analog broadcasting, from sensing discomfort at the digital broadcasting. A transmission apparatus causes encoding units 11 and 12 to generate low- and high-quality streams based on the same contents, and transmits these streams onto a transmission path while delaying the high-quality stream. In the receiving apparatuses, a reproduction unit 25 reproduces the high-quality stream in a normal state, while packets of the low-quality stream received during a time period T until the current time are accumulated in an accumulation unit 22. If a transmission path failure occurs, a reproduction control unit 26 causes the reproduction unit 25 to reproduce, instead of the high-quality stream, the accumulated packets of the low-quality stream.

FIG.1



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Description

BACKGROUND OF THE INVENTION

(1) Field of the Invention

[0001] The present invention relates to a broadcast system having a transmission apparatus and receiving apparatuses, specifically to improvements in digital broadcast services.

(2) Description of the Related Art

[0002] In recent years, the infrastructure for the shift from analog broadcasting to digital broadcasting has been improved steadily. In this improvement of the infrastructure, it is important to fully recognize the differences between the analog broadcasting and the digital broadcasting. One of such differences is observed when a transmission path failure occurs.

[0003] In the analog broadcasting, when a transmission path failure occurs, the failure is recognized by the audiences as deteriorated reproduction quality. Experiencing more than 50 years of operation of analog broadcasting, the audiences are familiar with such deteriorated reproduction quality that is caused by a thunderstorm or the like.

[0004] On the other hand, in digital broadcasting, a transmission path failure causes receiving apparatuses to detect a bit error. When they detect a bit error in a received broadcast wave, the receiving apparatuses correct the bit error using Reed-Solomon parity codes or the like before supplying reproduction output. With these operations, the audiences are supplied with reproduction outputs not deteriorated by the bit error. However, the receiving apparatuses stop supplying the reproduction outputs if a thunderstorm or the like causes a large amount of bit error that cannot be corrected by a bit error correction. It should be noted here that in the present document, a "digital broadcast failure" indicates a large failure that cannot be overcome by a bit error correction.

[0005] Meanwhile, the common knowledge: "when a transmission path failure occurs, the failure is recognized by the audiences as deteriorated reproduction quality" may become an unexpected obstacle in digital broadcasting. That is to say, for example, if a sudden thunderstorm occurs while a user is supplied with a reproduction output, the user will probably expect deterioration in the reproduction quality due to the above-mentioned common knowledge that has taken root. However, if supply of reproduction output from a receiving apparatus suddenly stops against this expectation due to a transmission path failure, the user may mistake the transmission path failure for a receiving apparatus failure. In such circumstances, there is a possibility that a flood of complaints about a receiving apparatus failure are sent to the maker of the receiving apparatus each time a thunderstorm or the like causes a lot of transmission path failures. In such a case, the maker will be tied up with dealing with the complaints.

SUMMARY OF THE INVENTION

[0006] The object of the present invention is therefore to provide a broadcast system having digital receiving apparatuses that imitate deterioration of reproduction output that is observed in the analog receiving apparatuses when a transmission path failure occurs, thus preventing the audiences from mistaking a transmission path failure for a receiving apparatus failure.

[0007] The above object is fulfilled by a broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including: a generating unit operable to generate a first digital stream and a second digital stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first digital stream is lower than An encoding bit rate for the second digital stream; and a transmission unit operable to transmit the first and second digital streams onto a transmission path while delaying the second digital stream relative to the first digital stream, the receiving apparatus including: a reproduction unit operable to reproduce the second digital stream in a normal state; and a reproduction control unit operable to, if a transmission path failure occurs, cause the reproduction unit to reproduce, instead of the second digital stream, a portion of the first digital stream that has been received before the occurrence of the transmission path failure.

[0008] With the above-stated construction, the transmission apparatus transmits the low-quality stream preceding the high-quality stream. The receiving apparatus reproduces the high-quality stream in a normal state, but if a transmission path failure occurs, reproduces a portion of the low-quality stream that has been received prior to and has the same contents as a portion of the high-quality stream that should have been reproduced if the transmission path failure had not occurred. With this arrangement, the audience would fail to recognize that the reproduction has been suspended.

[0009] Also, by reproducing the low-quality stream in place of the high-quality stream during the reception-interruptedperiod, the receiving apparatus imitates deteriorated reproduction that has been observed long in analog receiving apparatuses when a transmission path failure occurs, thus preventing the audiences, who are accustomed to the analog broadcasting, from sensing discomfort at the digital broadcasting.

[0010] In the above broadcast system, the receiving apparatus may superpose a signal resembling a noise on the one or more packets accumulated in the accumulating unit when the one or more packets are reproduced due to occurrence of a transmission path failure.

[0011] With the above-stated construction, the digital receiving apparatus can reproduce a digital stream with

Webgroup CZ a.s. Ex. 1002, Page 499 of 1406

which a white noise is mixed in imitation of a degraded reproduction of analog receiving apparatuses. This realistic imitation prevents the audiences, who are accustomed to the analog broadcasting, from sensing discomfort at the digital broadcasting.

[0012] In the above broadcast system, the receiving apparatus may be provided with a pilot lamp that emits light in a manner in which a normal state is distinguished from an abnormal state, wherein in the normal state, the second digital stream is reproduced, and in the abnormal state, the first digital stream is reproduced.

[0013] With the above-stated construction, the digital receiving apparatus can reproduce a digital stream with blinking of the pilot lamp, which is familiar to the audiences of analog receiving apparatuses. This realistic imitation prevents the audiences, who are accustomed to the analog broadcasting, from sensing discomfort at the digital broadcasting.

[0014] In the above broadcast system, the receiving apparatus may further include: an operation receiving unit operable to receive input of an operation by a user to request real time reproduction; and a switch unit operable to switch from reproduction of the second digital stream to reproduction of the first digital stream if the operation receiving unit receives the input of the operation by the user.

[0015] The above-stated construction provides a practical advantage. For example, suppose a user is watching a real sports game while listening to the live broadcasting of the sports game with a portable-type receiving apparatus. The user can select either the high-quality stream which is provided with delay or the low-quality stream which is provided without delay. This function facilitates the user since he/she can select the reproduction of the low-quality stream and enjoy watching the game without being confused by the time lag between the real game and the broadcast of the game.

[0016] In the above broadcast system, the generating unit of the transmission apparatus may include two encoders that respectively generate the first digital stream and the second digital stream by performing a variable-length encoding onto an analog signal.

[0017] With the above-stated construction in which the generating unit performs a variable-length encoding onto an analog signal, as much amount of bit rate as omitted from the audio frames that contain less amounts of audible component can be appropriated to the audio frames that contain more amounts of audible component. This enables the quality of the audio reproduction to be improved in total.

[0018] The above objects are also fulfilled by a broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including: a generating unit operable to generate a first digital stream, a second digital stream, and a third digital stream by encoding a same signal respectively at different encoding bit rates, where an encoding bit rate for the first digital stream is the lowest among the encoding bits rates, an encoding bit rate for the second digital stream is the middle between encoding bit rates for the first and third digital streams, and an encoding bit rate for the third digital stream is the highest among the encoding bits rates; and a transmission unit operable to transmit the first, second, and third digital streams onto a transmission path while delaying the second digital stream by time period T1 and delaying the third digital stream by time period T2, wherein T2 > T1, the receiving apparatus including: an accumulating unit operable to accumulate part of the first and second digital streams received from the transmission apparatus; a reproduction unit operable to reproduce the third digital stream in a normal state; and a reproduction control unit operable to cause the reproduction unit to reproduce, instead of the third digital stream, the part of the second digital stream accumulated in the accumulating unit if a transmission path failure continues for the time period T2 or more, and to reproduce the part of the first digital stream accumulated in the accumulating unit following the reproduction of the part of the second digital stream accumulated in the accumulating unit.

[0019] With the above-stated construction, in the normal reception period, data is reproduced with a quality level that is proportionate to 85 % of the bit rate, and in the reception-interrupted period, first, data is reproduced with a quality level that is proportionate to 10 %, and then with a quality level that is proportionate to 5 % of the bit rate. This would give an impression to the audiences that the reproduction quality is gradually deteriorated, making them feel as if they were listening to an analog receiver.

[0020] The above objects are also fulfilled by a broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including: a first generating unit operable to generate a first audio stream and a second audio stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first audio stream is lower than an encoding bit rate for the second audio stream; a second generating unit operable to generate a first video stream and a second video stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first video stream is lower than an encoding bit rate for the second video stream; and a transmission unit operable to transmit the first and second audio streams and the first and second video streams onto a transmission path while delaying the second video stream by a time period T1 and delaying the second audio stream by a time period T2, wherein T2 > T1, the receiving apparatus including: a first accumulating unit operable to accumulate part of the first video stream received during the time period T1 until a current time; a second accumulating unit operable to accumulate part of the first audio stream received during the time period T2 until the current time; a reproduction unit operable to reproduce the second video stream and the second audio stream in a normal state; and a reproduction control

Webgroup CZ a.s. Ex. 1002, Page 500 of 1406

unit operable to cause the reproduction unit to reproduce (i) the part of the first video stream accumulated in the first accumulating unit and (ii) the part of the first audio stream accumulated in the second accumulating unit for the time period T1 if a transmission path failure continues for the time period T2 or more, and to reproduce, after the time period T1, the part of the first audio stream accumulated in the second accumulating unit.

[0021] With the above-stated construction, the "high-quality audio + high-quality video" output that is supplied during the normal reception period changes to the "low-quality audio + low-quality video" output if a failure occurs to the transmission path. Furthermore, if the time reception interruption continues for a certain time period, the reproduction changes from "audio + video" to "only audio". That is to say, the reproduced data changes step by step from the high-quality audio and video in the normal reception period to the low-quality audio and video, and to the only audio without video. In this way, the digital receiving apparatuses imitate the gradual deterioration of reproduction output that is observed in the analog receiving apparatuses when a transmission path failure occurs, giving an impression to the audiences that the reproduction quality is gradually degraded in the same manner as when they are listening to analog receivers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and the other objects, advantages and features of the inventionwillbecomeapparent from the followingdescription thereof taken in conjunction with the accompanying drawings which illustrate a specific embodiment of the invention. In the drawings:

Fig. 1 shows the construction of a broadcast system in Embodiment 1 of the present invention;
Fig. 2 shows encoding procedures performed by the encoding units 11 and 12;
Fig. 3 shows the structure of the digital stream generated by the encoding unit 11;
Fig. 4 shows how the high-quality stream is delayed by the delay unit 13 with reference to the low-quality stream;
Fig. 5 shows the construction of the receiving apparatuses;
Fig. 6 shows the portion of the low-quality stream that is accumulated in the accumulating unit 22;
Figs. 7A to 7D shows how packets are written (accumulated) into the accumulating unit 22;
Fig. 8 shows reproduction control performed by the reproduction control unit 26;
Fig. 9 is a flowchart showing the reproduction control procedures of the reproduction control unit 26;
Fig. 10 shows the construction of the receiving apparatuses in Embodiment 2;
Fig. 11 shows the construction of the receiving apparatuses in Embodiment 3;
Fig. 12 shows the construction of a transmission apparatus in Embodiment 4;
Fig. 13 shows the construction of the receiving apparatuses;
Fig. 14 shows the construction of the broadcast system in Embodiment 5;
Fig. 15 shows the construction of the receiving apparatuses in Embodiment 5; and
Fig. 16 shows the construction of a transmission apparatus in a broadcast system in Embodiment 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] The following describes a broadcast system according to preferred embodiments of the present invention.

Embodiment 1

[0024] Fig. 1 shows the construction of a broadcast system in Embodiment 1 of the present invention. In Fig. 1, the broadcast system includes a digital transmission apparatus 1 and digital receiving apparatuses 2-5, and provides a digital broadcast service. It should be noted here that the present embodiment deals with a terrestrial digital radio broadcasting.

[0025] The transmission apparatus 1 transmits a digital stream using a band for digital broadcasting. The band for digital broadcasting can be identified by a time slot in a radio frequency band. It is supposed here that a bit rate of 1 Mbps is assigned to the band.

[0026] The receiving apparatuses 2-5 are digital receiving apparatuses that have been developed to replace existent analog radio receiving apparatuses. There are portable and stationary types of digital receiving apparatuses, and both types receive the digital streams from the transmission apparatus and reproduce them.

[0027] Now, the construction of the transmission apparatus for use in the broadcast system outlined above will be described with reference to Fig. 1. As shown in Fig. 1, the transmission apparatus 1 includes a signal source 10, an encoding unit 11, an encoding unit 12, a delay unit 13, a multiplexing unit 14, and a modulating unit 15.

[0028] The signal source 10 receives audio signals from a sound recording apparatus in a broadcast station and/or a reproduction apparatus for reproducing analog audio signals recorded on tape, and outputs analog signals.

[0029] The encoding unit 11 encodes the analog signals output from the signal source 10 into a first type of digital stream. Fig. 2 shows encoding procedures performed by the encoding units 11 and 12. The upper portion of Fig. 2 is a graph showing change with time in the analog signals output from the signal source 10.

[0030] First, the encoding unit 11 samples the amplitude of the analog signals output from the signal source

Webgroup CZ a.s. Ex. 1002, Page 501 of 1406

10, with a predetermined sampling frequency "cy". The amplitude obtained by the sampling is represented by the number of quantization bits "rx". This encoding process outputs audio frames. The audio frame is the smallest unit of digital audio data, and has a time period (for example, an order of 20 milliseconds) that corresponds to the inverse of the sampling frequency. By repeating this encoding process while analog signals are output from the signal source 10, a digital stream composed of a sequence of audio frames is obtained. Fig. 3 shows the structure of the digital stream generated by the encoding unit 11. The digital stream includes a header and at least one audio frame. The header includes a packet identifier for identifying a packet that is currently received among those included in a digital stream. The encoding unit 11 encodes the received analog signal by obtaining the number of quantization bits at 10 % of 1 Mbps of bit rate assigned to one band. A bit rate is assigned to each type of digital stream by taking the transmission on a transmission path into account. It should be noted here that 1 Mbps of bit rate is only an example, and the bit rate may be different from this.

[0031] The encoding unit 12 encodes the analog signals output from the signal source 10 into a second type of digital stream. In this encoding, the encoding unit 12 assigns 90 % of the bit rate for one band to the second type of digital stream. The second type of digital stream has higher quality than the first type of digital streams due to a great difference between the bit rates. The arrows "ib1" and "ib2" in Fig. 2 indicate the encoding processes performed by the encoding units 1 and 2, respectively. The indicators "ib1" and "ib2" indicate "density" of the first and second types of digital streams, which results from the bit rates assigned by the encoding units 1 and 2, respectively. As the indicators indicate, the encoding unit 12 encodes analog signals with a lot of quantization bits, thus providing a high quality. For this reason, the second type of digital stream obtained by the encoding unit 12 is referred to as a high-quality stream, and the first type of digital stream obtained by the encoding unit 11 is referred to as a low-quality stream.

[0032] The delay unit 13 delays the high-quality stream generated by the encoding unit 12, by a time period T. Fig. 4 shows how the high-quality stream is delayed relative to the low-quality stream by the delay unit 13. Both low-quality and high-quality streams are a sequence of packets to which identifiers P1, P2, ... are assigned. As indicated by Fig. 4, the first packet P1 of the high-quality stream is provided together with packet P6 of the low-quality stream after the delay unit 13 delays the high-quality stream by time period T.

[0033] The multiplexing unit 14 multiplexes the low-quality stream generated by the encoding unit 11 and the high-quality stream generated by the encoding unit 12 and delayed by the delay unit 13, into a multiplexed stream.

[0034] The modulating unit 15 modulates the multiplexed stream, and transmits a broadcast wave obtained as a result of the modulation onto a transmission path using one band for digital broadcasting.

[0035] Now, the receiving apparatuses will be described. Fig. 5 shows the construction of the receiving apparatuses. As shown in Fig. 5, each receiving apparatus includes a demodulating unit 20, a demultiplexing unit 21, an accumulating unit 22, a complement data storage unit 23, a selection/output unit 24, a reproduction unit 25, and a reproduction control unit 26.

[0036] The demodulating unit 20 demodulates a broadcast wave received via the transmission path, performs an error correction onto the demodulated broadcast wave to obtain a multiplexed stream, and outputs the obtained multiplexed stream to the demultiplexing unit 21.

[0037] The demultiplexing unit 21 performs an error correction onto the multiplexed stream output from the demodulating unit 20, and demultiplexes the multiplexed stream into a high-quality stream and a low-quality stream. The demultiplexing unit 21 performs the error correction by calculating a bit error rate in the multiplexed stream, and judges whether the bit error rate exceeds a predetermined standard value, and if the judgment is positive, notifying the reproduction control unit 26 of the fact. The standard value used in the judgment is an acceptable limit within which the bit error can be corrected through an error correction. The notification that the bit error rate has exceeded the predetermined standard value indicates that the bit error found in the multiplexed stream cannot be corrected, and that the demultiplexing unit 21 has stopped execution of the demultiplexing process. The reproduction control unit 26 monitors how long the demultiplexing unit 21 stops execution of the demultiplexing process, and recognizes the time period detected by the monitoring as a reception-interrupted period. Conversely, a time period during which the digital streams are received normally is referred to as a normal reception period.

[0038] The accumulating unit 22 is a buffer memory in which part of the low-quality stream obtained by the demultiplexing is accumulated. The accumulating unit 22 accumulates a portion of the low-quality stream that corresponds to a time period T in the past up to the current time. In the present embodiment, the time period T is equal to the delay time T.

[0039] Fig. 6 shows the portion of the low-quality stream that is accumulated in the accumulating unit 22 . It is supposed here that among the packets in the low-quality stream, packet P10 was received most recently, and packets P6 to P10 received during the time period T are accumulated in the accumulating unit 22. It should be noted here that each receiving apparatus keeps receiving a new packet, and packets received during the time period T until the current time are always accumulated in the accumulating unit 22.

[0040] Figs. 7A to 7D shows how packets are written (accumulated) into the accumulating unit 22. Fig. 7A indicates that packet P11 is received newly when packets

Webgroup CZ a.s. Ex. 1002, Page 502 of 1406

P6 to P10 have been accumulated in the accumulating unit 22. Fig. 7B indicates that the oldest packet P6 is deleted and the newly received packet P11 is written into the accumulating unit 22. This applies to the case where packet P12 is received. Fig. 7C, indicates that packet P12 is received newly when packets P7 to P11 have been accumulated in the accumulating unit 22. Fig. 7D indicates that the oldest packet P7 is deleted and the newly received packet P12 is written into the accumulating unit 22.

[0041] The above-described procedures are repeated and most recently received packets during the time period T are always accumulated in the accumulating unit 22. The capacity of the accumulating unit 22 is set to "time period T × 1 Mbps × 10 %". The accumulating unit 22 keeps on accumulating part of the low-quality stream as long as the low-quality stream is received normally. The accumulating unit 22 does not accumulate the low-quality stream when the low-quality stream is not received, namely in the reception-interrupted period.

[0042] It should be noted here that in the present embodiment, the time period T is equal to the delay time T for the sake of convenience, but in realty, the two time periods may differ from each other.

[0043] The complement data storage unit 23 stores complement data realized by supplementary audio data that is used to complement the stopped reproduction during the reception-interrupted period. The supplementary audio data is an announcement of the fact that the reproduction output has been stopped due to deteriorated condition of the transmission path.

[0044] The selection/output unit 24 selects one from: (a) a high-quality stream; (b) part of the low-quality stream accumulated in the accumulating unit 22; and (c) audio data stored in the complement data storage unit 23, and outputs the selected one to the reproduction unit 25. The selection and output is performed by the selection/output unit 24 in accordance with instructions sent from the reproduction control unit 26.

[0045] The reproduction unit 25 reproduces the digital stream selectively output from the selection/output unit 24. Since the digital stream dealt with in the present embodiment is audio data, the reproduction unit 25 supplies audio outputs. When the part of the low-quality stream accumulated in the accumulating unit 22 is reproduced by the reproduction unit 25, the quality of the reproduced audio is low since only 10 % of the bit rate is assigned to the low-quality stream.

[0046] The reproduction control unit 26 instructs the selection/output unit 24 to select and output the high-quality stream while the multiplexed stream is received normally. The reproduction control unit 26 instructs the selection/output unit 24 to select and output the part of the low-quality stream accumulated in the accumulating unit 22 when it is notified from the demultiplexing unit 21 of occurrence of.a reception interruption. That is to say, the part of the low-quality stream accumulated in the accumulating unit 22 is output during the reception-interrupted period.

[0047] Fig. 8 shows reproduction control performed by the reproduction control unit 26. During the reception-interrupted period shown in Fig. 8, packets P11 to P16 of the low-quality stream and packets P6 to P11 of the high-quality stream are expected to be received. It is supposed here that it is inevitable that some packets drop out from both the high-quality and low-quality streams due to the reception interruption.

[0048] On the other hand, the accumulating unit 22 has accumulated packets of the low-quality stream during the time period T immediately before the start of the reception-interrupted period. In this example shown in Fig. 8, the accumulating unit 22 has accumulated packets P6 to P10 of the low-quality stream during the period. This is because as explained earlier, the reception of the high-quality stream is delayed from the reception of the low-quality stream. With this arrangement, it is possible for the reproduction control unit 26 to instruct the selection/output unit to select and output the packets of the low-quality stream accumulated in the accumulating unit 22 so that packets P6 to P10 of the low-quality stream are reproduced instead of packets P6 to P10 of the high-quality stream during the reception-interrupted period.

[0049] As apparent from above, both packets P6 to P10 of the low-quality stream and P6 to P10 of the high-quality stream have been generated from the same source and have the same broadcast contents, but are different in that while 90 % of the bit rate for one band for digital broadcasting are assigned to the high-quality stream, 10 % of the same bit rate for the band are assigned to the low-quality stream. When reproduced by the reproduction unit 25, the quality of the low-quality stream is lower than that of the high-quality stream, though the broadcast contents are the same. This gives an impression to the audiences that the reproduction quality has been degraded.

[0050] Fig. 9 is a flowchart showing the reproduction control procedures of the reproduction control unit 26.

[0051] The process performed by the reproduction control unit 26 is broadly divided into the process for the normal reception period (steps S1-S2) and the process for the reception-interrupted period (steps S3-S7).

[0052] In the normal reception period, the reproduction control unit 26 instructs the selection/output unit 24 to select and output the high-quality stream unless it is notified from the demultiplexing unit 21 that the bit error rate exceeded the standard value (steps S1-S2).

[0053] If it is notified from the demultiplexing unit 21 that the bit error rate exceeded the standard value, the reproduction control unit 26 performs the process for the reception-interrupted period, starting with obtaining a packet identifier of a packet of the high-quality stream that has been demultiplexed most recently by the demultiplexing unit 21 (step S3). The reproduction control unit 26 then judges whether a packet having a packet identifier that follows the packet identifier obtained in step S3 has been accumulated in the accumulating unit

Webgroup CZ a.s. Ex. 1002, Page 503 of 1406

22 (step S4). If the judgment result is positive, the reproduction control unit 26 reads the packet from the accumulating unit 22 and instructs the selection/output unit 24 to output the read packet (step S5). The above steps S4-S6 are executed repeatedly during the reception-interrupted period, and the packets accumulated in the accumulating unit 22 are output and reproduced in succession. If the reception-interrupted period is longer than a time required to reproduce the packets accumulated in the accumulating unit 22, it may happen that there is no packet accumulated in the accumulating unit 22 that can be reproduced before the reception-interrupted period ends. In this case, the reproduction control unit 26 instructs the selection/output unit 24 to output the audio data stored in the complement data storage unit 23 (step S7). This enables the audiences to be informed that the reproduction output has been stopped due to deteriorated condition of the transmission path.

[0054] As described above, according to the broadcast system in the present embodiment, the low-quality stream is transmitted preceding the high-quality stream by apredetermined time period, and most recently received packets of the low-quality stream during the predetermined time period are always accumulated in the accumulating unit 22. And if a reception interruption occurs, the packets accumulated in the accumulating unit 22 are reproduced. This prevents the audiences from recognizing a suspended reproduction.

[0055] With the above-described arrangement in which the digital receiving apparatuses imitate deterioration of reproduction output that is observed in the analog receiving apparatuses when a transmission path failure occurs, it is possible to prevent the audiences, who are familiar with deterioration in reproduction quality in such a case, from being confused by a sudden stop of reproduction supply.

[0056] It is preferable that the time period T is determined based on statistics of the reception-interrupted period for the transmission path. This is because with such an arrangement, if a reception interruption occurs, the high-quality stream is delayed by the time period T, packets of the low-quality stream are always accumulated during the time period T until the current time, and the reception-interrupted period lasts for the time period T, thus making it highly possible that the audiences can enjoy seamless reproduction of the broadcasting even during the reception-interrupted period.

[0057] In the present embodiment, the high-quality stream and the low-quality stream are multiplexed into one multiplexed stream, which is then transmitted onto a transmission path. However, the high-quality stream and the low-quality stream may be transmitted onto different transmission paths, respectively. For example, the high-quality stream and the low-quality stream may be transmitted onto transmission paths for the radio broadcasting and the cable broadcasting, respectively. In this case, even if a thunderstorm or the like causes a failure on a transmission path for the high-quality stream, the failure does not affect a transmission path for the low-quality stream, and the broadcast is provided without interruption.

[0058] Also, in the present embodiment, an audio announcement is provided as the complement data. However, music or an electronic sound may be provided instead of announcement. It is preferred that the music or electronic sound has such a tone as makes the audiences feel alarmed that the transmission path failure might have occurred.

Embodiment 2

[0059] Embodiment 2 relates to an improvement of the receiving apparatuses in live broadcasting of a sports game or the like. In Embodiment 1, the receiving apparatuses reproduce delayed high-quality stream during the normal reception period. This means that the audiences listen to the broadcast contents always after a delay of time period T. The audiences do not recognize such a delay when they listen to a pre-recordedbroadcast program. However, when the audiences listen to a live broadcast program of a sports game or the like, some problems may occur. For example, suppose a user is watching a real sports game listening to the live broadcasting of the sports game with a portable-type receiving apparatus. The user might be confused by the time lag between the real game and the broadcast of the game, which is caused by the receiving apparatus reproducing the delayed high-quality stream.

[0060] The present embodiment provides a method to solve the problem. Fig. 10 shows the construction of the receiving apparatuses in Embodiment 2. The construction resembles the construction shown in Fig. 1, but differs from it in that the multiplexing unit 21 outputs both the low-quality and high-quality streams directly to the selection/output unit 24, as well as outputting the low-quality stream to the accumulating unit 22. The receiving apparatuses in the present embodiment also include a switch 27 that receives an instruction by the user (audience) to switch between the low- and high-quality streams, and sends the instruction to the selection/output unit 24.

[0061] Now, the operation of the receiving apparatuses in the present embodiment will be described.

[0062] As described in Embodiment 1, the selection/output unit 24 receives the high-quality stream output from the multiplexing unit 21 and outputs it to the reproduction unit 25. However, if the user operates the switch 27 to switch from the high-quality stream to low-quality stream, the selection/output unit 24 receives the low-quality stream from the multiplexing unit 21 and outputs it to the reproduction unit 25.

[0063] As described above, audiences can select either the high-quality stream which is provided with delay or the low-quality stream which is provided without delay. This function facilitates the audiences, especially when they are watching a sports game while listening

Webgroup CZ a.s. Ex. 1002, Page 504 of 1406

to the broadcast of the game since they can select the reproduction of the low-quality stream and enjoy watching the game without being confused by the time lag between the real game and the broadcast of the game.

Embodiment 3

[0064] In Embodiment 3, the imitation of analog receiving apparatuses by the digital receiving apparatuses in Embodiment 1 is performed in a more realistic manner. Fig. 11 shows the construction of the receiving apparatuses in Embodiment 3. Fig. 11 differs from Fig. 5 in that it additionally includes a superposing unit 28 and a pilot lamp 29.

[0065] The superposing unit 28 superposes a noise signal on the reproduced low-quality stream output from the reproduction unit 25 during the reception-interrupted period. The noise signal has a signal waveform that resembles the white noise. When the noise signal is superposed on the reproduced low-quality stream, the audiences can hear, together with voices/sounds output from the reproduction unit 25, a burst of noise that is familiar to them through analog broadcasting output from analog receiving apparatuses. This may give an impression to the audiences that they are listening to an analog receiving apparatus.

[0066] The pilot lamp 29 is a light-emitting element such as a light-emitting diode, where the light emitted from the pilot lamp indicates a state of stream reception. The reproduction control unit 26 controls the pilot lamp 29 for the audiences to visually distinguish the reception-interrupted period from the normal reception period. More specifically, the reproduction control unit 26 causes the pilot lamp 29 to blink stably during the normal reception period, and in contrast, to emit light intermittently on an unstable basis during the reception-interrupted period. This operation is an imitation of the blinking of a pilot lamp that is provided in many analog receiving apparatuses.

[0067] As described above, according to the present embodiment, the digital receiving apparatuses imitate the noise andblinking of a pilot lamp which have been familiar to the audiences of analog receiving apparatuses, thus preventing the audiences from sensing discomfort at the digital broadcasting.

Embodiment 4

[0068] In Embodiment 1, the low-quality stream and the high-quality stream are transmitted onto a transmission path. In Embodiment 4, n digital streams are transmitted onto a transmission path. Fig. 12 shows the construction of a transmission apparatus in Embodiment 4. In Fig. 12, it is presumed that the number of digital streams "n" is 3. The encoding units 11 and 12 shown in Fig. 1 are replaced with a low-rate encoding unit 31, a middle-rate encoding unit 32, and a high-rate encoding unit 33 in Fig. 12. The encoding units 31-33 encodes analog signals output from the signal source 10. Embodiment 4 differs from Embodiment 1 in the bit rate assigned to each digital stream by each encoding unit. More specifically, in Embodiment 1, the encoding units 11 and 12 assign 10 % and 90 % of the bit rate for one band to the two types of digital streams, respectively, while in Embodiment 4, the encoding units assign 5 %, 10 %, and 85 % of the bit rate for one band to three types of digital streams, respectively.

[0069] The delay unit 13 shown in Fig. 1 is replaced with delay units 34 and 35 in Fig. 12. The delay units 34 and 35 delays digital streams generated by the encoding units 32 and 33, respectively. The delay unit 34 delays digital streams generated by the middle-rate encoding unit 32 by a time period T/2, and outputs the delayed digital streams to the multiplexing unit 14. The delay unit 35 delays digital streams generated by the high-rate encoding unit 33 by a time period T, and outputs the delayed digital streams to the multiplexing unit 14.

[0070] With the above-described replacement of components, the multiplexing unit 14 shown in Fig. 12 multiplexes the following three types of digital streams into one multiplexed stream: (1) a digital stream generated by the low-rate encoding unit 31; (2) a digital stream generated by the middle-rate encoding unit 32 and delayed by the delay unit 34 by time period T/2; and (3) a digital stream generated by the high-rate encoding unit 33 and delayed by the delay unit 35 by time period T.

[0071] Now, the construction of the receiving apparatuses will be described. Fig. 13 shows the construction of the receiving apparatuses. In Fig. 13, the accumulating unit 22 shown in Fig. 5 has been replaced with accumulating units 36 and 37. The accumulating unit 37 accumulates in itself a low-quality digital stream to which 5 % of the bit rate for one band is assigned. The accumulating unit 36 accumulates in itself a middle-quality digital stream to which 10 % of the bit rate for one band is assigned and delayed by time period T/2.

[0072] In Embodiment 4, the reproduction control unit 26 instructs the selection/output unit 24 to select and output a high-quality digital stream to which 85 % of the bit rate for one band is assigned and delayed by time period T in the normal reception period. With this arrangement, the high-quality digital stream is reproduced by the reproduction unit 25 during the normal reception period.

[0073] The reproduction control during the reception-interrupted period will be described next. It is presumed here for the sake of convenience that the reception-interrupted period lasts for time period T. During the first half (T/2) of the reception-interrupted period, the reproduction control unit 26 instructs the selection/output unit 24 to output the middle-quality digital stream accumulated in the accumulating unit 36. With this change of outputs, the quality of data reproducedby the reproduction unit 25 is degraded in proportionate to the change from 85 % to 10 % of the bit rate. Duringthesecondhalf (T/2) ofthereception-interruptedperiod, the reproduction

Webgroup CZ a.s. Ex. 1002, Page 505 of 1406

control unit 26 instructs the selection/output unit 24 to output the low-quality digital stream accumulated in the accumulating unit 37. With this change of outputs, the quality of data reproducedby the reproduction unit 25 is degraded in proportionate to the change from 10 % to 5 % of the bit rate.

[0074] As described above, in the present embodiment, in the normal reception period, data is reproduced with a quality level that is proportionate to 85 % of the bit rate, and in the reception-interrupted period, first, data is reproduced with a quality level that is proportionate to 10 %, and then with a quality level that is proportionate to 5 % of the bit rate. This would give an impression to the audiences that the reproduction quality is graduallydeteriorated, making them feel as if they were listening to an analog receiver.

[0075] It should be noted here that the distribution rate of 85 %, 10 %, and 5 % is only an example, and it may be varied in so far as it gives an impression to the audiences that the reproduction quality is gradually deteriorated.

Embodiment 5

[0076] In Embodiment 1, only one signal source is provided. In Embodiment 5, different signal sources are provided for video and audio, respectively. Fig. 14 shows the construction of the broadcast system in Embodiment 5. Signal sources 10a and 10b generate audio and video analog signals, respectively. Encoding units 11a and 12a and delay unit 13a are provided in correspondence with the signal source 10a, and encoding units 11b and 12b and delay unit 13b are provided in correspondence with the signal source 10b. With this construction, a low-quality stream and a high-quality stream are generated and the high-quality stream is delayed, for each of the audio and video signals.

[0077] Video data requires a higher bit rate in transmission than does audio data. As a result, the encoding unit 11a, 12a, 11b, and 12b assign different bit rates to digital streams, respectively.

[0078] As is the case with Embodiment 1, the encoding units 11a and 12a assign 10 % and 90 % of the bit rate (1 Mbps) for one band to the low- and high-quality streams for audio, respectively. It is supposed here that the bit rate for video data transmission in digital broadcasting is 5 Mbps. The encoding units 11b and 12b assign 10 % and 90 % of the bit rate (5 Mbps) for one band to the low- and high-quality streams for video, respectively.

[0079] That is to say, the encoding by the encoding units 11a, 12a, 11b, and 12b provides: (1) an audio digital stream to which 10 % of 1 Mbps is assigned; (2) an audio digital stream to which 90 % of 1 Mbps is assigned; (3) a video digital stream to which 10 % of 5 Mbps is assigned; and (4) a video digital stream to which 90 % of 5 Mbps is assigned. It should be noted here that 5 Mbps for video digital stream is given only as an example, and the bit rate may differ from this.

[0080] The delay units 13a and 13b delay the audio and video digital streams, respectively. As is the case with Embodiment 1, the delay unit 13a delays the audio high-quality stream generated by the encoding unit 12a by time period T. The delay unit 13b delays the video high-quality stream generated by the encoding unit 12b by time period T/2. The reason why the delay given by the encoding unit 12b is half the delay given by the encoding unit 12a is that the capacity of the accumulating unit 22 increases as the time period T increases, where the capacity of the accumulating unit 22 is calculated by: time period T $\times$ 1 Mbps $\times$ 10 %.

[0081] The video low-quality stream receives higher assignment of the bit rate, which is 5 Mbps $\times$ 10 % in the present embodiment, than the audio low-quality stream, which is 1 Mbps $\times$ 10 %. If the data is accumulated with this rate for the time period T, the video accumulating unit would require a storage capacity five times that of the audio accumulating unit. As a result, the video high-quality stream is delayed by T/2, so that the amount of the low-quality stream to be accumulated in the receiving apparatuses is reduced as much.

[0082] The low- and high-quality streams for audio and video, with the high-quality streams being delayed, are output to the multiplexing unit 14 to be multiplexed into streams.

[0083] The multiplexing unit 14 multiplexes all the types of digital streams into one multiplexed stream, and outputs the generated multiplexed stream to the modulating unit 15.

[0084] Up to now, the construction and operation of the transmission apparatus in Embodiment 5 has been described. Now, the construction of the receiving apparatuses in Embodiment 5 will be described.

[0085] Fig. 15 shows the construction of the receiving apparatuses in Embodiment 5. In the receiving apparatuses in Embodiment 5, the accumulating unit 22, the selection/output unit 24, and the reproduction unit 25 are provided for each audio and video. More specifically, an accumulating unit 22a, aselection/output unit 24a, and a reproduction unit 25a deal with the low- and high-quality streams for audio, and an accumulating unit 22b, a selection/output unit 24b, and a reproduction unit 25b deal with the low- and high-quality streams for video.

[0086] The demultiplexing unit 21 demultiplexes a multiplexed stream to obtain four types of digital streams: an audio low-quality stream; a video low-quality stream; an audio high-quality stream; and a video high-quality stream.

[0087] The accumulating unit 22a accumulates part of the audio low-quality stream that has been obtained during a time period T until the current time.

[0088] The accumulating unit 22b accumulates part of the video low-quality stream that has been obtained during a time period T/2 until the current time.

[0089] The selection/output unit 24a selects one among (i) the audio high-quality stream output from the

Webgroup CZ a.s. Ex. 1002, Page 506 of 1406

demultiplexing unit 21 and (ii) part of the audio low-quality stream accumulated in the accumulating unit 22a, and outputs the selected audio digital stream to the reproduction unit 25a.

[0090] The selection/output unit 24b selects one among (i) the video high-quality stream output from the demultiplexing unit 21 and (ii) part of the video low-quality stream accumulated in the accumulating unit 22b, and outputs the selected video digital stream to the reproduction unit 25b.

[0091] The reproduction unit 25a reproduces the audio digital stream output from the selection/output unit 24a.

[0092] The reproduction unit 25b reproduces the video digital stream output from the selection/output unit 24b.

[0093] The reproduction control unit 26 controls the output of the selection/output units 24a and 24b. The reproduction control unit 26 instructs the selection/output unit 24a to output the audio high-quality stream and the selection/output unit 24b to output the video high-quality stream while the multiplexed stream is normally received. The reproduction control unit 26 performs the reproduction control during the reception-interrupted period as follows, where it is supposed that the reception-interrupted period lasts for time period T.

[0094] During the first half (T/2) of the reception-interrupted period, the reproduction control unit 26 instructs the selection/output unit 24a to output the packets accumulated in the accumulating unit 22a, and instructs the selection/output unit 24b to output the packets accumulated in the accumulating unit 22b. Since the accumulating unit 22a accumulates part of the audio low-quality stream and the accumulating unit 22b accumulates part of the video low-quality stream, the audio low-quality stream and the video low-quality stream are reproduced during the first half (T/2) of the reception-interrupted period.

[0095] During the second half (T/2) of the reception-interrupted period, the reproduction control unit 26 instructs the selection/output unit 24a to output the packets accumulated in the accumulating unit 22a. However, since all the packets accumulated in the accumulating unit 22b, that is, part of the video low-quality stream has been reproduced during the first half (T/2) of the reception-interrupted period, only the audio low-quality stream is reproduced during the second half (T/2) of the reception-interrupted period.

[0096] As described above, according to the present embodiment, the "high-quality audio + high-quality video" output that is supplied during the normal reception period changes to the "low-quality audio + low-quality video" output if a failure occurs to the transmission path. Furthermore, if the time reception interruption continues for a certain time period, the reproduction changes from "audio + video" to "only audio" . That is to say, the reproduced data changes step by step from the high-quality audio and video in the normal reception period to the low-quality audio and video, and to the only audio without video. In this way, the digital receiving apparatuses imitate the gradual deterioration of reproduction output that is observed in the analog receiving apparatuses when a transmission path failure occurs, giving an impression to the audiences that the reproduction quality is gradually degraded in the same manner as when they are listening to analog receivers.

Embodiment 6

[0097] The encoding units 11 and 12 in Embodiment 1 perform a fixed-bit-rate encoding. In Embodiment 6, the transmission apparatus performs a variable-length encoding.

[0098] Fig. 16 shows the construction of a transmission apparatus in a broadcast system in Embodiment 6. In comparison with Fig. 1, Fig. 16 includes encoding units 60 and 62 respectively in place of the encoding units 11 and 12, and includes buffers 61 and 63 that respectively correspond to the encoding units 11 and 12.

[0099] The encoding unit 60 generates a low-quality stream by performing a variable-length encoding in which it assigns a variable-length bit rate to each audio frame.

[0100] The buffer 61 stores 30 seconds of audio frames among those constituting the low-quality stream generated by the encoding unit 60.

[0101] The encoding unit 62 generates a high-quality stream by performing a variable-length encoding in which it assigns a variable-length bit rate to each audio frame.

[0102] The buffer 63 stores 30 seconds of audio frames among those constituting the high-quality stream generated by the encoding unit 62.

[0103] The multiplexing unit 14 multiplexes the 30 seconds of audio frames stored in the buffer 61 with the 30 seconds of audio frames stored in the buffer 63 into one multiplexed stream, and outputs the multiplexed stream to the modulating unit 15. The modulating unit 15 outputs the multiplexed stream at 1 Mbps of the bit rate for one band.

[0104] Here, the variable-length encoding performed by the encoding units 60 and 62 will be described.

[0105] In the variable-length encoding, the encoding unit 60 (62) checks each section of an analog signal that corresponds to each audio frame and detects an amount of audible component the section contains, assigns a bit rate to each section in proportionate to the detected amount of audible component, and generates audio frames by encoding each section in accordance with the assigned bit rate. With this arrangement, as much amount of bit rate as omitted from the audio frames that contain less amounts of audible component can be appropriated to the audio frames that contain more amounts of audible component. This enables the quality of the audio reproduction to be improved in total.

[0106] The bit rate assigned to each audio frame by

Webgroup CZ a.s. Ex. 1002, Page 507 of 1406

the encoding unit 60 is a part of the number of bits obtained by "1 Mbps × 10 % × 30 seconds" . That is to say, although the encoding unit 60 assigns a variable-length bit rate to each audio frame, the total bit rate for 30 seconds does not exceed "1 Mbps × 10 %".

[0107] Similarly, the bit rate assigned to each audio frame by the encoding unit 62 is a part of the number of bits obtained by "1 Mbps × 90 % × 30 seconds". That is to say, although the encoding unit 62 assigns a variable-length bit rate to each audio frame, the total bit rate for 30 seconds does not exceed "1 Mbps × 90 %".

[0108] This is because the 30 seconds of audio frames stored in the buffer 61 and the 30 seconds of audio frames stored in the buffer 63, which are multiplexed together and output onto a transmission path, should not exceed 1 Mbps of the bit rate for one band.

[0109] As described above, the present embodiment enables the quality of the audio reproduction to be improved in total by assigning higher bit rates to the audio frames that contain more amounts of audible component, and assigning lower bit rates to the audio frames that contain less amounts of audible component.

[0110] It should be noted here that the time period of 30 seconds is only an example given for the sake of convenience, and it may be either increased or decreased.

Embodiment 7

[0111] In Embodiments 1 to 6, the signal source 10 generates an analog signal, and the encoding units 11 and 12 perform a quantization process with different numbers of quantization bits, so that two digital streams are transmitted at different bit rates on transmission paths. In Embodiment 7, the signal source 10 generates a digital signal. That is say, the signal source 10 generates a quantized digital signal and the encoding units 11 and 12 encode the quantized digital signal. In this encoding, the encoding amount in the encoding unit 11 is set to a larger value, and the encoding amount in the encoding unit 12 is set to a smaller value. It is possible to assign different bit rates to two digital streams for transmission only by adjusting the encoding amount as explained above. It is accordingly possible to use a digital signal source that has been encoded by MPEG and accumulated, as it is. This facilitates the broadcasting stations.

[0112] In the transmission apparatus in Embodiments 1-7, the delay unit 13 operates after the encoding unit 12 . However, the delay unit 13 may operate before the encoding unit 12. That is to say, the delay unit 13 may delay the signal from the signal source 10 before the signal is input to the encoding unit 12.

[0113] The features of the transmission apparatus and the receiving apparatuses described in Embodiments 1-7 can be realized by a computer-readable program. Such a computer-readable program can be executed separately from the transmission apparatus and the receiving apparatuses. Also, such a programmay be recorded into a computer-readable recording medium, may be transferred or lent to other parties via the recording medium, and may be executed by the parties. Also, such a program may be distributed on a network and executed by the receivers.

[0114] Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted that various changes and modifications will be apparent to those skilled in the art. Therefore, unless such changes and modifications depart from the scope of the present invention, they should be construed as being included therein.

Claims

1. A broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including:

   a generating unit operable to generate a first digital stream and a second digital stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first digital stream is lower than an encoding bit rate for the second digital stream; and
   a transmission unit operable to transmit the first and second digital streams onto a transmission path while delaying the second digital stream relative to the first digital stream,
   the receiving apparatus including:

   a reproduction unit operable to reproduce the second digital stream in a normal state; and
   a reproduction control unit operable to, if a transmission path failure occurs, cause the reproduction unit to reproduce, instead of the second digital stream, a portion of the first digital stream that has been received before the occurrence of the transmission path failure.

2. The broadcast system of Claim 1, wherein
   the receiving apparatus further includes:

   a receiving unit operable to receive packets constituting the first and second digital streams for each digital stream; and
   an accumulating unit operable to accumulate one or more packets of the first digital stream received by the receiving unit during a predetermined time period until a current time, wherein
   the reproduction control unit causes the reproduction unit to reproduce the one or more packets of the first digital stream accumulated in the

Webgroup CZ a.s. Ex. 1002, Page 508 of 1406

accumulating unit, if a transmission path failure occurs.

3. The broadcast system of Claim 2, wherein
the predetermined time period is equal to a time period by which the second digital stream is delayed by the transmission unit.

4. The broadcast system of Claim 2, wherein
the receiving apparatus further includes
a write control unit operable to, each time the receiving unit newly receives a packet, write the newly received packet into the accumulating unit after deleting an oldest packet among the one or more packets accumulated in the accumulating unit.

5. The broadcast system of Claim 4, wherein
the predetermined time period is determined based on statistics of a time period for which a transmission path failure continues.

6. The broadcast system of Claim 1, wherein
the receiving apparatus superposes a signal resembling a noise on the one or more packets accumulated in the accumulating unit when the one or more packets are reproduced due to occurrence of a transmission path failure.

7. The broadcast system of Claim 1, wherein
the receiving apparatus is provided with a pilot lamp that emits light in a manner in which a normal state is distinguished from an abnormal state, wherein in the normal state, the second digital stream is reproduced, and in the abnormal state, the first digital stream is reproduced.

8. The broadcast system of Claim 2, wherein
if a transmission path failure continues exceeding the predetermined time period during which the one or more packets are accumulated in the accumulating unit, the receiving apparatus reproduces supplementary data so as to complement the reproduction of the accumulated packets.

9. The broadcast system of Claim 1, wherein
the receiving apparatus further includes:

an operation receiving unit operable to receive input of an operation by a user to request real time reproduction; and
a switch unit operable to switch from reproduction of the second digital stream to reproduction of the first digital stream if the operation receiving unit receives the input of the operation by the user.

10. The broadcast system of Claim 1, wherein
the generating unit of the transmission apparatusincludes two encoders that respectively generate the first digital stream and the second digital stream by performing a variable-length encoding onto an analog signal.

11. A broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including:

a generating unit operable to generate a first digital stream, a second digital stream, and a third digital stream by encoding a same signal respectively at different encoding bit rates, where an encoding bit rate for the first digital stream is the lowest among the encoding bits rates, an encoding bit rate for the second digital stream is the middle between encoding bit rates for the first and third digital streams, and an encoding bit rate for the third digital stream is the highest among the encoding bits rates; and
a transmission unit operable to transmit the first, second, and third digital streams onto a transmission path while delaying the second digital stream by time period T1 and delaying the third digital stream by time period T2, wherein T2 > T1,
the receiving apparatus including:

an accumulating unit operable to accumulate part of the first and second digital streams received from the transmission apparatus;
a reproduction unit operable to reproduce the thirddigital stream in a normal state; and
a reproduction control unit operable to cause the reproduction unit to reproduce, instead of the third digital stream, the part of the second digital stream accumulated in the accumulating unit if a transmission path failure continues for the time period T2 or more, and to reproduce the part of the first digital stream accumulated in the accumulating unit following the reproduction of the part of the second digital stream accumulated in the accumulating unit.

12. A broadcast system including a transmission apparatus and a receiving apparatus, the transmission apparatus including:

a first generating unit operable to generate a first audio stream and a second audio stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first audio stream is lower than an encoding bit rate for the second audio stream;
a second generating unit operable to generate

Webgroup CZ a.s. Ex. 1002, Page 509 of 1406

a first video stream and a second video stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first video stream is lower than an encoding bit rate for the second video stream; and
a transmission unit operable to transmit the first and second audio streams and the first and second video streams onto a transmission path while delaying the second video stream by a time period T1 and delaying the second audio stream by a time period T2, wherein T2 > T1,
the receiving apparatus including:

a first accumulating unit operable to accumulate part of the first video stream received during the time period T1 until a current time;
a second accumulating unit operable to accumulate part of the first audio stream received during the time period T2 until the current time;
a reproduction unit operable to reproduce the second video stream and the second audio stream in a normal state; and
a reproduction control unit operable to cause the reproduction unit to reproduce (i) the part of the first video stream accumulated in the first accumulating unit and (ii) the part of the first audio stream accumulated in the second accumulating unit for the time period T1 if a transmission path failure continues for the time period T2 or more, and to reproduce, after the time period T1, the part of the first audio stream accumulated in the second accumulating unit.

13. A receiving apparatus for use in a broadcast system including a transmission apparatus that generates a first digital stream and a second digital stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first digital stream is lower than an encoding bit rate for the second digital stream, and transmits the first and second digital streams onto a transmission path while delaying the second digital stream relative to the first digital stream, the receiving apparatus comprising:

a reproduction unit operable to reproduce the second digital stream in a normal state; and
a reproduction control unit operable to, if a transmission path failure occurs, cause the reproduction unit to reproduce, instead of the second digital stream, a portion of the first digital stream that has been received before the occurrence of the transmission path failure.

14. The receiving apparatus of Claim 13 further comprising :

a receiving unit operable to receive packets constituting the first and second digital streams for each digital stream; and
an accumulating unit operable to accumulate one or more packets of the first digital stream received by the receiving unit during a predetermined time period until a current time, wherein
the reproduction control unit causes the reproduction unit to reproduce the one or more packets of the first digital stream accumulated in the accumulating unit, if a transmission path failure occurs.

15. The receiving apparatus of Claim 14, wherein
the predetermined time period is equal to a time period by which the second digital stream is delayed by the transmission apparatus.

16. The receiving apparatus of Claim 14 further comprising
a write control unit operable to, each time the receiving unit newly receives a packet, write the newly received packet into the accumulating unit after deleting an oldest packet among the one or more packets accumulated in the accumulating unit.

17. The receiving apparatus of Claim 16, wherein
the predetermined time period is determined based on statistics of a time period for which a transmission path failure continues.

18. The receiving apparatus of Claim 13, wherein
the receiving apparatus superposes a signal resembling a noise on the one or more packets accumulated in the accumulating unit when the one or more packets are reproduced due to occurrence of a transmission path failure.

19. The receiving apparatus of Claim 13, wherein
the receiving apparatus is provided with a pilot lamp that emits light in a manner in which a normal state is distinguished from an abnormal state, wherein in the normal state, the second digital stream is reproduced with delay, and in the abnormal state, the first digital stream is reproduced without delay.

20. The receiving apparatus of Claim 13, wherein
if a transmission path failure continues exceeding the predetermined time period during which the one or more packets are accumulated in the accumulating unit, the receiving apparatus reproduces supplementary data so as to complement the reproduction of the accumulated packets.

Webgroup CZ a.s. Ex. 1002, Page 510 of 1406

21. The receiving apparatus of Claim 13 further comprising:

an operation receiving unit operable to receive input of an operation by a user to request real time reproduction; and
a switch unit operable to switch from reproduction of the second digital stream to reproduction of the first digital stream if the operation receiving unit receives the input of the operation by the user.

22. A receiving apparatus for use in a broadcast system including a transmission apparatus that generates a first digital stream, a second digital stream, and a third digital stream by encoding a same signal respectively at different encoding bit rates, where an encoding bit rate for the first digital stream is the lowest among the encoding bits rates, an encoding bit rate for the second digital stream is the middle between encoding bit rates for the first and third digital streams, and an encoding bit rate for the third digital stream is the highest among the encoding bits rates, and transmits the first, second, and third digital streams onto a transmission path while delaying the second digital stream by time period T1 and delaying the third digital stream by time period T2, wherein T2 > T1, the receiving apparatus comprising:

an accumulating unit operable to accumulate part of the first and second digital streams received from the transmission apparatus;
a reproduction unit operable to reproduce the third digital stream in a normal state; and
a reproduction control unit operable to cause the reproduction unit to reproduce, instead of the third digital stream, the part of the second digital stream accumulated in the accumulating unit if a transmission path failure continues for the time period T2 or more, and to reproduce the part of the first digital stream accumulated in the accumulating unit following the reproduction of the part of the second digital stream accumulated in the accumulating unit.

23. A receiving apparatus for use in a broadcast system including a transmission apparatus that generates a first audio stream and a second audio stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first audio stream is lower than an encoding bit rate for the second audio stream, generates a first video stream and a second video stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first video stream is lower than an encoding bit rate for the second video stream, and transmits the first and second audio streams and the first and second video streams onto a transmission path while delaying the second video stream by a time period T1 and delaying the second audio stream by a time period T2, wherein T2 > T1, the receiving apparatus comprising:

a first accumulating unit operable to accumulate part of the first video stream received during the time period T1 until a current time;
a second accumulating unit operable to accumulate part of the first audio stream received during the time period T2 until the current time;
a reproduction unit operable to reproduce the second video stream and the second audio stream in a normal state; and
a reproduction control unit operable to cause the reproduction unit to reproduce (i) the part of the first video stream accumulated in the first accumulating unit and (ii) the part of the first audio stream accumulated in the second accumulating unit for the time period T1 if a transmission path failure continues for the time period T2 ormore, and to reproduce, after the time period T1, the part of the first audio stream accumulated in the second accumulating unit.

24. A program that causes a computer to execute a reception process in a broadcast system including a transmission apparatus that generates a first digital stream and a second digital stream from a same signal source by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first digital stream is lower than an encoding bit rate for the second digital stream, and transmits the first and second digital streams onto a transmission path while delaying the second digital stream relative to the first digital stream, the reception process including:

a reproduction step for reproducing the second digital stream in a normal state; and
a reproduction control step for causing, if a transmission path failure occurs, the reproduction step to reproduce, instead of the second digital stream, a portion of the first digital stream that has been.received before the occurrence of the. transmission path failure.

25. The program of Claim 24, wherein
the computer includes:

a receiving unit operable to receive packets constituting the first and second digital streams for each digital stream; and
an accumulating unit operable to accumulate one or more packets of the first digital stream received by the receiving unit during a predetermined time period until a current time,

Webgroup CZ a.s. Ex. 1002, Page 511 of 1406

wherein
the reproduction control step causes the reproduction step to reproduce the one or more packets of the first digital stream accumulated in the accumulating unit, if a transmission path failure occurs.

26. The program of Claim 25, wherein
the predetermined time period is equal to a time period by which the second digital stream is delayed by the transmission apparatus.

27. The program of Claim 25, wherein
the reception process further includes
a write control step for, each time the receiving unit newly receives a packet, writing the newly received packet into the accumulating unit after deleting an oldest packet among the one or more packets accumulated in the accumulating unit.

28. The program of Claim 27, wherein
the predetermined time period is determined based on statistics of a time period for which a transmission path failure continues.

29. The program of Claim 24, wherein
the computer further includes
an operation receiving unit operable to receive input of an operation by a user to request real time reproduction, and
the reception process further includes
a switch step for switching from reproduction of the second digital stream to reproduction of the first digital stream if the operation receiving unit receives the input of the operation by the user.

30. A program that causes a computer to execute a reception process in a broadcast system including a transmission apparatus that generates a first digital stream, a second digital stream, and a third digital stream by encoding a same signal respectively at different encoding bit rates, where an encoding bit rate for the first digital stream is the lowest among the encoding bits rates, an encoding bit rate for the second digital stream is the middle between encoding bit rates for the first and third digital streams, and an encoding bit rate for the third digital stream is the highest among the encoding bits rates, and transmits the first, second, and third digital streams onto a transmission path while delaying the second digital stream by time period T1 and delaying the third digital streamby time period T2, wherein T2 > T1, the computer including
an accumulating unit operable to accumulate part of the first and second digital streams received from the transmission apparatus,
the reception process including:
a reproduction step for reproducing the third digital stream in a normal state; and
a reproduction control step for causing the reproduction step to reproduce, instead of the third digital stream, the part of the second digital stream accumulated in the accumulating unit if a transmission path failure continues for the time period T2 or more, and to reproduce the part of the first digital stream accumulated in the accumulating unit following the reproduction of the part of the second digital stream accumulated in the accumulating unit.

31. A program that causes a computer to execute a reception process in a broadcast system including a transmission apparatus that generates a first audio stream and a second audio stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first audio stream is lower than an encoding bit rate for the second audio stream, generates a first video stream and a second video stream by encoding a same signal at different encoding bit rates, where an encoding bit rate for the first video stream is lower than an encoding bit rate for the second video stream, and transmits the first and second audio streams and the first and second video streams onto a transmission path while delaying the second video stream by a time period T1 and delaying the second audio stream by a time period T2, wherein T2 > T1, the computer including:

a first accumulating unit operable to accumulate part of the first video stream received during the time period T1 until a current time; and
a second accumulating unit operable to accumulate part of the first audio stream received during the time period T2 until the current time,
the reception process comprising:

a reproduction step for reproducing the secondvideo stream and the second audio stream in a normal state; and
a reproduction control step for causing the reproduction step to reproduce (i) the part of the first video stream accumulated in the first accumulating unit and (ii) the part of the first audio stream accumulated in the second accumulating unit for the time period T1 if a transmission path failure continues for the time period T2 or more, and to reproduce, after the time period T1, the part of the first audio stream accumulated in the second accumulating unit.

Webgroup CZ a.s. Ex. 1002, Page 512 of 1406

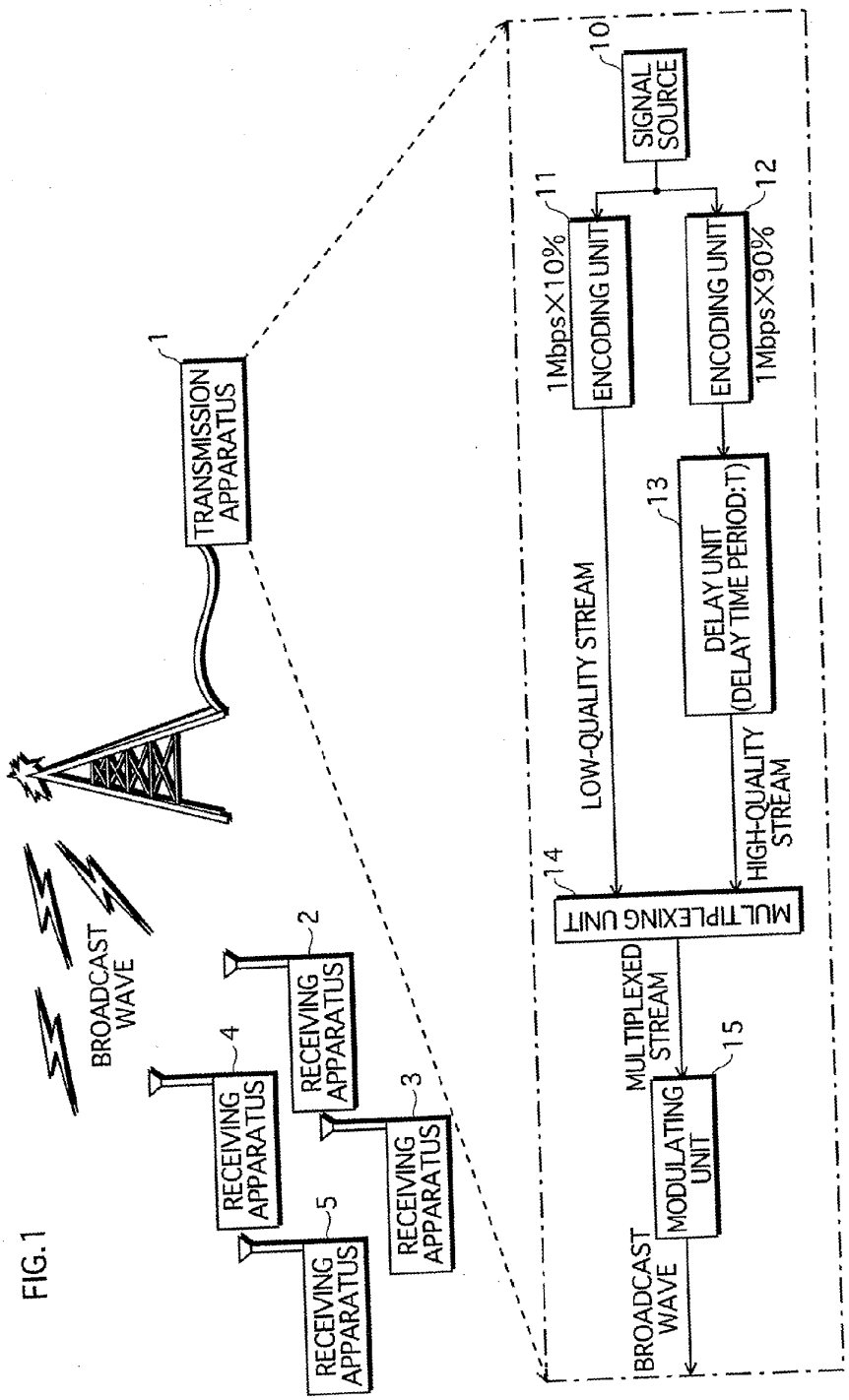

TRANSMISSION APPARATUS
1
BROADCAST WAVE
RECEIVING APPARATUS
2
RECEIVING APPARATUS
3
RECEIVING APPARATUS
4
RECEIVING APPARATUS
5
SIGNAL SOURCE
10
1Mbps×10%
ENCODING UNIT
11
1Mbps×90%
ENCODING UNIT
12
DELAY UNIT (DELAY TIME PERIOD:T)
13
LOW-QUALITY STREAM
HIGH-QUALITY STREAM
MULTIPLEXING UNIT
14
MULTIPLEXED STREAM
MODULATING UNIT
15
BROADCAST WAVE

FIG.1

FIG.2

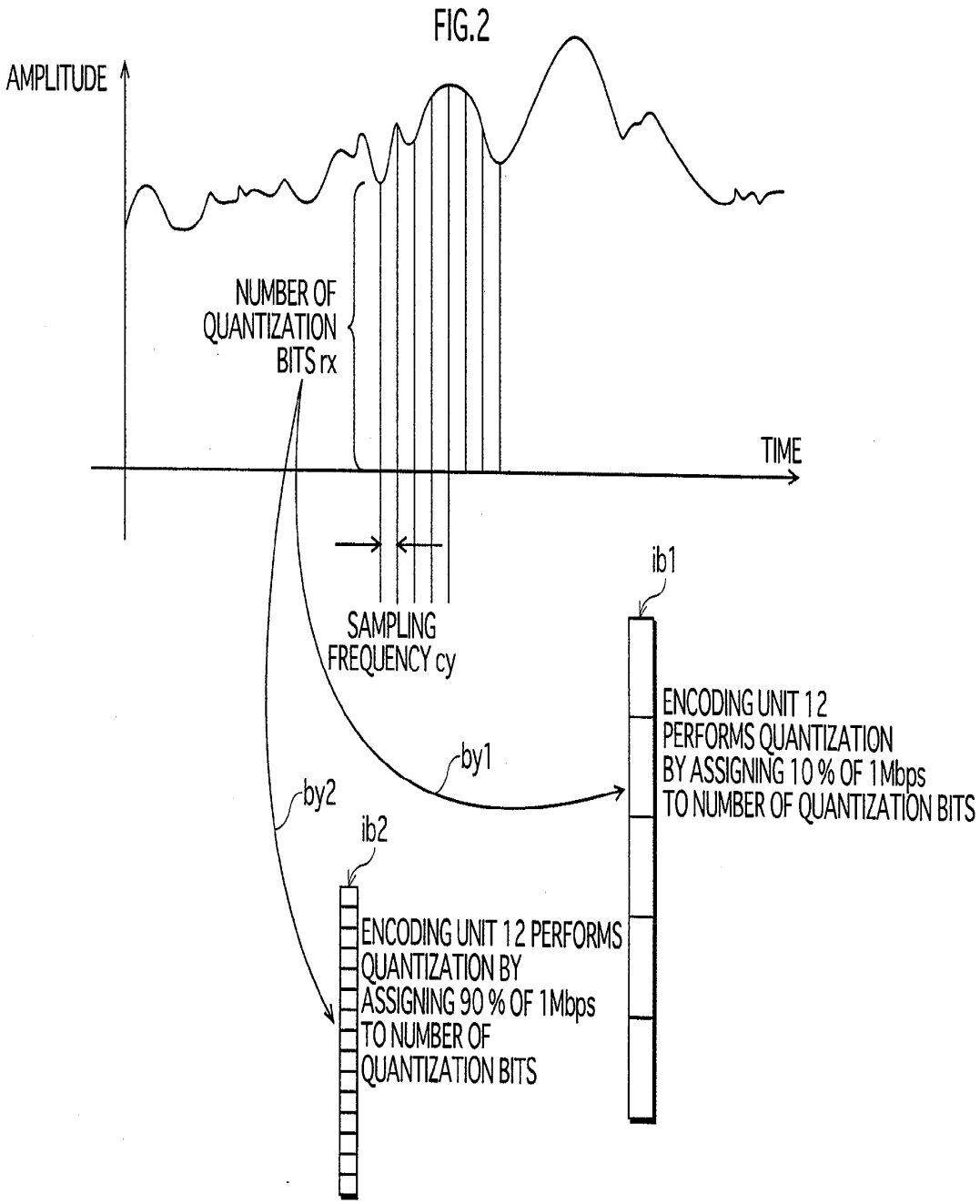
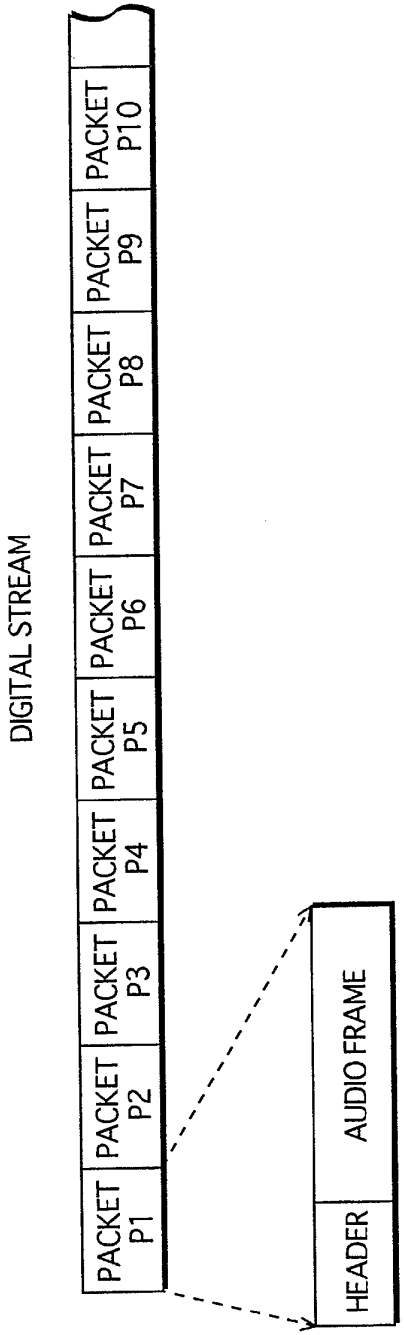
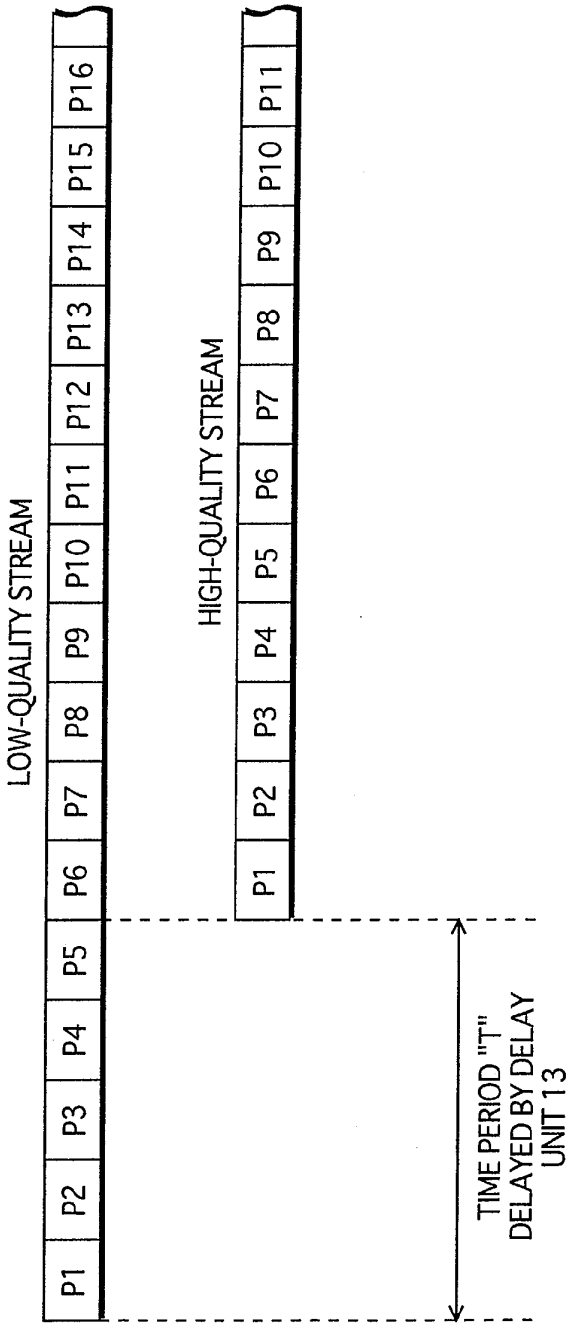

AMPLITUDE
NUMBER OF QUANTIZATION BITS rx
TIME
SAMPLING FREQUENCY cy
ib1
ENCODING UNIT 12 PERFORMS QUANTIZATION BY ASSIGNING 10 % OF 1Mbps TO NUMBER OF QUANTIZATION BITS
by1
by2
ib2
ENCODING UNIT 12 PERFORMS QUANTIZATION BY ASSIGNING 90 % OF 1Mbps TO NUMBER OF QUANTIZATION BITS

FIG.3



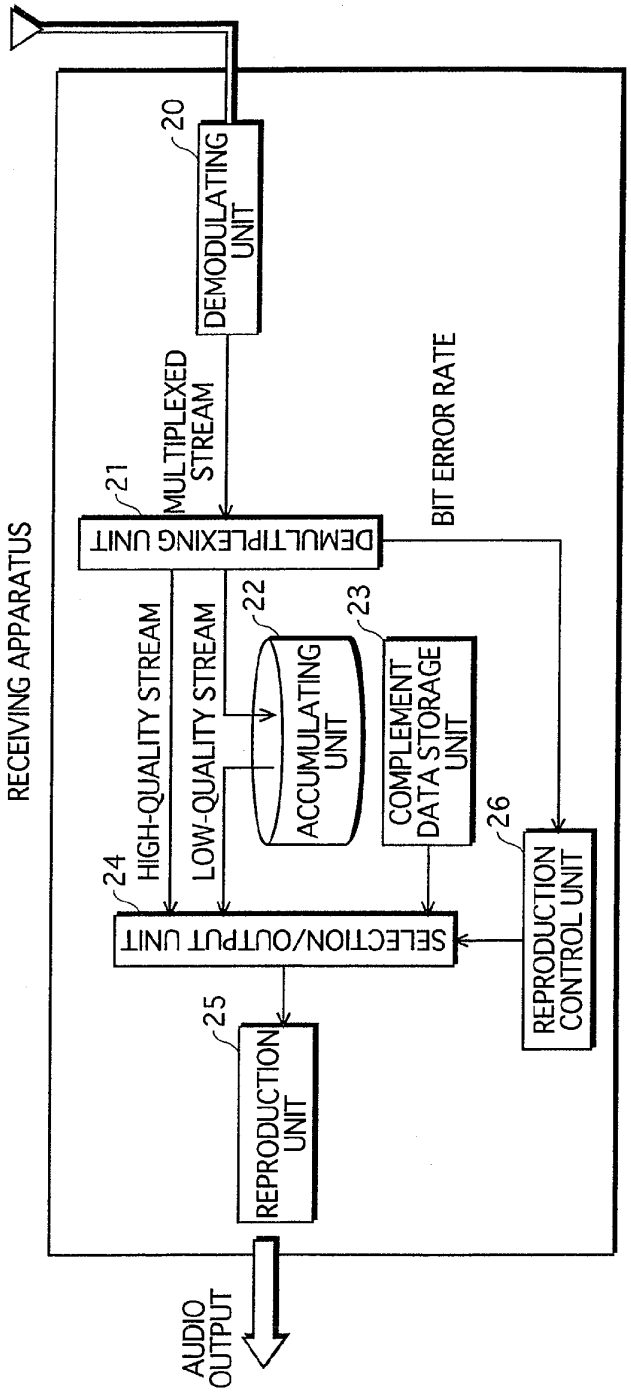
Webgroup CZ a.s. Ex. 1002, Page 515 of 1406

FIG.4



Webgroup CZ a.s. Ex. 1002, Page 516 of 1406

FIG.5



Webgroup CZ a.s. Ex. 1002, Page 517 of 1406

FIG.6

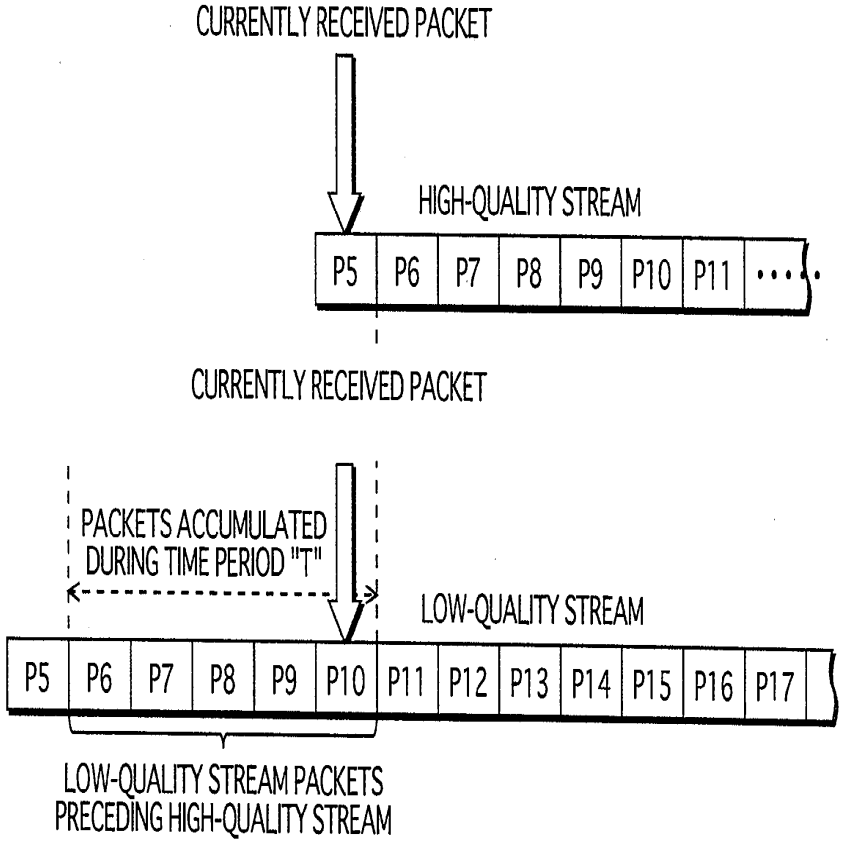

CURRENTLY RECEIVED PACKET
HIGH-QUALITY STREAM
P5
P6
P7
P8
P9
P10
P11
CURRENTLY RECEIVED PACKET
PACKETS ACCUMULATED DURING TIME PERIOD "T"
LOW-QUALITY STREAM
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
LOW-QUALITY STREAM PACKETS PRECEDING HIGH-QUALITY STREAM

FIG.7A

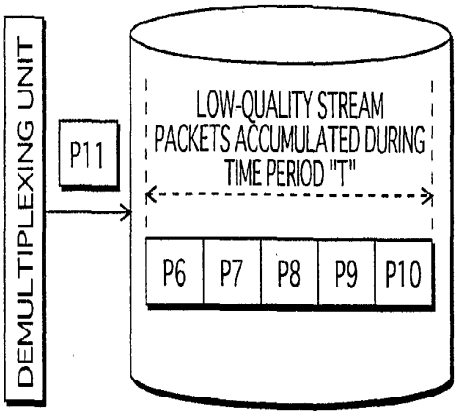


FIG.7B

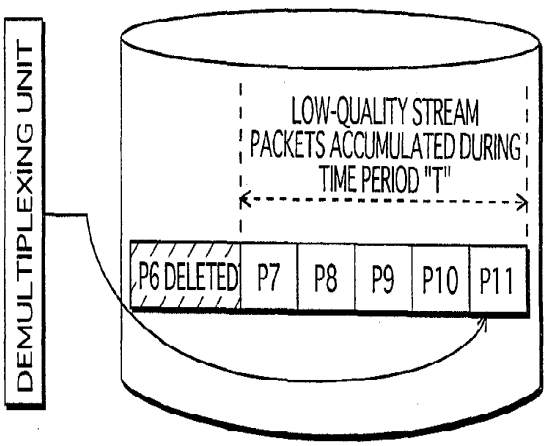


FIG.7C

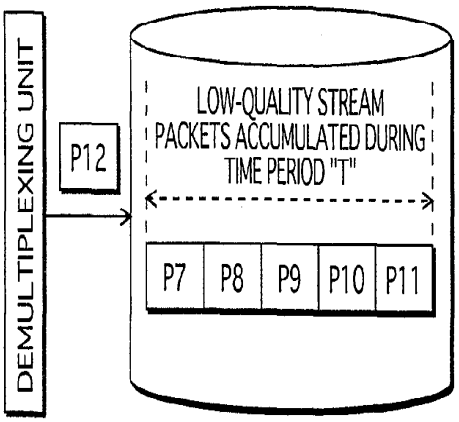


FIG.7D

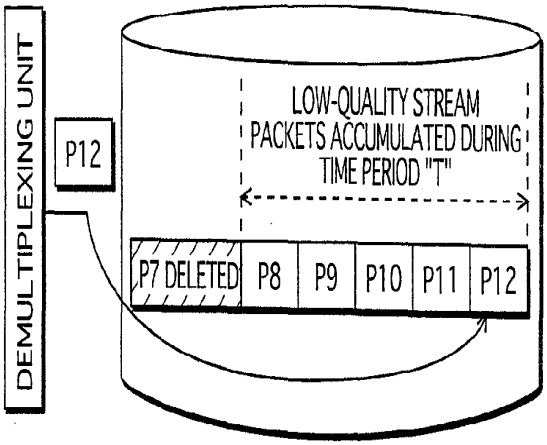
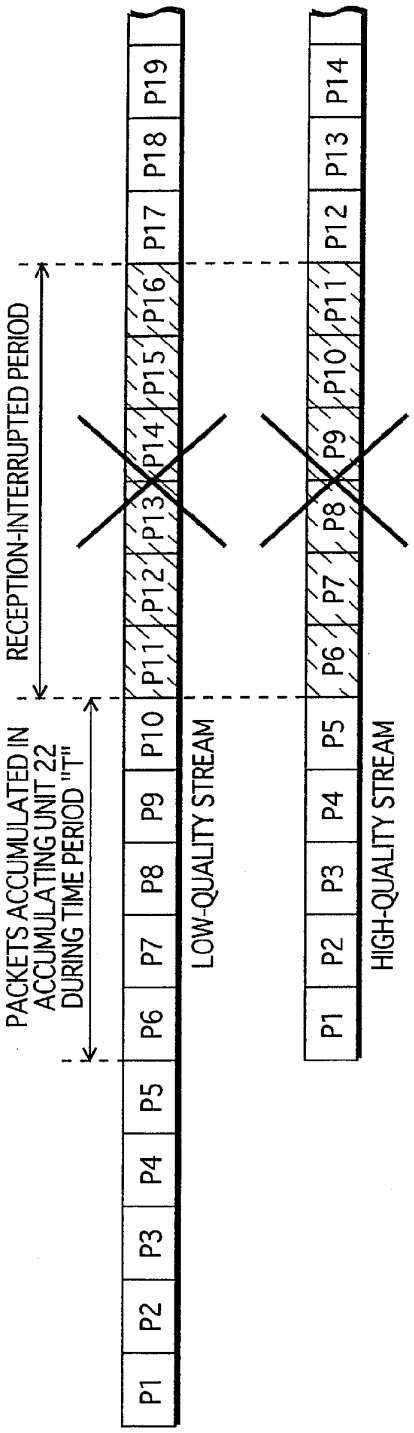
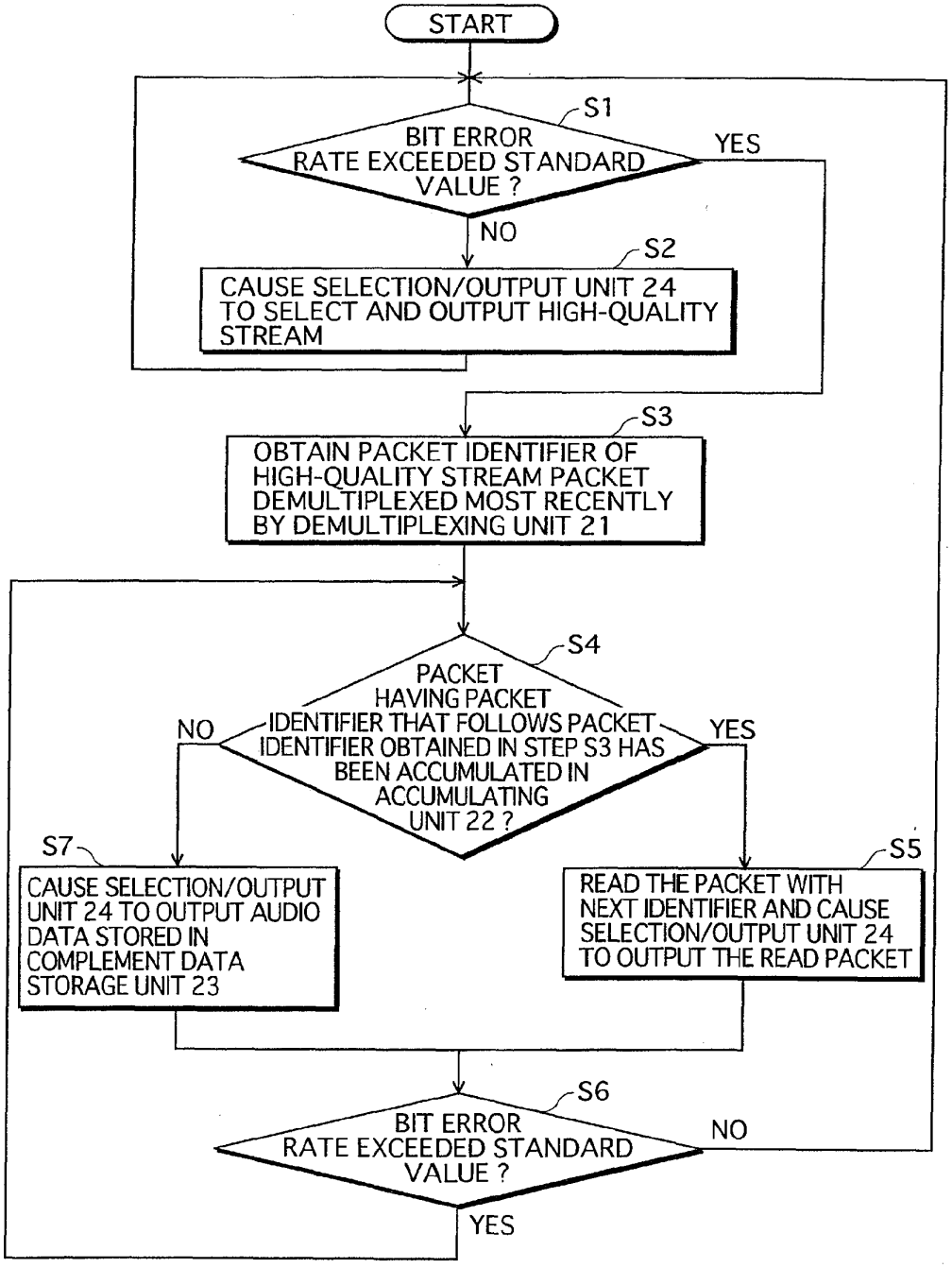


FIG.8



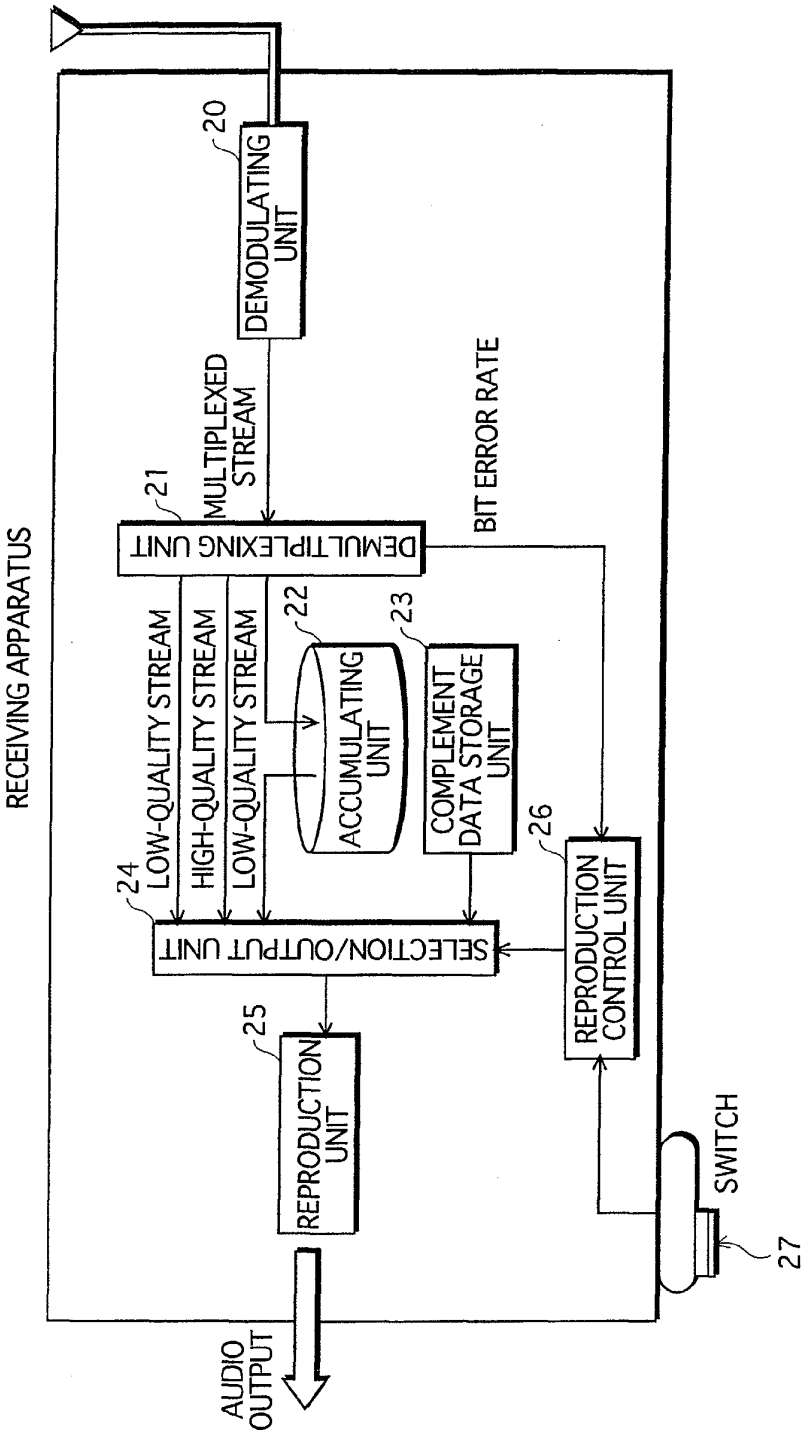
Webgroup CZ a.s. Ex. 1002, Page 520 of 1406

FIG.9



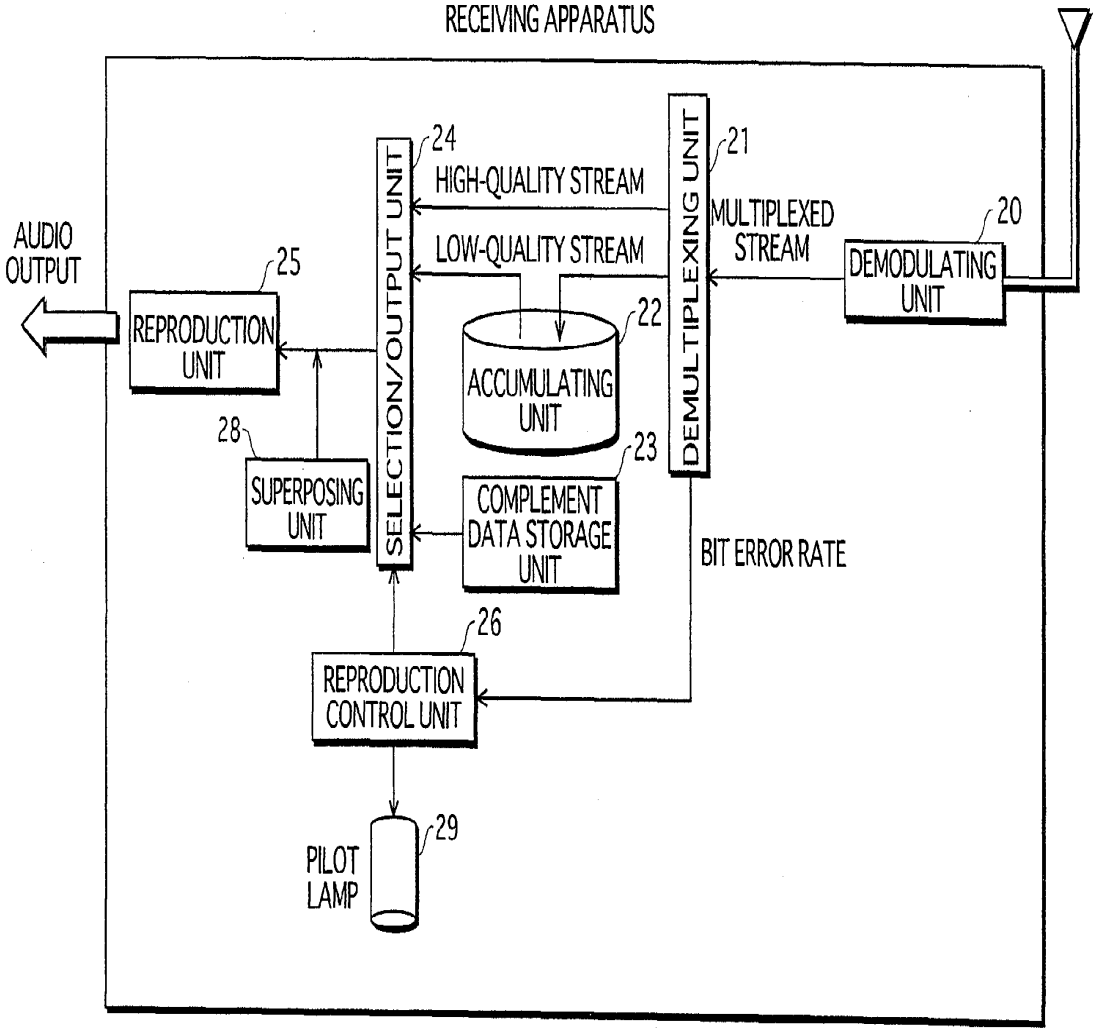
Webgroup CZ a.s. Ex. 1002, Page 521 of 1406

FIG.10



Webgroup CZ a.s. Ex. 1002, Page 522 of 1406

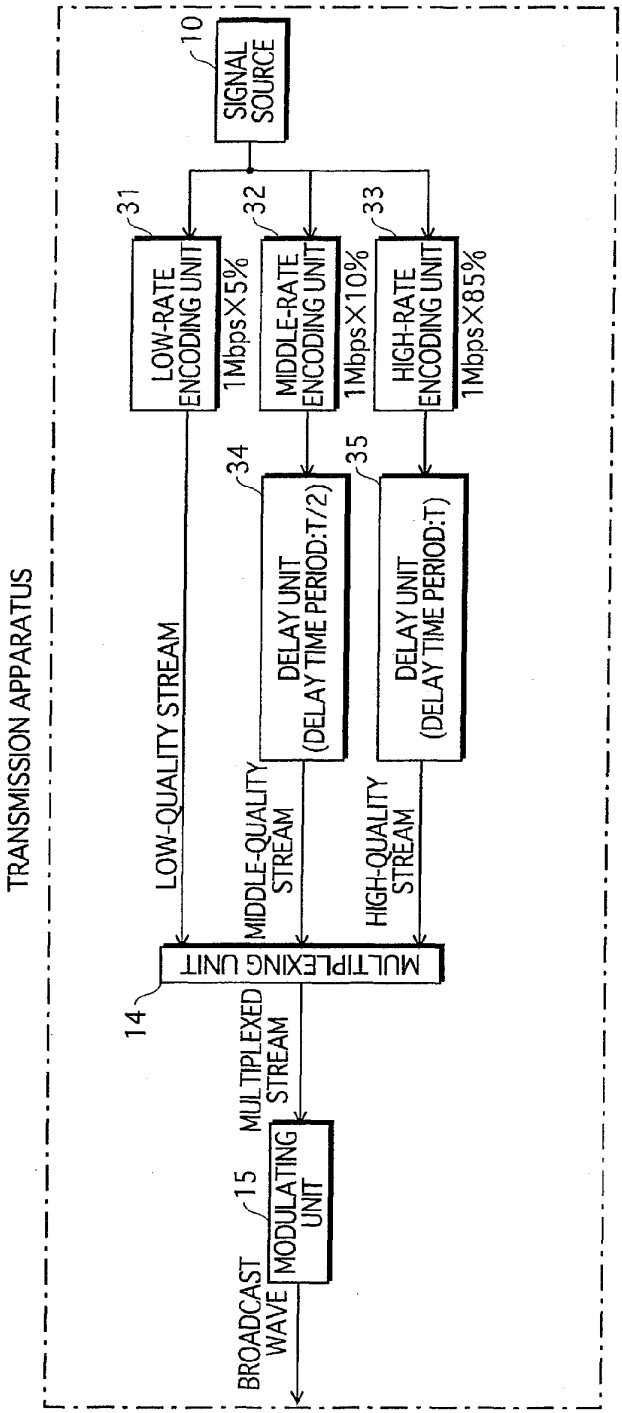
FIG.11



EP 1 394 973 A2

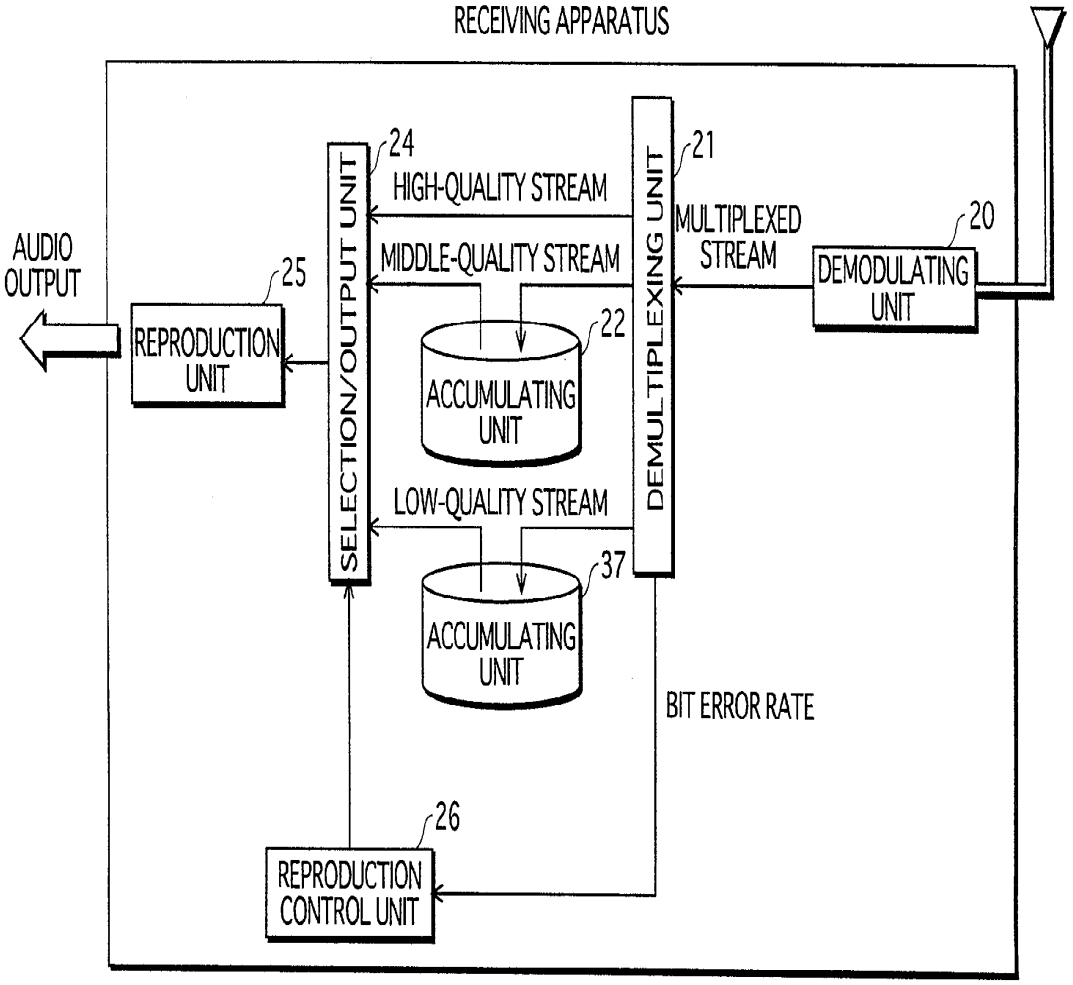
Webgroup CZ a.s. Ex. 1002, Page 523 of 1406

FIG.12



Webgroup CZ a.s. Ex. 1002, Page 524 of 1406

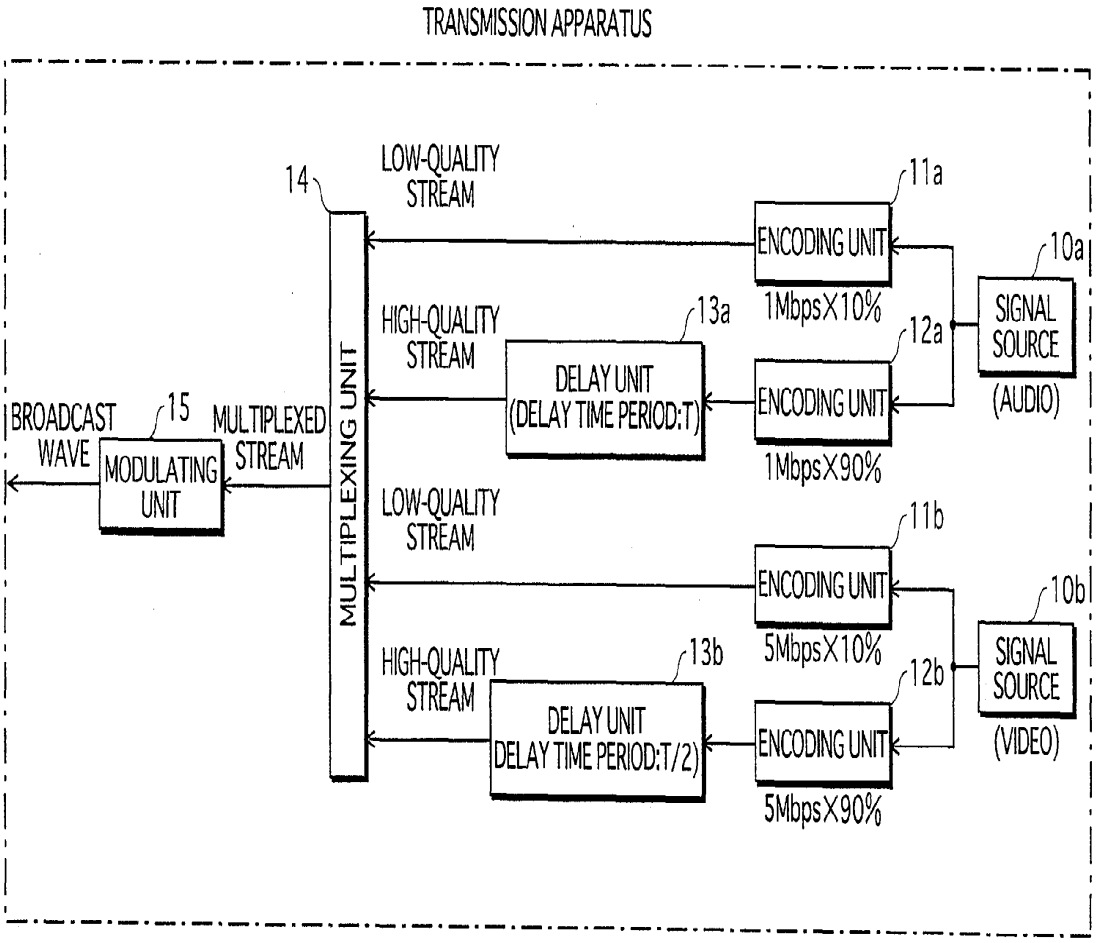
FIG.13



28

EP 1 394 973 A2

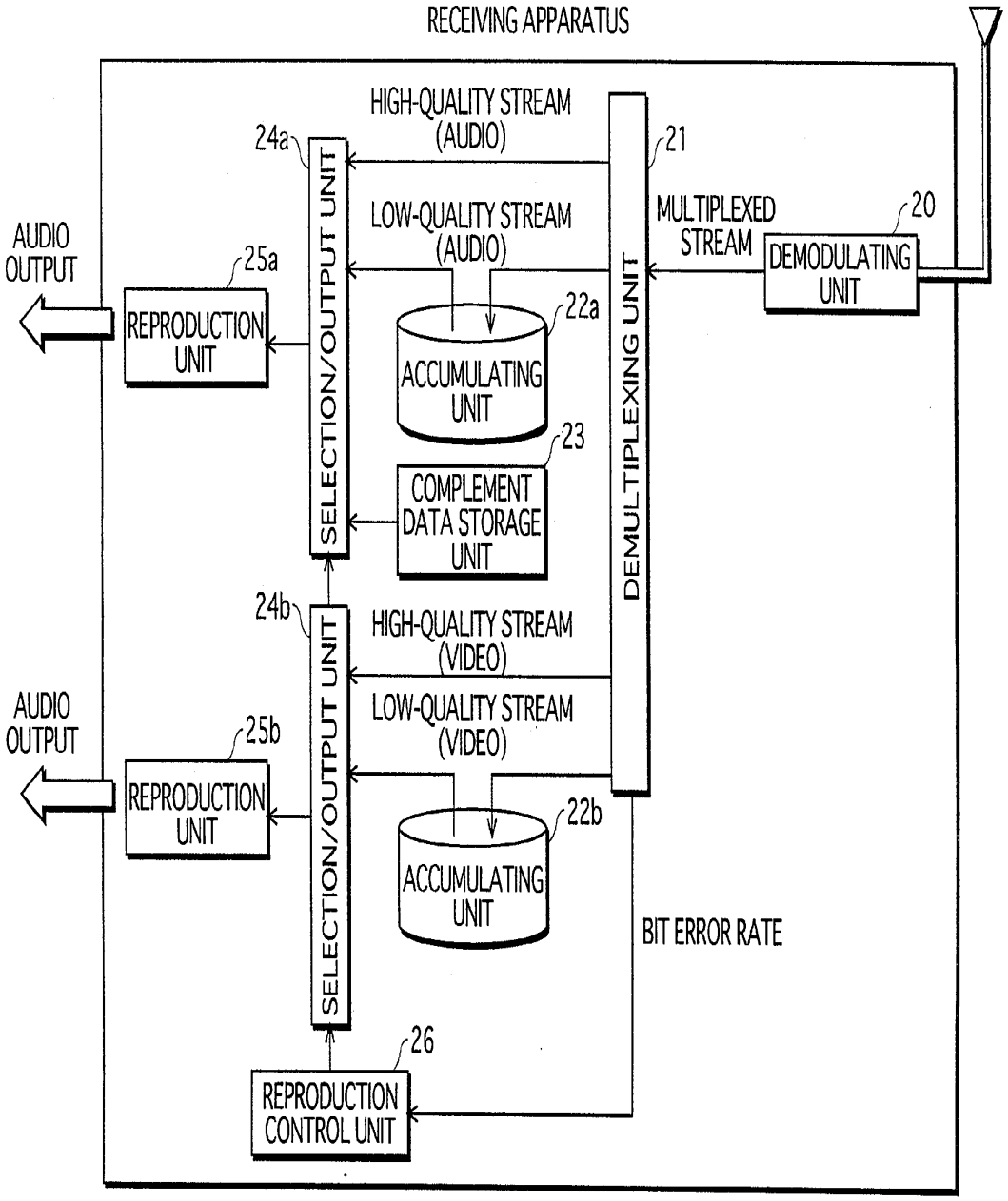
FIG.14



EP 1 394 973 A2

Webgroup CZ a.s. Ex. 1002, Page 526 of 1406

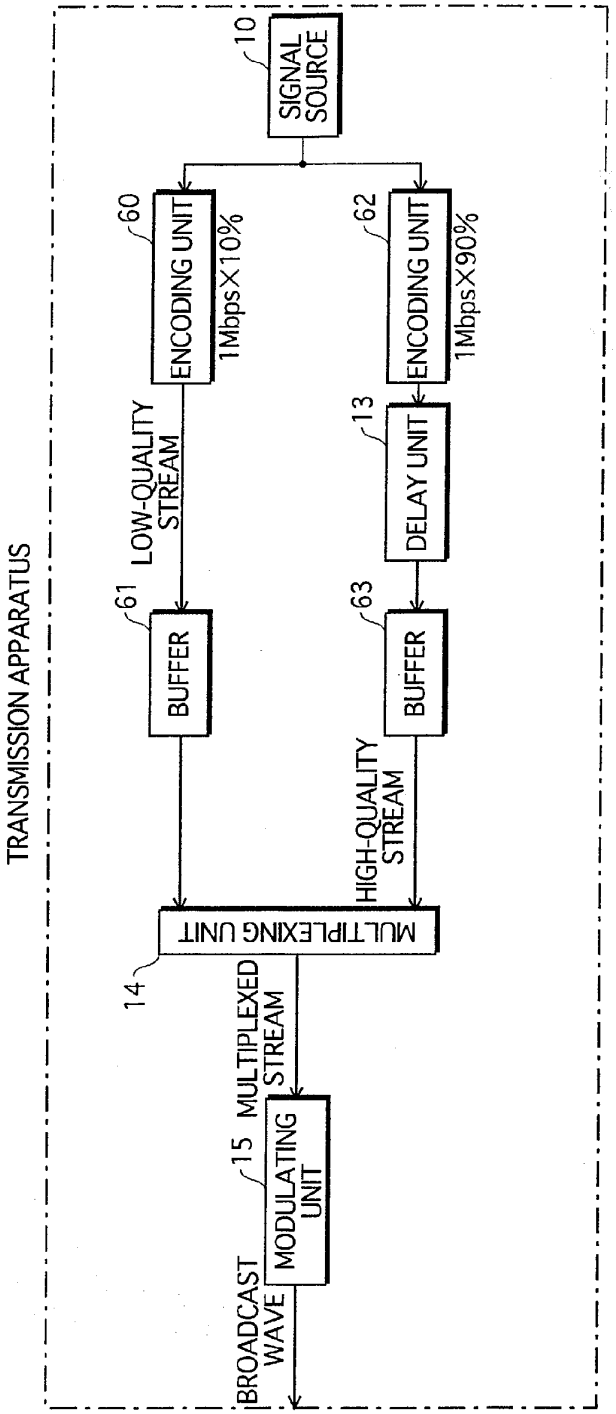
FIG.15



30

EP 1 394 973 A2

FIG.16



Webgroup CZ a.s. Ex. 1002, Page 528 of 1406

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(71) Applicant *(for all designated States except US)*: **BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY** [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **JACOBS, Richard, James** [GB/GB]; 15 Through Duncans, Woodbridge, Suffolk IP12 4EA (GB). **WALKER, Matthew, David** [GB/GB]; 9 Thirlmere Court, Felixstowe, Suffolk IP11 9SN (GB). **MIRAS, Dimitrios** [GR/GR]; 12 Proti Parodos Avras, 24100 Kalamata (GR).

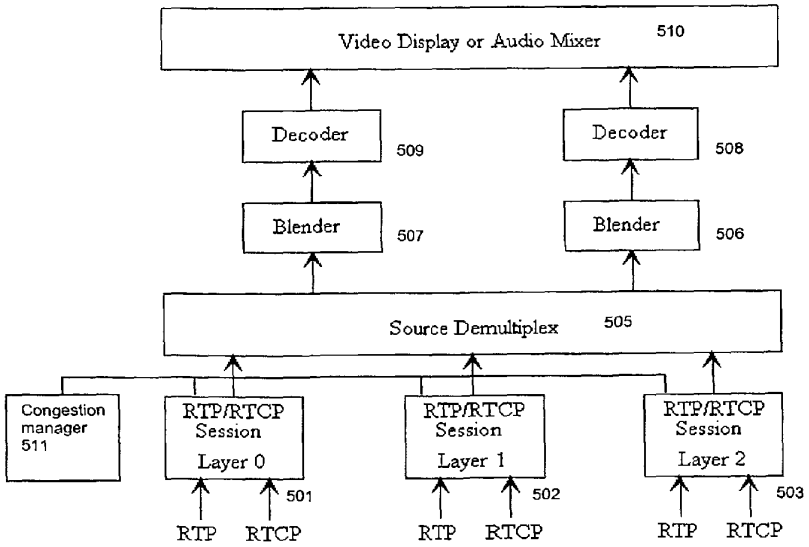
(74) Agent: **WILLIAMSON, Simeon, Paul**; 0T Group Legal, Intellectual Property Department, Holborn Centre 8th Floor, 120 Holborn, London EC1N 2TE (GB).

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[Continued on next page]

(54) Title: VIDEO STREAM SWITCHING



(57) Abstract: A technique is described for providing a client on a packet based network with a stream of encoded video data. The system is able to maximise the bit-rate of the video stream by adapting to fluctuations in network capacity. The technique is characterised in that adaptation of the bit-rate of the transmitted encoded video data is timed to occur upon a scene change in the video sequence. In this way the interruption to the viewer when the perceived quality of the video sequence increases or decreases is minimised as it is 'hidden' in the scene change. The technique is described as applied to hierarchically encoded video data but equally may be applied to other encoding techniques which adapt to network conditions.

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Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Video Stream Switching

The invention is in the field of video streaming over packet networks and in particular concerns the adaptive transmission of data in response to network congestion.

In recent years, the Internet has experienced a proliferation in transmission of real-time multimedia, mainly in the form of streamed audio-visual content, either delivered live or from pre-recorded sources. Furthermore, traditional forms of multimedia such as streaming and conferencing are being followed by applications with richer content such as Internet multi-channel TV and complex immersive environments. This increase in traffic will put strains on the network and it is therefore desirable that application programs are designed to respond to congestion if stability of the network is to be maintained. It is desirable that network conditions are monitored and output bit-rates adjusted to the available bandwidth.

There is a more immediate advantage to the user in having an adaptive output bit-rate which is that the highest possible transmission bit-rate that the network will allow is used and therefore the user will always receive the best possible image quality. There are a number of known approaches to adaptive quality video streaming, one of which is hierarchical coding. In this technique the original video data is encoded into a number of discreet streams called layers, where the first layer consists of basic data of a relatively poor quality and where successive layers represent more detailed information so that layers can be added to increase the image quality or layers can be taken away, depending on the available bandwidth.

As the bit-rate available to a session is subject to significant variations in the number of layers that are transmitted, quality fluctuations occur in the decoded image as layers are added or dropped. When layers are added or dropped frequently the fluctuations in quality may become disturbing to a viewer.

In a first embodiment of the present invention there is provided a method of operating a multimedia server, said method comprising:

providing a stream of video data representing a video sequence to an output of the multimedia server, wherein the output of the media server is connected to a packet based network,

measuring a property of the video data in order to determine the occurrence of a scene change in the video sequence,

detecting the available bandwidth on the network,

varying the bit-rate of the stream of video data,

wherein the method is characterised in that

variation in the bit-rate of the video data is controlled to occur in response to variations in the capacity of the network (203) and preferentially with a scene change in the video sequence.

The term preferentially used herein is meant to indicate that in certain circumstances (discussed in greater detail below) it may not be practical to wait for a change of scene to occur in the video sequence before varying the bit-rate of the video stream, and in such circumstances the bit-rate will be changed at points in the video stream which do not correspond to a change of scene.

The term scene change (or change of scene) is intended to refer to a sudden change in a video sequence within the space of a one or a very few frames such as typically occurs at a change of scene, whether or not there has been an actual change of scene.

Embodiments of the present invention will now be described, by way of example only, with reference to the following figures, where;

Figure 1 is a schematic diagram of the content-based inter-stream session bandwidth sharing architecture.

Figure 2 shows the order of packets in a layered coding system.

Figure 3 is a diagram of a media server.

Figure 4 is a diagram of the network interface of the media server shown in Figure 3.

Figure 5 is a diagram of a client.

Figure 6 is a diagram of a client according to a first embodiment of the present invention.

The client/ server arrangement for a known hierarchical streaming technology is shown in Figure 1. A media server 202 is provided which has access to compressed audiovisual data 201, which may be fed 'live' from an outside broadcast or may be pre-compressed and stored in a database. The data source 201 may be on the same premises as the media server 202 and linked via an intranet. The media server 202 runs on a suitable server computer and which has access to the Internet 203.

A video viewer, hitherto referred to as the client 204, running on a PC suitably configured to have access to the Internet 203, may connect to the media server 202 via the Internet 203 and thus the client 204 is able to access content. A suitable PC terminal is used.

Layered video compression is achieved with the 1998 version of H.263 but equally may be any other codec, such as MPEG4. Each layer in the hierarchy is coded in such a way as to allow the quality of individual pictures to be enhanced and their resolution to be increased, and additional pictures to be included to increase the overall picture rate, as explained with reference to Figure 2. Figure 2 illustrates a typical dependency between pictures in an H.263 scalable layered coder, with the boxes representing the frames for each layer and arrows showing the dependency between frames. The lowest row shows original, un-coded frames. The next row shows the lowest layer (Layer 0) of the hierarchy which is coded at half the frame rate of Layer 1. Frames in Layer 0 are predicted from the previously encoded frame, as in conventional video compression. Frames in Layer 1 may be predicted from the previously encoded frame in Layer 1 and, if present, the temporally simultaneous Layer 0 encoded frame. Frames in Layer 2 may be predicted from the previously encoded frame in Layer 2 and, if present, the temporally simultaneous Layer 1 or Layer 0 encoded frame. The H.263 specification allows for 15 layers; in the present embodiment server and client software is not limited in the number of layers that can be used, but in this case a database has been generated with video streams containing four layers.

Figure 3 shows the architecture of media server 201. In the present embodiment the audiovisual source is a database 301 of compressed video data and the media server 201 is responsible for reading the compressed data from a database, packetising and distributing it. The data is distributed according to the

Real-time Transport Protocol (RTP) which provides end-to-end network transport functions suitable for applications transmitting real-time data such as audio, video or simulation data. RTP does not address resource reservation and does not guarantee quality-of-service for real-time services. The data transport is augmented by a control protocol (RTCP) to allow monitoring of the data delivery and to provide minimal control and identification functionality. RTP and RTCP are designed to be independent of the underlying transport and network layers. The media server 201 has four major components: database reader 302, video RTP packetiser 303, audio RTP packetiser 305 and a network interface 304. Video and audio data are stored as files of compressed bits in the database 301. The database reader 302 retrieves and synchronises the compressed audio and video from the database 301.

The audio and video data is then sent to a RTP packetiser 303,305. Audio and video information is transmitted over the IP network using the User Datagram Protocol (UDP) and Real-time Transport Protocol (RTP) packetisation. UDP provides a checksum to detect transmission errors, but does not guarantee data delivery: packets may be lost, duplicated or re-ordered. RTP provides end-to-end delivery services, such as payload type identification, sequence numbering, time-stamping and delivery monitoring. RTP packetisers 303,305 attach the RTP Header and, in the case of video packets, the H.263 Payload Header which provides some protection from packet loss. The Payload Header contains information specific to the video stream, such as motion vector predictors, which is obtained by decoding the compressed bit stream.

The rate at which data is read from the database 301 is controlled from the network interface 304, which is illustrated in greater detail in Figure 4. With reference to Figure 4 the arrangement of the network interface 304 for the video data will now be described. A packet numbering module 401 assigns a number to each packet of data. These packet numbers are used by the client to assemble packets into the sequence required for decoding. The number of bits produced by compressing a picture is in general not constant, even when the transmission rate is constant. The first picture of a new scene will usually produce a larger number of bits than a picture where there is little movement or detail. The encoding process will use a control strategy together with an output data buffer to smooth these variations in preparation for transmission at a

constant bit rate. In the case of layered coding, each layer has its own control strategy and buffer as it has its own constant bit rate constraint to meet. The delay across each of these buffers will not be constant and will not be the same for each layer. Delay variation between the layers is therefore introduced at the source of the data. Transmission across a network may cause this delay variation to increase. A packet numbering scheme is therefore needed to ensure that a client can arrange the packets it receives into the order required for decoding. This scheme is required to handle the cases of the client not receiving all of the layers and of packet loss in the layers that it does receive.

Each layer is transmitted as an independent RTP Session on a separate IP address by a session handler 403, 405, 407, 409. The rate at which data is transmitted is controlled by the Transfer Rate Control module 402, which counts Layer 0 bytes to ensure that the correct number are transmitted in a given period of time. The transmission rate of the other layers is smoothed and locked to the rate of Layer 0 using First-In First-Out (FIFO) buffer elements 404, 406, 408.

The client 204 of the known hierarchical streaming technology will now be described with reference to Figure 5. Each RTP/RTCP Session associated with each layer of encoded data has a session handler 501, 502, 503, 504 at the client which is responsible for receiving RTP packets from the network.

The packets are then passed to a source demultiplex module 505. This receives packets from all layers and all sources, demultiplexes them by source, and routes them to a blender module 506, 507 for that source.

The blender module 506, 507 receives packets from all layers from one source in the order that they were received from the network. This may not be the order required for decoding because of packet inter-arrival jitter or packet loss. The blender module 506, 507 uses the packet numbers in the RTP headers to arrange the packets from each layer in order and then combines the packets from all layers together. The output of the blender module 506, 507 is a single stream of packets which are in the correct order for decoding. This is the same order as they come out of the packet numbering module 401 of the media server 202.

Packets are then sent to the decoder 508, 509 where the packets are decoded into 20ms blocks of audio samples or to video pictures. In the case of pictures, these are rendered to a window on the display 508.

Also provided is a congestion manager 511 to which the session handlers 501-504 report packet loss. If packets are being consistently lost, indicating network congestion, the congestion manager 511 will instruct the session handler responsible for the highest layer of compressed data to terminate the RTP/RTCP Session. Periodically the congestion manager 511 will instruct an experimental joining of a layer via the appropriate session handler to test whether there is available bandwidth in the network. If this experiment is successful, i.e. that substantially all of the packets of each layer are getting reaching the client, then the new layer will be adopted. In this way the maximum available bandwidth is employed.

It possible for the congestion manager 509 to instruct layers to be dropped and restored rapidly as the network bandwidth fluctuates. This could be annoying for a viewer and so a way of 'hiding' the shift is employed. The layered encoding method described above is adapted so that if a layer is to be dropped or added, the changeover preferentially occurs during a scene-change in the video data. A video scene is typically perceived as the number of consecutive frames within a video sequence that do not show significant changes in the video content. Within a video scene or shot, the camera action may be fixed or may exhibit a number of relatively uniform changes like panning, zooming, tracking etc. Scene changes may be recognised as abrupt transitions of the camera action or gradual transitions. In order to identify the scenes within a video sequence the assumption is that the levels of motion energy as well as those of luminance and colour do not change much between successive frames within a single scene. Techniques of scene boundary identification include pixel differencing, motion vector and block matching techniques. A very sudden change in the content of temporally adjacent frames will thus appear as a change of scene; clearly it is conceivable that such a change might not actually relate to a scene change at all, but, for example, may instead be the consequence of a large foreground object coming rapidly into view. However, such an abrupt change will nonetheless be a good place to add or remove a

session layer and thus the term scene change is meant to cover such large changes in frame content from one frame to another.

Figure 6 illustrates a system which detects congestion in the network and also imposes the extra condition of adding or dropping a layer upon a scene change. The server 601 comprises the components of the media server 202 of Figure 1 and the unit 603 comprises the components of the client 204 also shown in Figure 1. Video data from the audiovisual source is also passed to a content analyser 604 which segments the video sequence into scenes. The segmented video is then passed to an objective quality assessment module (OQAM) 605 which assesses the contribution to the perceived quality of a scene that each component layer provides.

These results are then passed to an inter layer adaptation module (ILAM) 607. The function of the ILAM 607 is to continuously calculate the number of layers that maximise the perceived quality for the session. The ILAM 607 also receives input from a sender congestion manager 608 which reports on the bandwidth available to the session on the network 203. The sender congestion manager 608 receives feedback from a client congestion manager 609 on the number of packets that have been received. If this matches the number of packets that were sent then the bandwidth is known to be the current transmission rate. If packets are being lost then the bandwidth available to the session is less than the transmission rate, in which case the sender congestion manager 608 informs the ILAM 607 that a layer should be dropped.

In order to select which layer should be dropped the ILAM 607 couples the bandwidth required by a layer with its contribution to the quality of the complete image, as calculated by the OQAM 605. The ILAM 607 performs an exhaustive search on all of the bandwidth/quality values. When the ILAM 607 has selected which layer is to be dropped from a particular scene, the timing of the drop is preferentially set to coincide with the transmission of that particular scene. In this way the drop in quality occurs with the scene change and is thus much less noticeable to a viewer than if the quality change had occurred during a scene. In the case that no packets have been lost for a preset period of time the sender congestion manager 608 will request the ILAM 607 to add in a layer to test

whether all of the available bandwidth is being employed. If no packets are lost during this experiment then the newly added layer is maintained. This process of experimentation with adding layers is continued until a significant proportion of packets are lost, in which instance the system can be confident that all of the available bandwidth is being employed. Again, the timing of the introduction of a layer is set to occur preferentially as the scene changes.

Under a given bit-rate allocation the levels of perceived quality do not change considerably within a scene, but scene cuts cause considerable changes in perceived quality, especially when the content features (spatial and motion energy) change a lot between subsequent scenes. As a consequence there will also be a significant difference in the corresponding quality scores for those successive scenes which may justify a rescheduling of the number of layers in the stream.

The invention is not limited in use to hierarchical encoding schemes. The invention is suitable for use in any encoding technique where the adaptation of transmission bit-rate to accommodate fluctuations in network capacity occurs. For instance the invention may be applied to a transcoding system where encoded data streams are transcoded from a high bit-rate to a low bit-rate or from a low bit-rate to a high bit-rate. The present invention would be suitable to reduce the impact for the viewer as the output bit-rate shifts in response to network conditions by timing the transition to occur upon a scene change in the encoded video sequence. Another example of an adaptive video streaming technique to which the invention may be applied is where multiple independent video streams of different bit-rates are transmitted. In this case the client chooses which stream to accept based on session bandwidth. The client may switch from one stream to another as bandwidth fluctuates; the present invention ensures that the switch is timed to coincide with a scene change in the encoded video stream.

Naturally, there may be times when a change of scene is such a long way away that it is advantageous to switch from one bit-rate to another other than during a change of scene. For example, consider the case where multiple independent video streams at different bit-rates are available for transmission by a media server to a client as, for example, described in co-pending European patent

application No. 00310594.7 the contents of which are hereby incorporated herein by way of reference. In such a case, the server may be capable of transmitting a first stream at a bit-rate of 500kbit/s and a second, higher quality stream at a bit-rate of 1500kbit/s. The client may initially request that the server transmit the first stream at a transmission rate of 1000kbit/s. If the network is not congested and all of the packets transmitted are successfully received by the client, the receive buffer at the client will start to fill with data at a rate of 500kbit/s, since the client will only be removing data from the buffer at a rate of 500kbit/s. After say 10 seconds of filling up the buffer at this rate, the client will have a buffer of ten seconds worth of data at which point it may decide it can attempt to receive the higher bit-rate second stream of video data from the server and thus sends an appropriate request to the server to this effect. If, however, the server is aware that the client has a receive buffer of 5 Mbytes size, it knows that it may continue sending data from the first stream at the rate of 1000kbit/s for at least another 150 seconds before the receive buffer overflows, causing problems for the client. Therefore, the server may attempt to wait for a specified period to see if a scene change occurs during this interval. If so, a switch to the second higher bit-rate signal is not made until the change of scene occurs. Of course, if there is no change of scene within the determined period, the server switches to the higher rate anyway. In this example, a period of only ten seconds is deemed appropriate as the waiting time.

Note that instead of simply waiting to see if a change of scene occurs in the specified period and switching at the end of the period if no such change of scene is detected, an alternative method would be to pre-analyse the video to be sent (clearly this only applies to pre-stored video data and not live video) and to note when changes of scene occur. In such a case, the server, upon receipt of a request from the client to switch streams, could search to see if a suitable change of scene will occur within the predetermined period and if not to switch immediately to the new bit stream.

In the present example, upon switching to the higher rate bit stream, the client may have requested a transmission rate of 1500kbit/s corresponding to the rate at which the data will be drawn from the receive buffer by the client. In such a case, the buffer size of 10 seconds should remain constant so long as all of the

transmitted packets are successfully received by the client. However, in the event of congestion on the network, a proportion of packets may fail to arrive at the client. In such a case, the server will be warned of this via the RTCP. If the congestion is sufficiently severe, the server may deduce that the buffer is in danger of emptying which would cause a break in the video displayed by the client to occur. To prevent this, the server may switch back to the lower bit rate stream. Via the notification of how many packets are being lost, the server can deduce how long it will be before the buffer is emptied. For this time, the server can wait to see if a change of scene occurs, and if so, the new stream will be switched to at that point. Note that it would also be possible for the client to simply request that the new stream be switched to upon detecting that its receive buffer is emptying at an unsustainable rate.

Note that the amount of data in the buffer is actually of less significance than the rate of change of the amount of data in the buffer. Thus it is preferably this quantity which either the server or the client measures in order to determine whether to change from one bit stream to another (or whether to add or drop a layer in the first example).

CLAIMS

1. A method of operating a multimedia server (202), said method comprising;

providing a stream of video data representing a video sequence to an output of the multimedia server (202), wherein the output of the media server (202) is connected to a packet based network (203),

measuring a property of the video data in order to determine the occurrence of a scene change in the video sequence,

detecting the available bandwidth on the network (203),

varying the bit-rate of the stream of video data,

wherein the method is characterised in that

variation in the bit-rate of the video data is controlled to occur in response to variations in the capacity of the network (203) and preferentially with a scene change in the video sequence.

2. A method of operating a multimedia server (202) in accordance with claim 1 wherein upon detecting a decrease in the available bandwidth the bit-rate of the video data is decreased.

3. A method of operating a multimedia server (202) in accordance with claim 1 wherein the bit-rate of the video data is periodically increased in order to ensure that all of the available bandwidth is being used.

4. A method of operating a multimedia server 202 in accordance with claims 1 to 3 wherein said stream of video data is comprised of a plurality of hierarchically encoded layers.

5. A method of operating a multimedia server (202) in accordance with claim 4 wherein the bit-rate of the video data is varied by adding or dropping layers from the stream of data transferred to the output port.

6. A method of operating a multimedia server (202) in accordance with claims 4 or 5 wherein the objective quality contribution of each layer to the

overall quality of the video sequence is measured in order to determine which of the layers is to be added or dropped from the stream of data transferred to the output port.

7. A method of operating a multimedia server 202 in accordance with claims 1 to 3 wherein said stream of video data is comprised of a plurality of independently encoded flows each of which encoded at different bit-rates.

8. A method of operating a multimedia server (202) in accordance with claim 7 wherein the bit-rate of the video data is varied by switching between independently encoded flows.

9. A method of operating a multimedia server 202 in accordance with any of the preceding claims in which the source 201 of video data is stored in encoded form in a database.

10. A method of operating a multimedia server 202 in accordance with any of claims 1 to 8 in which the source 201 of video data is encoded in real-time.

11. A method of operating a multimedia server 202 in accordance with any of the preceding claims wherein, upon detecting a variation in the capacity of the network such as to render it appropriate for a change in bit rate to occur, the server waits for a predetermined time to attempt to detect a change of scene, and if such a change of scene is detected within the predetermined time, the change of bit rate is caused to occur at the time of the change of scene, but if a change of scene is not detected within the predetermined time, then the change of bit rate is caused to occur at the expiry of the predetermined time.

12. A method of operating a multimedia server 202 in accordance with any of the preceding claims wherein, upon detecting a variation in the capacity of the network such as to render it appropriate for a change in bit rate to occur, the server determines if there is going to be a change of scene within a predetermined time, and if it is determined that there will be such a change of scene within the predetermined time, the change of bit rate is caused to occur at the time of the change of scene, but if it is determined that there is not going to

be a change of scene within the predetermined time, then the change of bit rate is caused to occur substantially immediately after having made such a determination.

13. The method of claim 12 further including the step of, prior to providing a stream of video data to the output of the media server, processing the video data to determine the positions within the video data in which changes of scenes occur and making this information available for permitting whether a scene change will occur within a predetermined period at any point along the stream of video data.

14. A multimedia server (202) comprising;

a reader (302) for reading video data representing a video sequence from a source (301),

a scene change detector (604) for detecting changes of scene in the video sequence,

a bit-rate controller (607) for controlling the rate at which the video data is transferred from the reader to an output port, wherein the output port is capable of communicating with a client (204) on a packet network (203);

the media server further comprising means (608) for detecting available bandwidth between the multimedia server (202) and client (204) on the packet network,

characterised in that

the bit-rate controller (607) is arranged to vary the bit-rate of the video data transferred to the output port in dependence on the detected bandwidth preferentially in correlation with a scene change detected by the scene change detector (604).

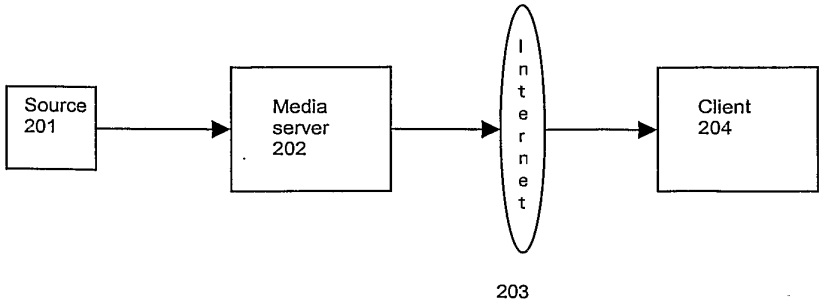


Figure 1

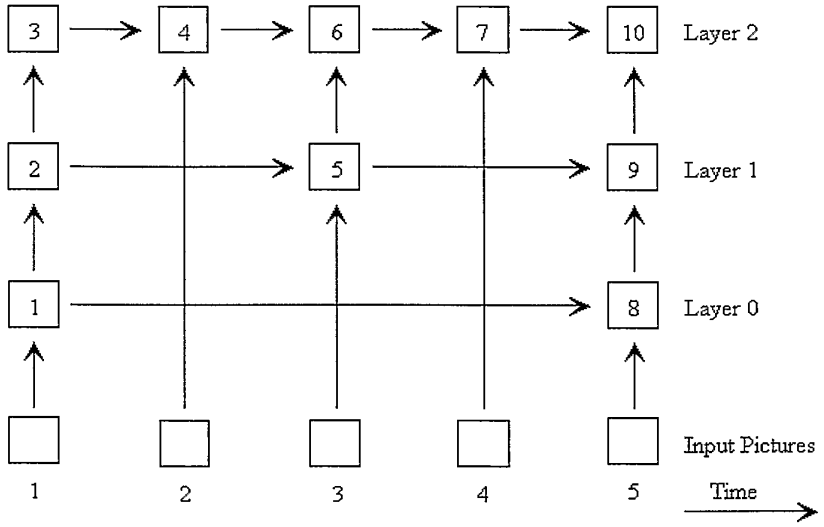


Figure 2

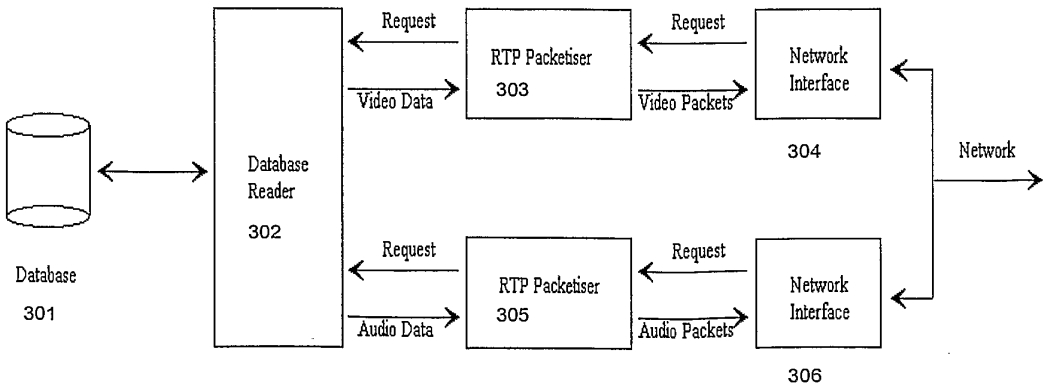


Figure 3

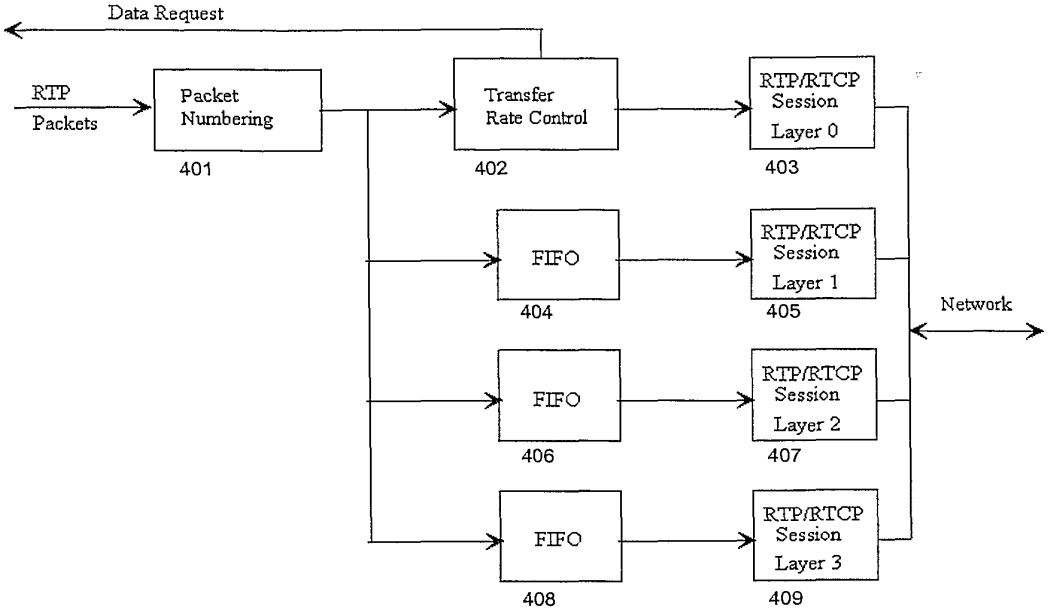


Figure 4

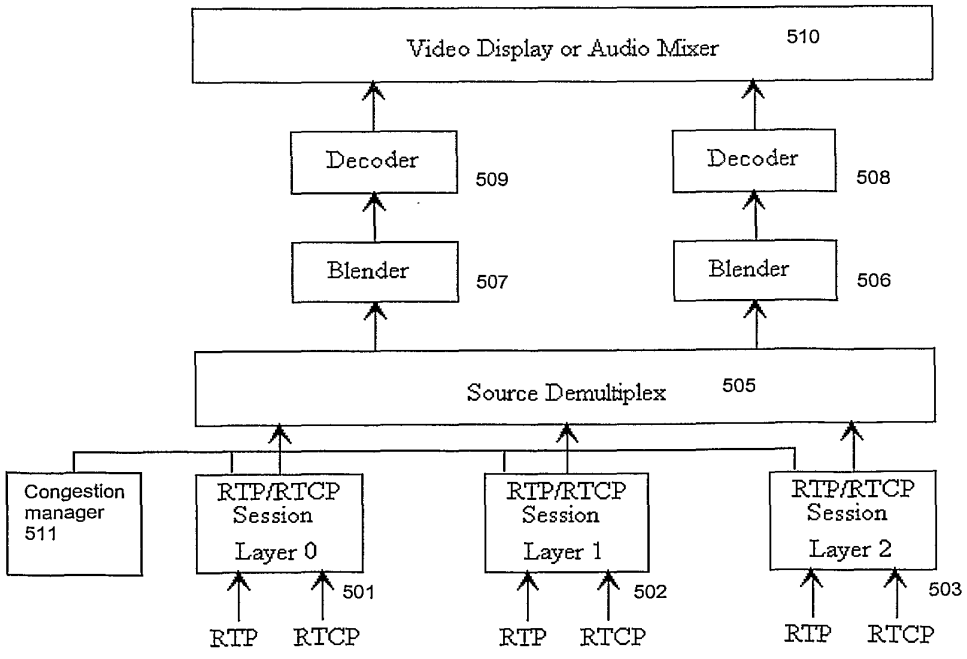


Figure 5

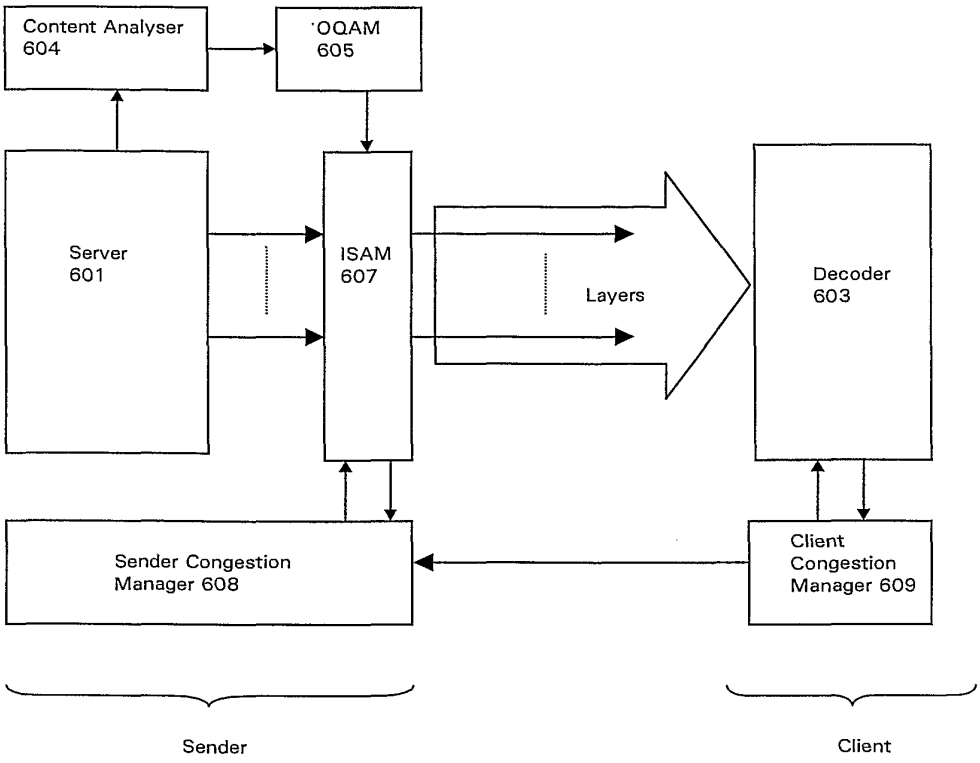

Content Analyser
604
OQAM
605
Server
601
ISAM
607
Layers
Decoder
603
Sender Congestion
Manager 608
Client
Congestion
Manager 609
Sender
Client

Figure 6

INTERNATIONAL SEARCH REPORT

ational Application No
PCT/GB 02/03307

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/00 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N H04L G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 014 694 A (AHARONI AMIR ET AL) 11 January 2000 (2000-01-11)	1-10,14
Y	abstract column 2, line 29 - line 65 column 3, line 62 -column 4, line 34 column 8, line 54 -column 9, line 35 column 10, line 34 - line 49 column 14, line 34 -column 15, line 6	11-13
X	ANONYMOUS: "Method to Deliver Scalable Video across a Distributed Computer System" IBM TECHNICAL DISCLOSURE BULLETIN, IBM CORP. NEW YORK, US, vol. 5, no. 37, 1 May 1994 (1994-05-01), pages 251-256, XP002079392 ISSN: 0018-8689	1-10,14
A	the whole document	11-13

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 September 2002	23/09/2002

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

nal Application No
PCT/GB 02/03307

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 038 000 A (HURST JR ROBERT NORMAN) 14 March 2000 (2000-03-14)	11-13
A	column 2, line 52 -column 3, line 22 column 4, line 20 - line 49 column 6, line 9 - line 45 column 7, line 1 - line 24 column 13, line 46 -column 14, line 18 column 20, line 13 - line 30	1,14
A	EP 1 079 631 A (SONY UK LTD) 28 February 2001 (2001-02-28) page 3, line 1 - line 4	1-14
A	US 5 990 945 A (DENTENEER THEODORUS J J ET AL) 23 November 1999 (1999-11-23) abstract column 3, line 13 - line 35 column 4, line 42 - line 44 column 5, line 37 - line 39	11-13

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

ıtional Application No
PCT/GB 02/03307

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6014694 A	11-01-2000	AU 7928998 A	19-01-1999
		EP 0992160 A1	12-04-2000
		WO 9900984 A1	07-01-1999
		JP 2002511216 T	09-04-2002
US 6038000 A	14-03-2000	US 6137834 A	24-10-2000
		EP 0954924 A1	10-11-1999
		JP 2001509354 T	10-07-2001
		WO 9832281 A1	23-07-1998
		EP 0901718 A1	17-03-1999
		JP 2002503402 T	29-01-2002
		KR 2000016034 A	25-03-2000
		WO 9745965 A1	04-12-1997
EP 1079631 A	28-02-2001	GB 2353653 A	28-02-2001
		EP 1079631 A1	28-02-2001
		JP 2001119305 A	27-04-2001
US 5990945 A	23-11-1999	CN 1199532 A	18-11-1998
		EP 0860087 A1	26-08-1998
		WO 9809442 A1	05-03-1998
		JP 11514825 T	14-12-1999

IDS CERTIFICATION STATEMENTS

I. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(b): (check one box)**

☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

☐ Within three months of the date of entry of the national stage as set forth in 1.491 in an international application.

☐ Before the mailing date of a first Office Action on the merits. In the event that a first Office Action on the merits has been mailed, please consider this IDS under 37 C.F.R. 1.97(c) and see the statement under 1.97(e) or charge deposit account 50-2091 the fee specified by 37 C.F.R. 1.17(p) if such statement is not selected in Section IV.

☑ Before the mailing of a first Office Action after the filing of a request for continued examination under 1.114.

II. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(c):**

☐ After the period specified in 37 C.F.R. 1.97(b) and before the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, and accompanied by:

- ☐ a statement specified in 1.97(e) as subsequently provided in this IDS; or
- ☐ the fee set forth in 1.17(p).

III. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(d):**

☐ After the period specified in 37 C.F.R. 1.97(c) and on or after the mailing date of any of a final action under 1.113, a notice of allowance under 1.311 or an action that otherwise closes prosecution in the application, but before or simultaneous with payment of the issue fee, and accompanied by a statement specified in 1.97(e) as subsequently provided in this IDS **and** the fee set forth in 1.17(p).

IV. **Statement under 37 C.F.R. 1.97(e) (check only one box)**

The undersigned hereby states that:

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☐ No item of information contained in the IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the IDS was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this IDS.

V. **Statement under 37 C.F.R. §1.704(d)**:

☐ The undersigned hereby states that each item of information contained in the information disclosure statement: (i) was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement; or (ii) is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of the information disclosure statement..

VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

If the Examiner has any questions concerning this IDS, the Examiner is requested to contact the undersigned at the telephone number associated with Customer No. 70560 . If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule, with a petition if necessary, and charge the appropriate fee to Deposit Account No. 50-2091.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
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(71) Applicant *(for all designated States except US)*: **BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY** [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **WALKER, Matthew, David** [GB/GB]; 9 Thirlmere Court, Felixstowe, Suffolk IP11 9SN (GB). **JACOBS, Richard, James** [GB/GB]; 15 Through Duncans, Woodbridge, Suffolk IP12 4EA (GB). **NILSSON, Michael, Erling** [GB/GB]; 5 Laburnum Gardens, Rushmere St. Andrew, Ipswich IP5 1BY (GB).

(74) Agent: **ROBINSON, Simon, Benjamin**; BT Group Legal Services, Intellectual Property Dept., Holborn Centre, 8th Floor, 120 Holborn, London EC1N 2TE (GB).

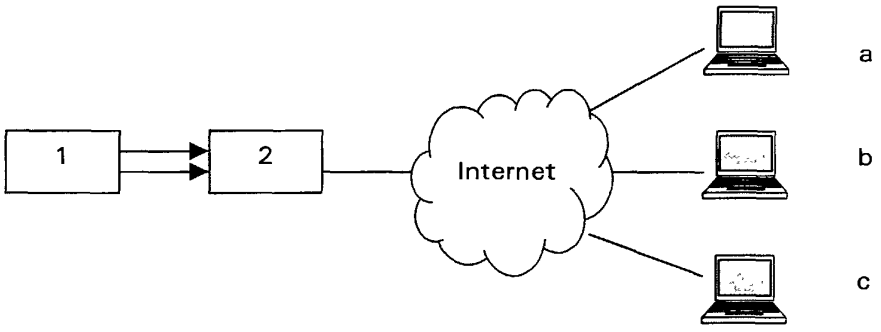
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(54) Title: TRANSMITTING AND RECEIVING REAL-TIME DATA



(57) Abstract: The invention concerns streaming real-time data (e.g. video) over packet networks (e.g. the Internet). Conventionally, in packet networks, in order to view streamed video data a reservoir of data is built up to reduce the effect of jitter, caused by variations in the inter-arrival times of packets of data. Consequently, a delay is experienced before the video material can be viewed as the reservoir is filled. The invention is concerned with providing streamed video without the start-up delay by transmitting data from a video streamer to the video viewer more rapidly than the video viewer consumes the data and using the excess data to build a buffer at the video viewer. When a suitable sized buffer is built the transmission rate of data to the buffer may be reduced. In order to deliver the best quality material for the available bandwidth, the supply of video data may be switched to a higher bit-rate source when the reservoir is filled. Fluctuations in network throughput may be accommodated during the transmission of data on a fine scale by adjusting the transmission rate of the data and on a coarse scale by switching between data streams encoded at different bit-rates. Fluctuations in network throughput are determined by counting the number of missing packets at the video viewer which information may then be fed back to the video streamer to adjust the flow of data accordingly.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Transmitting and Receiving Real-Time Data

The invention is in the field of handling of time-sensitive data over packet switched networks, and more particularly transmitting and receiving video data over the Internet.

The invention relates to a method of providing a streaming video service to a client across a packet network whilst reducing the start-up delay usually associated with preparing a buffer of data while maintaining the use of a buffer. The invention also relates to a method of controlling the transmission rate of the streaming video to adapt to congestion in the network.

Traditionally the Internet has supported traffic such as FTP, e-mail and web-surfing, where the overall delay does not intrinsically detract from the final presentation of the media. The advent of faster processing multimedia PC's has driven the delivery of multimedia, including video, over the Internet. Time-sensitive applications however require continuous, quality of service guaranteed, high bandwidth data channels, which is seemingly at odds with the packet-based nature of the Internet and has the potential to disrupt transmissions with unacceptable packet jitter, i.e. the variation in the inter-arrival times of packets caused by variable routing and changeability of delivery rates owing to congestion. Currently, commercial streaming technologies overcome jitter by constructing a large buffer (5-30 seconds) before starting to playback video material. This start-up delay is non-optimal for a user, who may have to wait for this period, before realising that the content requested is incorrect; and generally detracts from the users experience of the multimedia presentation.

According to a first aspect of the present invention there is provided a method of operating a real-time communication apparatus comprising a real-time data sender, a real-time data display device having a store and a network connecting said sender and said display device, said method comprising the steps of:

operating said sender to transmit a plurality first-encoding-rate data packets representing a first part of a real-time presentation to said display device, said transmission rate being higher than said encoding rate;

operating said display device to:

receive said first-encoding-rate data packets into said store;

remove first-encoding-rate data packets from said store at said first encoding rate for decoding to present said real-time presentation to said user at a first level of quality;

on said store being filled with said first-encoding-rate data to a predetermined level, sending an indication that said level has been reached to said sender;

operating said sender, on receipt of said indication, to send second-encoding-rate data packets representing subsequent parts of said real-time presentation to said display device, said second encoding rate being higher than said first encoding rate;

operating said display device to:

receive second-encoding-rate data packets representing a subsequent part of real-time presentation into said store;

remove second-encoding-rate data packets from said store at said second encoding rate for decoding to present said real-time presentation to said user at a second level of quality higher than said first level of quality.

According to another aspect of the present invention there is provided a method of presenting time-sensitive data at a client while constructing a buffer of time-sensitive data, said method comprising receiving time-sensitive data which has been transmitted to said client, passing said time-sensitive data to a data buffer; and, monitoring the quantity of time-sensitive data in the data buffer; reading said time dependent data out of the data buffer to be processed for viewing; wherein the method is characterised in that the rate at which the time-sensitive data is read out of the data buffer is lower than the rate at which the time-sensitive data is passed to the data buffer; and the time-sensitive data is read out of the data buffer when it

arrives in the data buffer, such that there is substantially no delay between the client receiving the time-sensitive data and making the time-sensitive data available; and, presenting the time-sensitive data.

There will come a point when the data buffer becomes sufficiently full. The rate of transmission can then be reduced to equal the rate of consumption by the viewing means which will bring the quantity of data in the buffer to an equilibrium. However, in this situation the bandwidth of the connection may not be employed to full capacity.

In a further aspect of the present invention there is provided a method of presenting time-sensitive data at a client, wherein, time-sensitive data encoded at a first bit-rate is received until a pre-determined quantity of data fills the data buffer, whereupon time-sensitive data encoded at a second bit-rate is received, wherein said second bit-rate is higher than the first bit-rate.

A still further aspect of the present invention provides a method of providing time-sensitive data to a client is taught, wherein time-sensitive data encoded at a first bit-rate is read from a first data buffer at a first transmission rate to be transmitted to the client; and, upon request, time-sensitive data encoded at a second bit-rate is read from a second data buffer at a second rate.

It is desirable to use as much of the available bandwidth of a link as possible to transmit data because with a higher bit-rate of video data comes better quality reproduction. However, loss of data in the network causes severe degradation of service – far outstripping the benefits of increased bit-rate. For example, with predictive coding schemes such as H.263 and MPEG, receiving half of a 500 $kbits^{-1}$ video stream is likely to give a much worse quality than all of a 250 $kbits^{-1}$ stream. It is therefore important to reduce transmission rate in a controlled way, rather than letting data be lost to the network. The Internet protocol TCP has a built-in control mechanism whereby the data transmission rate is steadily increased until packet loss is detected, whereupon the data rate is reduced. The data rate is then increased again until packet loss reoccurs. A variable transmission rate is said to be elastic and applications which are able to control the transmission rate of data in response to network conditions are said to be TCP-friendly. It is desirable to provide video data in

a TCP-friendly way so that the as much of the bandwidth available at any particular time is utilised. A further benefit of TCP-friendly data delivery is that congestion in the network is managed as individual applications themselves reduce data rates until each has a fair share of the bandwidth.

Standard compression technologies, such as MPEG4 or H.263 can be managed to exhibit TCP-friendly behaviour, see for example the applicant's co-pending patent application number GB 9928023.2. This solution, however, requires a high-speed, dedicated PC per video stream. Transcoding an encoded data stream from a high bit-rate to a low bit-rate when network congestion is detected also suffers from the problem of being computationally demanding. Another approach is to use layering of video streams, whereby quality adaption is achieved by adding or dropping layers of the video stream. The disadvantage of this method is that it is inefficient, as a certain proportion of the available bandwidth must be allocated to instructions for integrating the layers.

The present invention further provides a method wherein the rate at which time-sensitive data is read out from first and second buffers may be dynamically varied in dependence upon the condition of a link to the client, and further, time-sensitive data encoded at a first bit-rate is read from a first data buffer at a first transmission rate to be transmitted to the client; or, time-sensitive data encoded at a second bit-rate is read from a second data buffer at a second rate, in dependence upon the condition of a link to the client, wherein said first bit-rate is lower than the second bit-rate.

Embodiments of the invention will now be described, by way of example only, with reference to the figures, where:

Figure 1 is a schematic overview of the relationship between encoder, video streamer and clients;

Figure 2 shows the arrangement of the video streamer;

Figure 3 shows the arrangement of a client; and

Figure 4 shows the stepwise operation of one embodiment of the present invention.

As shown in Figure 1, a first embodiment of the present invention consists of a source of compressed video data, encoder 1, which encodes data both at a low bit-rate R_L, which may have a value of for example 500 $kbits^{-1}$, and a high bit-rate R_H, of

for example 1500 $kbits^{-1}$. The compression codec used is H.263 but equally may be any other codec, such as MPEG4. Encoder 1 takes 'live' video data as its input, for instance a broadcast of a sporting event.

The two encoded data streams are transmitted via separate logical connections to the video streamer 2 at a transmission rate T_E. The video streamer 2 may be on the same premises as the encoder 1 and linked via an intranet. The video streamer 2 runs on a server computer, for instance one comprising a Pentium III 700 MHz, 256MB RAM which has access to the Internet.

A video viewer, hitherto referred to as the client, running on a PC (a,b,c etc in Figure 1) suitably configured to have access to the Internet, may connect to the video streamer 2 via the Internet and thus the client is able to access content. A suitable PC terminal is a 266 MHz Pentium II laptop PC. The video streamer 2 can support a large number of clients (typically up to 1000) viewing the same stream.

For a live broadcast, the encoder 1 will transmit at a transmission rate T_E which is real-time. The two streams of data R_L and R_H coded at different bit-rates offer different quality video reproduction, but each data stream has the same transmission rate, T_E. The data must be decoded at this rate for the program to play back in real-time.

Figure 2 shows the arrangement of the video streamer 2. Low quality encoded video data encoded at a low bit-rate R_L and high quality encoded video data encoded at a high bit-rate R_H from the encoder 2 is received at the input connections 21 and 22 respectively and fed to buffers 23 and 24 respectively. It should be noted that there is provided one buffer per channel of encoded video data that is received by the video streamer 2. Encoded video data is read out from each buffer 23, 24 via a switch 26 which selects which encoded video data stream is to be sent to the output connection 27. There is provided a buffer manager 25 which is capable of controlling the rate at which data is read out from each of the buffers 23, 24 and thus defines the transmission rate T_S of the video streamer 2. The buffer manager is also in connection with the switch 26 and is further capable of receiving signals from connection 28. T_S is selected by varying the time delay between the transmission of each packet, such that T_S may be less than, equal to or greater than the encoder transmission rate T_E. Those skilled in the art will realise that the limiting factor on the sustainability of transmission where $T_S > T_E$ is the size of the buffer 23, 24 such that

a buffer of size S kbits will be able to sustain a transmission rate of $T_S = 2T_E$ for twice as long as a buffer of size S/2 kbits. Through the control of both switch 26 and the transmission rate T_S the buffer manager is able to control the bit-rate which is output from the video streamer 2 on two scales; by adjusting the transmission rate T_S fine control of the bit-rate is achieved, and by switching between the two encoded data streams encoded at bit-rates R_L and R_H control of the bit-rate on a coarse scale may be achieved. The buffer manager 25 makes adjustments to T_S or switches the output between buffers in response to signals received from connection 28.

Figure 3 shows the arrangement of the client running on a PC 3a, b, c etc. The encoded video data that is sent from the video streamer 2 is received at the client via a connection 27 and checked for completeness by a packet loss detector 31. The data is then sent into a client buffer 32 which is of a size suitable to absorb fluctuations in network throughput. The client buffer 32 is connected directly to a decoder 33 and from there decoded data is sent to be displayed at the client screen (not shown). A client status monitor 34 is connected to the packet loss detector 31 and client buffer 32. The client status monitor 34 is able to send signals via connection 28.

The packet loss detector 31 monitors incoming packets. If packet loss is detected then a signal is sent to the client status monitor 34, which is informs the buffer manager at the video streamer 2 via connection 28. Missing packets can be retransmitted. The buffer manager 25 steadily increases the transmission rate T_S until a consistent pattern of packet loss occurs, indicating that the maximum bandwidth is being utilised. In the interest of maintaining a congestion free network, the transmission rate T_S may then be exponentially reduced. The client status monitor 34 monitors the volume of data in the client buffer 32 such that a signal is sent via connection 28 to the buffer manager 25 at the video streamer 2 when the client buffer 32 becomes sufficiently full of data.

The system of video streamer 2 and client 3 as described above allows user-friendly video streaming, i.e. the client buffer 32 enables the quality of the video to be despite variations in network conditions, which might otherwise have a detrimental effect on the overall perceived quality of the media.

The operation of the present embodiment of the invention will now be described with reference to Figure 4.

The video streamer 2 is initialised, which involves filling the buffers 23, 24 with a quantity of data from the encoder 1. For a live broadcast, data is constantly fed into the buffers 23, 24 and is subsequently discarded after an amount of time defined by the size of the buffer and the quality of data being received.

A PC running browser software to browse web pages on the Internet may be used to select a link to, for example, a live broadcast on a site hosted by the entity providing streamed video. Being interested in viewing the particular clip or broadcast, the user clicks (selects) the link. The browsing software detects that streamed video data has been requested and launches the video viewing client software which embodies the client 3. The client 3 issues a "send data" command via connection 28 to the buffer manager 25, which sets switch 26 to read encoded video data from the low bit-rate data buffer 23 and requests a transmission rate of $T_S = 2T_E$. The data is transmitted to the data connection 27 and thence to the client 3. Using the example encoding bit-rate cited above of 500 $kbits^{-1}$ for R_L , data flows into the network to the client at a rate of 1000 $kbits^{-1}$.

The client 3 receives the encoded video data and sends it via the packet loss detector 31 to the client buffer 32 which is supplied at the rate $2T_E$. When data is detected in the buffer 32 the encoded video data is promptly read out to the decoder 33 at a rate of T_E. Therefore the buffer 32 fills at a rate T_E while the decoded data from the decoder 33 is displayed. Thus the user is provided with video pictures without having to wait for the client buffer 32 to fill.

The client monitor 34 waits for the quantity of R_L data in the client buffer 32 to reach a specified level, upon which a "switch buffer" command is sent to the buffer manager 25 at the video streamer 2 via the connection 28. The buffer manager 25 then switches the flow of data from the low bit-rate data buffer 23 to the high bit-rate data buffer 24 and instructs transmission at a rate $T_S = T_E$. Using the example encoding rate cited above, data is transmitted on the network at 1500 $kbits^{-1}$.

The client buffer 32 will then begin filling with high quality data which will be placed behind the low quality data. After a length of time the R_H data will begin to be read into the decoder 33, whereupon the user will perceive an increase in the picture quality. At this point, the client 3 has a full buffer and the user is watching images of a quality which is consistent with the capacity of the network link.

The video streamer 2 can support a number of clients (typically 1000). Each client is initially given a unique read-out point for the start-up phase, whereupon, after equilibrium of the client buffer 32 has been reached and the video streamer 2 is supplying high bit-rate data from the buffer 24, the read-out point can be amalgamated with other client read-out points. Read-out points may have to be devolved as discrepancies in network capacity demand increasing or decreasing the transmission rate for a particular client.

The skilled person will appreciate that the low bit-rate data buffer 23 should be of a size which will allow data to be read from it at a rate $2T_E$ for a period of time which is long enough to provide the client buffer 32 with a suitable quantity of data. For example, in order to buffer 5 seconds worth of 500 $kbits^{-1}$ data at the client 3, the video streamer 2 must supply 1000 kbits of data for 5 seconds, 500 kbits of which will be consumed by the decoder 33 per second and 500 kbits will build up in the buffer per second until 5 seconds has elapsed. Therefore the low bit-rate data buffer must be able to hold at least 5Mbits of data (5x1000kbits), or just over 0.5Mb.

The skilled person will appreciate that there are problems associated with 'tapping into' a stream of encoded data when data is initially read out of a buffer. The compression technology typically employed by the encoder 1 involved coding a frame of video data, termed an anchor frame or an I-frame and from this frame an estimate is made as to what the next frame will look like, this estimated frame being termed a B-frame. In this way the quantity of data representing a series of frames may be greatly reduced. However, if the first frame to be read from either of the data buffers 23, 24 is a B-frame then the first few frames of decoded data may be unintelligible as the decoder tries to reconstruct frames based on an estimate. In a further embodiment of the invention, an extra buffer of data is supplied in parallel with the data buffers 23, 24 consisting solely of I-frames. The first frame to be transmitted is read from the I-frame buffer and thus gives the decoder a reliable point from which to start decoding. Data is then switched to be read from either of the data buffers 23, 24.

The system allows user-friendly video streaming, i.e. the quality of the video does not fluctuate rapidly as network conditions vary, which can have a detrimental affect on the overall perceived quality of the media. In the event of packet loss being reported by the client, the system can exponentially reduce its transmission rate. This need

not result in an immediate switching of the video source, as there may be data buffered at the client. Immediately after the packet loss it is possible that the transmission rate is lower than the encoding rate, and the client is supplementing received data with buffered data in order to meet the demands of the video decoder, with the result that the client's buffer is emptying. In the event of isolated packet loss, the system can again ramp up the transmission rate, initially slowing the rate at which the client's buffer is emptying before eventually returning to a state of filling it.

The skilled person will appreciate that the ability to transmit data at variable rates for a period of time enables the streamed data to be elastic and allows TCP-friendly transmission. Detection of sustained packet loss by the packet loss detector 31 is indicative of network congestion. The buffer manager 25 at the video streamer 2 reacts to notification of packet loss by instructing a reduction in the transmission rate of data from the high bit-rate data buffer 24. The high bit-rate data buffer 24 should be appropriately sized to cope with such an event. If packet loss persists at the reduced transmission rate for longer than the high bit-rate data buffer can sustain, then the buffer manager 25 will switch to supply data from the low bit-rate data buffer 23. Effective management protocols are necessary to prevent rapid switching between data buffers 23 and 24 as the data capacity of the network fluctuates, because this will cause changes in the perceived quality of the played back video. While a user will tolerate low quality playback, rapid changes in quality can be irritating to a user.

There is no limit to the number of encoded data streams that may be provided to the video streamer. Maximum bandwidth utilisation may be achieved thus: starting by reading data from a low bit-rate data buffer, the transmission rate is increased. Finding that no packets are lost at this transmission rate, the output is switched to a higher bit-rate data buffer, whereupon the transmission rate is increased. If this transmission rate encounters no obstacle then a higher still bit-rate data buffer can be switched in, and so on until the maximum bandwidth is employed.

The buffer manager 25 located at the video streamer 2 is enabled to decide how to adjust the transmission rate T_S and when to switch buffers. Equally, instructions may be sent from the client 3 to the video streamer 2 about transmission rate T_S and which buffer to feed data from. The location of the buffer manager 25 in the

embodiments described has been chosen because it is practical to situate the control centre close to the centre which is responsible for charging for the service, which in this case is the ISP.

The example of video data is chosen as an example of multimedia data to illustrate the above embodiments. The invention is equally suited to any other form of time-sensitive data, such as audio data or a multimedia presentation.

In the embodiment described above, data is supplied by the encoder 1. Equally, compressed video data may be held in a library of program data files, for example a library of feature films, which may be accessed when required.

The video streamer 2 may be remote from the encoder 1, such that the video streamer 2 and the encoder 1 are connected via the Internet. It is likely that the video streamer 2 would be operated by an Internet Service Provider (ISP) and remote connection of the video streamer 2 and encoder 1, would allow the ISP to make content available to the client from many encoders.

CLAIMS

1. A method of operating a real-time communication apparatus comprising a real-time data sender, a real-time data display device having a store and a network connecting said sender and said display device, said method comprising the steps of:

operating said sender to transmit a plurality first-encoding-rate data packets representing a first part of a real-time presentation to said display device, said transmission rate being higher than said encoding rate;

operating said display device to:

receive said first-encoding-rate data packets into said store;

remove first-encoding-rate data packets from said store at said first encoding rate for decoding to present said real-time presentation to said user at a first level of quality;

on said store being filled with said first-encoding-rate data to a predetermined level, sending an indication that said level has been reached to said sender;

operating said sender, on receipt of said indication, to send second-encoding-rate data packets representing subsequent parts of said real-time presentation to said display device, said second encoding rate being higher than said first encoding rate;

operating said display device to:

receive second-encoding-rate data packets representing a subsequent part of real-time presentation into said store;

remove second-encoding-rate data packets from said store at said second encoding rate for decoding to present said real-time presentation to said user at a second level of quality higher than said first level of quality.

2. A method of presenting time-sensitive data and constructing a buffer of time-sensitive data, said method comprising

receiving time-sensitive data;

reading said time-sensitive data into a data buffer; and,

reading said time-sensitive data out of the data buffer for presentation; and,

presenting the time-sensitive data;

wherein the method is characterised in that

the rate at which the time-sensitive data is read out of the data buffer is lower than the rate at which the time-sensitive data is read into the data buffer; and,

reading the time-sensitive data out of the data buffer is initiated when the time-sensitive data first arrives at the data buffer, such that there is substantially no delay between the client first receiving the time-sensitive data and making the time-sensitive data available for presentation.

3. A method of presenting time-sensitive data at a client according to claim 2, including the step of,

monitoring the quantity of time-sensitive data in the data buffer;

wherein the bit-rate of the received time-sensitive data is dependent on the quantity of data in the data buffer.

4. A method of presenting time-sensitive data at a client according to claim 3, wherein,

time-sensitive data encoded at a first bit-rate is received until the quantity of data in the data buffer reaches an upper threshold, whereupon time-sensitive data encoded at a second bit-rate is received, wherein said first bit-rate is lower than the second bit-rate.

5. A method of presenting time-sensitive data at a client according to claim 4, wherein,

time-sensitive data encoded at the second bit-rate is received until the quantity of data in the data buffer reaches a lower threshold, whereupon time-sensitive data encoded at the first bit-rate is received.

6. A method of presenting time-sensitive data at a client according to any one of the preceding claims, wherein,

the rate at which the time-sensitive data is read into the data buffer is dependent on the quantity of data in the data buffer.

7. A method of providing time-sensitive data to a client, wherein

time-sensitive data is encoded at a plurality of bit-rates;

wherein data encoded at one of the plurality of bit-rates is selected for transmission to the client;

transmitting the data to the client.

8. A method of providing time-sensitive data to a client according to claim 7, wherein,

the rate at which time-sensitive data selected for transmission to the client is transmitted to the client may be dynamically varied.

9. A method of providing time-sensitive data to a client, according to claim 7, wherein,

the time-sensitive data encoded at one of the plurality of bit-rates is selected in dependence upon a received signal.

10. A method of providing time-sensitive data to a client according to claim 8, wherein,

the rate at which the time-sensitive data selected for transmission is transmitted is dependent upon a received signal.

11. A method of providing time-sensitive data to a client according to claims 9 or 10, wherein,

the received signal is representative of the condition of the link to the client.

12. A method of providing time-sensitive data to a client according to claims 9 or 10, wherein,

the received signal is representative of the quantity of data in a data buffer at the client.

13. A method of providing time-sensitive data to a client according to claim 11, wherein,

the condition of the link to the client is determined by the quantity of data in a data buffer at the client.

14. A method of providing time-sensitive data to a client in accordance with any one of the preceding claims, wherein the time-sensitive data represents video data or may represent audio data.

15. Apparatus for receiving time-sensitive data, said apparatus comprising,

buffer means for storing received time-sensitive data for a period of time,

means for reading said time-sensitive data into the buffer means,

means for reading said time dependent data out of said buffer means,

monitoring means for monitoring the quantity of data held in the buffer means; and

means for transmitting data relating to the quantity of time dependent data held in said buffer means,

said apparatus being characterised in that means for initiating reading the time-sensitive data out of the data buffer when the monitoring means detects the arrival of time-sensitive data at the data buffer, such that there is substantially no delay between the client first receiving the time-sensitive data and the time-sensitive data being read out of the buffer.

16. Apparatus for supplying encoded video data to at least one client, said apparatus comprising,

receiving means to receive a plurality of data streams, wherein each of the plurality of data streams comprises video data encoded from the same source with differing quantisation parameters,

a plurality of buffer means for storing each stream of encoded video data for a period of time,

at least one reading means for reading encoded video data from one of the plurality of buffer means,

buffer management means arranged to control the at least one reading means,

characterised in that,

said reading means is arranged to read, under control of the buffer management means, encoded video data from any of the buffer means at a frame rate which may be less than, equal to or greater than the frame rate at which the video data is encoded.

17. Apparatus for supplying encoded video data to a client as claimed in claim 16, including,

means for receiving data relating to the quantity of encoded video data in the buffer of the client, and

means for determining the current capacity of the link to the client,

wherein the buffer management means is arranged to control the reading means in dependence on the quantity of encoded video data in the buffer of the client and on the capacity of the link to the client.

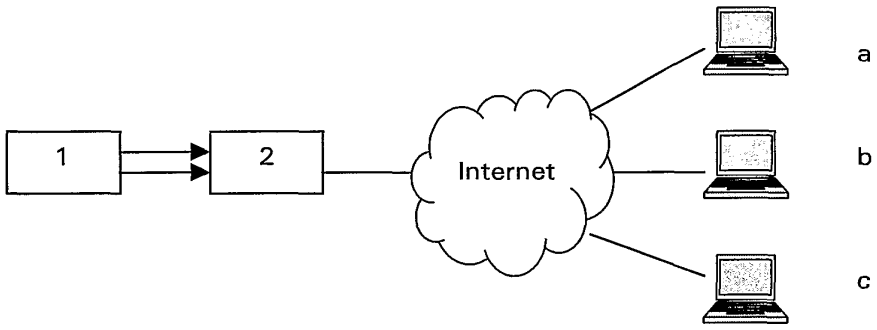


Figure 1

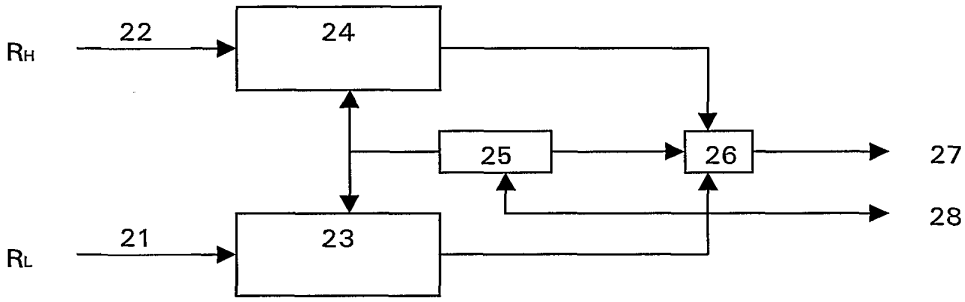


Figure 2

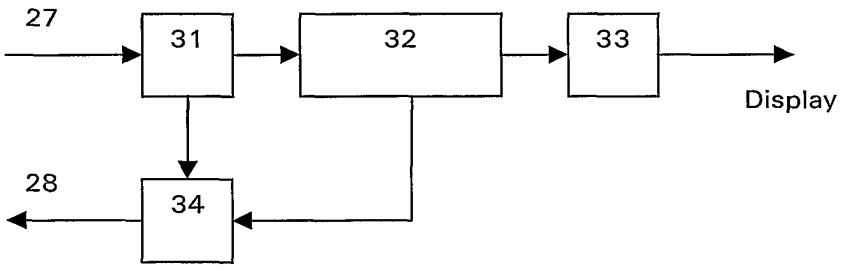


Figure 3

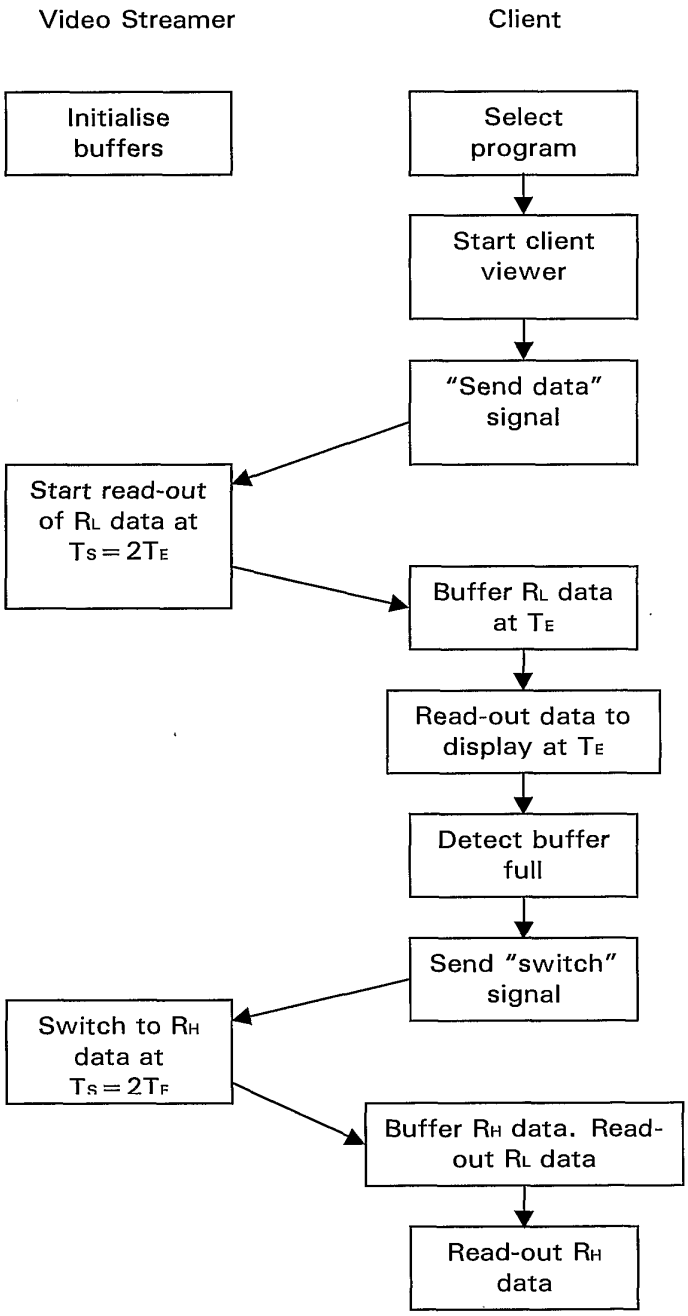

Video Streamer
Client
Initialise buffers
Select program
Start client viewer
"Send data" signal
Start read-out of R_L data at $T_S = 2T_E$
Buffer R_L data at T_E
Read-out data to display at T_E
Detect buffer full
Send "switch" signal
Switch to R_H data at $T_S = 2T_F$
Buffer R_H data. Read-out R_L data
Read-out R_H data

Figure 4

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

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Title of Invention

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	3720	FILED BY	Francene Stewart
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CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 23

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
20210819_IDS_066-0141X1C9.pdf	9	Information Disclosure Statement (IDS) Form (SB08)	1013 KB
20210819_IDSCert_066-0141X1C9.pdf	1	Transmittal Letter	228 KB
EP1394973A2.pdf	31	Foreign Reference	1571 KB
JP2004295569A.pdf	62	Foreign Reference	2969 KB
WO2003009581.pdf	21	Foreign Reference	803 KB
WO2003041413.pdf	47	Foreign Reference	1912 KB

WO2003042856.pdf	38	Foreign Reference	1615 KB
WO2002045372.pdf	19	Foreign Reference	726 KB
NPL3_Dawson-ImprovingQuality.pdf	17	Non Patent Literature	2586 KB
NPL4_IntervuGranted.pdf	3	Non Patent Literature	61 KB
NPL5_InterVuStreams.pdf	4	Non Patent Literature	64 KB
NPL6_MicrosoftAnnounces.pdf	5	Non Patent Literature	88 KB
NPL7_SandpiperAddsRealSystem.pdf	4	Non Patent Literature	1401 KB
NPL8_Speedera.pdf	5	Non Patent Literature	147 KB
NPL9_DeveloperDocumentation2002.pdf	240	Non Patent Literature	1676 KB
NPL10_IBM-DigitalLibrary.pdf	26	Non Patent Literature	117 KB
NPL11_FreshApproach.pdf	6	Non Patent Literature	104 KB
NPL13_20210618-MIRRORResponseToComplaint.pdf	87	Non Patent Literature	1139 KB
NPL14_20210618-PelotonResponseToComplaint.pdf	59	Non Patent Literature	611 KB
NPL15_20210618-VerifiedResponseICONToComplaint.pdf	78	Non Patent Literature	668 KB
NPL1_AppendixREAL06_RPG2Manual.pdf	77	Non Patent Literature	1082 KB

NPL12_MacOSX.pdf	65	Non Patent Literature	1344 KB
NPL2_Kontothanassis-TransportLayer2.pdf	11	Non Patent Literature	332 KB

Digest

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Espacenet

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INFORMATION PROCESSOR, INFORMATION PROCESSING METHOD, AND COMPUTER PROGRAM

Inventor(s): YOSHIKAWA NORIFUMI; HONDA YASUAKI; MORITA TOSHIHIRO; KUSAKABE TOSHIAKI ± (YOSHIKAWA NORIFUMI, ; HONDA YASUAKI, ; MORITA TOSHIHIRO, ; KUSAKABE TOSHIAKI)

Applicant(s): SONY CORP ± (SONY CORP)

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Abstract of JP2004295569 (A)

PROBLEM TO BE SOLVED: To provide a device and method efficiently carrying out a content reproduction process in random order while reducing a load of a client. ;SOLUTION: A list randomly setting a reproduction order of contents is created in a server side on the basis of a request from the client, and it is sent to the client. Random order information corresponding to list order setting information of the content reproduction list is stored in property information corresponding to contents stored in a server, and in response to a browse request or the like from the client, a shuffle shifting process of the random order information of contents in a specific folder is carried out, a contents reproduction list set with a list order corresponding to shifted random order information is created, and it is sent to the client. By this composition, necessity to carry out a shuffle process by the user and a client side is eliminated. ;COPYRIGHT: (C)2005,JPO&NCIPI

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DESCRIPTION JP2004295569A

10 Information processing equipment, information processing methods, and computer programs

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14 The present invention relates to an information processing apparatus, an information processing method, and a computer program. Further, in detail, when the content provided by the content providing server is reproduced on the client side, the content reproduction sequence can be appropriately changed and reproduced without causing a burden on the client side. Information processing equipment, information processing methods, and computer programs. Conventional Technology With the spread of data communication networks in recent years, home appliances, computers, and other peripheral devices are connected to the network to enable communication between each device, that is, a so-called home network. Is permeating. The home network provides convenience and comfort to users, such as sharing the data processing function of each device by communicating between network-connected devices and sending and receiving content between devices. It is expected that it will become more and more popular. Universal Plug and Play (UPnP: Universal Plug and Play) is known as a protocol suitable for such a home network configuration. Universal Plug and Play (UPnP) makes it possible to easily build a network without complicated operations, and provides services for each connected device in network-connected devices without difficult operations or settings. It is intended to be receivable. In addition, UPnP has the advantage that devices can be easily added without depending on the OS (operating system) on the device. UPnP exchanges definition files conforming to XML (eXtensible Markup Language) between connected devices, and performs mutual recognition between the devices. The outline of UPnP processing is as follows. (1) Addressing process for acquiring own device ID such as IP address. (2) A discovery process that searches for each device on the network, receives a response from each device, and acquires information such as the device type and function included in the response. (3) Service request processing that requests a service from each device based on the information acquired in the discovery processing. By performing the

above processing procedure, it is possible to provide and receive a service to which a device connected to the network is applied.

The device newly connected to the network acquires the device ID by the above addressing process, acquires the information of the other device connected to the network by the discovery process, and requests the service from the other device based on the acquired information. Is possible. For example, when trying to play content such as music data and image data stored in a server on a client-side device, the client acquires information about the content held by the server. The server stores the content in the storage unit and also stores the attribute information for the stored content. The attribute information includes, for example, various information such as the title of a song or movie, the artist name, the recording date and time, the data compression mode, and the like as contents. These attribute information is called metadata or meta information. For example, when trying to play content such as music data and image data stored in a server on a client-side device, the content information stored in the server from the client side to the server, for example, a song or a movie. Sends a request to acquire attribute information of various contents such as title, artist name, data compression mode information (ATRAC: moving picture experts group, MPEG: moving picture experts group, etc.), and copyright information as necessary. .. The server transmits metadata (attribute information) related to the contents held by the server to the client in response to a request from the client. The client displays the content information on the display of the client device according to a predetermined display program based on the metadata acquired from the server. For example, a list of songs consisting of artist names, titles, etc. is displayed on the display. The user confirms or selects the content to be played back based on the display information, and transmits the content transmission request to the server. The server receives the content request from the client, the server sends the content to the client in response to the reception request, and the received content is played back on the client side. The content stored in the server in this way can be searched from another device (client) connected to the network, and a specific content can be specified and played back.

For example, when the client selects only one music content as a playback target, a content transmission request including an identifier of the one music content is transmitted to the server, and the server acquires the designated content from the storage unit. Is sent to the client and played on the client, and the process ends. When a plurality of music contents are selected by the client as a playback target, a transmission request is transmitted from the client to the server for each content, and each music content is sequentially provided from the server to the client and played on the client side. Become. The content folder stored in the server includes a content folder containing a plurality of music contents, for example, a folder created by collecting only favorite songs by the user, or a plurality of music contents such as a specific artist and genre. The stored folders and the like can be set, and the user on the client side can specify these specific folders and sequentially play back a plurality of contents (songs) stored in the folders. For example, Patent Document 1 describes a configuration in which content and its management data are transmitted together when an aggregate composed of a plurality of songs is transferred from a recording / playback device to a terminal such as a portable device. .. When a client executes a plurality of contents in a folder

Webgroup CZ a.s. Ex. 1002, Page 577 of 1406

in which a plurality of contents are stored as a playback target, if the playback order of the songs is always in a fixed order, the user who listens to the contents enjoys the content. Decline. Therefore, a process of changing the order of playing a plurality of contents, that is, shuffling the order of playing a plurality of contents to change the playing order is performed. Conventionally, in such a content reproduction sequence change process, the user performs a reproduction order determination process based on a data list such as a song related to a plurality of contents transmitted from the server to the client, or the client. Processing such as determining the playback order was performed by the playback sequence determination program stored in the device on the side. That is, the client side takes the initiative in determining the content reproduction order, and the client sends the content request to the server according to the determined content reproduction order. In general, the server simply sends the contents in sequence based on the request information from the client.

92 In such a configuration, it is necessary to execute a process of changing the playback order of a plurality of contents on the client side, such as setting the playback order of the contents or shuffling, which causes a burden on the user or the client side. was there. Japanese Patent Application Laid-Open No. 2001-216766 [0017] The present invention has been made in view of the above-mentioned problems, and is borne by the user or the client. It is an object of the present invention to provide an information processing device, an information processing method, and a computer program capable of appropriately changing and reproducing a reproduction sequence of contents without generating an information processing device. A first aspect of the present invention is an information processing device that executes a content information transmission process, an object including at least one of a content or a data folder, and attributes of the object. A storage unit that stores property information as information, a data transmission / reception unit that executes data transmission / reception processing between the client as a content information requesting device, and content information that generates content information to be transmitted to the client based on the property information. The property information has a rewritable random order information corresponding to the list order setting information of the content playback list, and the content information generation unit responds to a content playback list request from a client. It is characterized by having a configuration in which an update process is executed as a process of replacing and resetting the random order information, and a process of generating content playback list information having list order information according to the update information and transmitting it to a client is executed. It is in the information processing device. Further, in one embodiment of the information processing apparatus of the present invention, the random order information is set for each property information corresponding to each content included in the content folder set as a set of a plurality of contents. It is numbering data as a number, and is information set so that n random order numbers are not duplicated with respect to the number n of contents included in the content folder, and the content information generation unit corresponds to the number of contents n. It is characterized in that the random order information of 1 to n is shuffled and the random order information exchange processing set for each property information is executed.

121 Further, in one embodiment of the information processing apparatus of the present invention,

Webgroup CZ a.s. Ex. 1002, Page 578 of 1406

the random order information is numbering data as a number set for the property information corresponding to the content reproduction list folder storing the content reproduction list. The content information generation unit shuffles the random order information of 1 to n corresponding to the number of folders n to be shuffled, and executes the replacement process of the random order information set for each property information. It is characterized by executing the list order setting process for each folder. Further, in one embodiment of the information processing apparatus of the present invention, the information processing apparatus determines whether or not there is a content reproduction list generation request by a random order in the content reproduction list request data from the client. It is characterized in that the configuration is such that the update process of the random order information is executed on condition that there is a content reproduction list generation request by the random order. Further, in one embodiment of the information processing apparatus of the present invention, the information processing apparatus executes the update process of the random order information, and then the random order information is being reproduced while the content is being reproduced according to the content reproduction list in the client. It is characterized in that it is configured to maintain and retain the memory. Further, in one embodiment of the information processing apparatus of the present invention, the information processing apparatus executes the update processing of the random order information, and then the random order information is being reproduced while the content is being reproduced according to the content reproduction list in the client. Is maintained and stored, and during the storage retention period, content playback list information based on the stored random order information is generated and transmitted to the client in response to a re-request of the content playback list request from the client. It is characterized in that it has a configuration for executing processing. Further, in one embodiment of the information processing apparatus of the present invention, the content information generation unit is characterized in that it executes a process of generating the content playlist information as XML (eXtended Markup Language) data. And. Further, the second aspect of the present invention is an information processing apparatus that performs content information acquisition processing, with respect to a data transmission / reception unit that executes data transmission / reception processing with a server that holds the content information, and the server. Based on the content information request processing unit that executes the request processing of the content playback list set in the random order and the content information received from the server via the data transmission / reception unit, the content playback list composed of a plurality of content information is created. A content information analysis unit to be generated, a display unit to display the content playback list generated by the content information analysis unit, and a content acquisition request to be transmitted to the server according to the list order of the content playback list, and the content received from the server. The information processing apparatus is characterized by having a content reproduction control unit for executing the reproduction control process of the above.

162 Further, in one embodiment of the information processing apparatus of the present invention, the content information request processing unit sets a random order as the setting order sort

Webgroup CZ a.s. Ex. 1002, Page 579 of 1406

information of the content playback list together with the designation information of the content folder storing a plurality of contents. It is characterized in that it has a configuration for executing a process of generating content information request data in which information is stored. Further, in one embodiment of the information processing apparatus of the present invention, the content information request processing unit provides random order setting information as setting order sort information of the content playback list together with the designation information of a plurality of content playback list folders. It is characterized in that it has a configuration for executing a process of generating stored content information request data. Further, in one embodiment of the information processing apparatus of the present invention, the content reproduction control unit requests a content in which a content corresponding URL included in the content information received from the server is set according to the list order of the content reproduction list. It is characterized in that it is configured to execute a process of sequentially transmitting information to the server. Further, in one embodiment of the information processing apparatus of the present invention, the content information received from the server is XML (eXtended Markup Language) data that describes the property information corresponding to the content, and the content information analysis unit is The XML data is analyzed to generate a content reproduction list composed of a plurality of content information. Further, the third aspect of the present invention is an information processing method for executing the content information transmission process, the content information acquisition request receiving step for receiving the content information acquisition request from the client, and the property corresponding to the content. The random order information update step that executes the update processing of the random order information as the list order setting information of the content playback list stored in the information, and the content playback list information having the list order information according to the updated random order information. The information processing method is characterized by having a list generation step for generating the information and a step for transmitting the generation list to the client. Further, in one embodiment of the information processing method of the present invention, the random order information is set for each property information corresponding to each content included in the content folder set as a set of a plurality of contents. The numbering data as the number is set so that n random order numbers are not duplicated with respect to the number n of contents included in the content folder, and the random order information update step is set to the number of contents n. It is characterized in that the shuffle of the corresponding 1 to n random order information is executed and the random order information exchange processing set for each property information is executed.

199 Further, in one embodiment of the information processing method of the present invention, the random order information is numbering data as a number set for the property information corresponding to the content playback list folder storing the content playback list. Yes, in the random order information update step, the random order information of 1 to n corresponding to the number of folders n to be shuffled is shuffled, and the random order information set for each property information is replaced. It is characterized by executing the list order setting process for each folder. Further, in one embodiment of the information

Webgroup CZ a.s. Ex. 1002, Page 580 of 1406

processing method of the present invention, the information processing method further determines whether or not the request data of the content playlist from the client includes a content playlist generation request by a random order. It is characterized in that the update process of the random order information is executed on condition that the content playback list generation request by the random order is made. Further, in one embodiment of the information processing method of the present invention, the information processing method further executes the update processing of the random order information, and then the random is being played while the content is being played according to the content playback list on the client. It is characterized by having a step of maintaining and storing order information. Further, in one embodiment of the information processing method of the present invention, the information processing method further executes the update processing of the random order information, and then the random is being played while the content is being played according to the content playback list on the client. The order information is maintained and stored, and during the storage retention period, the content playback list information based on the stored random order information is generated to the client in response to the re-request of the content playback list request from the client. It is characterized by executing a process of transmitting. Further, in one embodiment of the information processing method of the present invention, the content information generation step is characterized in that a process of generating the content playlist information as XML (eXtended Markup Language) data is executed. Further, the fourth aspect of the present invention is an information processing method for performing content acquisition processing, and content information for executing request processing of a content playback list set in a random order for a server holding content information. A request processing step, a content information analysis step that generates a content playback list composed of a plurality of content information based on the content information received from the server, and a display step that displays the content playback list generated in the content information analysis step. The information processing method is characterized by having a content reproduction control step of transmitting a content acquisition request to the server according to the list order of the content reproduction list and executing a reproduction control process of the content received from the server. be.

236 Further, in one embodiment of the information processing method of the present invention, the content information request processing step sets a random order as setting order sort information of the content playback list together with the designation information of the content folder storing a plurality of contents. It is characterized by executing a process of generating content information request data in which information is stored. Further, in one embodiment of the information processing method of the present invention, the content information request processing step provides random order setting information as setting order sort information of the content playback list together with the designation information of a plurality of content playback list folders. It is characterized by executing a process of generating stored content information request data. Further, in one embodiment of the information processing method of the present invention, the content reproduction control step requests a content in which a content corresponding URL included in the content

Webgroup CZ a.s. Ex. 1002, Page 581 of 1406

information received from the server is set according to the list order of the content reproduction list. It is characterized in that a process of sequentially transmitting to the server is executed. Further, in one embodiment of the information processing method of the present invention, the content information received from the server is XML (eXtended Markup Language) data that describes the property information corresponding to the content, and the content information analysis step is It is characterized in that a process of generating a content reproduction list composed of a plurality of content information is executed by analyzing the XML data. Further, the fifth aspect of the present invention is a computer program that executes the content information transmission process, the content information acquisition request receiving step for receiving the content information acquisition request from the client, and the property corresponding to the content. Random order information update step that executes update processing of random order information as list order setting information of the content playback list stored in the information, and content playback list information that has list order information according to the updated random order information A computer program characterized by having a list generation step for generating information and a step for sending the generation list to a client. Further, the sixth aspect of the present invention is a computer program that performs content acquisition processing, and content information that executes request processing of a content playback list set in a random order for a server that holds content information. A request processing step, a content information analysis step that generates a content playback list composed of a plurality of content information based on the content information received from the server, and a display step that displays the content playback list generated in the content information analysis step. A computer program characterized by having a content reproduction control step of transmitting a content acquisition request to the server according to the list order of the content reproduction list and executing a reproduction control process of the content received from the server. be.

274 [Action] According to the configuration of the present invention, the client generates a list in which the playback order of the contents is randomly set on the server side based on the request from the client, and transmits the list to the client. Only by performing the playback process according to the list received from the server, it is possible to enjoy the content playback according to the random playback sequence, and the need for the shuffle process on the user and client sides is eliminated. Further, according to the configuration of the present invention, rewritable random order information corresponding to the list order setting information of the content playback list is stored in the property information corresponding to the content held in the server, and browsed from the client. Acquiring content information such as requests Content that acquires property information corresponding to the content in the specified folder, executes shuffle replacement processing of random order information, and sets the list order corresponding to the replaced random order information. Since the playback list is generated and sent to the client, the client can set the content playback sequence depending on the processing on the server side without increasing the processing load on the server side. Further, according to the configuration of the present invention, the server has a reset random order No. Random order No. based on

Webgroup CZ a.s. Ex. 1002, Page 582 of 1406

After generating sequential content playback list information and sending it to the client, the random order information is maintained and stored during content playback according to the content playback list on the client, and the content playback list from the client is stored during the storage retention period. When the request is re-requested, the content playback list information based on the stored random order information is generated and sent to the client, so the client executes the process of sending the content in the specific folder to the random sequence. It becomes possible to reproduce without duplication according to. The computer program of the present invention provides, for example, a storage medium, a communication medium, for example, a CD or an FD, which is provided in a computer-readable format to a general-purpose computer system capable of executing various program codes. , MO, or a computer program that can be provided by a communication medium such as a network. By providing such a program in a computer-readable format, processing according to the program is realized on the computer system.

303 Still other objectives, features and advantages of the present invention will be clarified by more detailed description based on the examples of the present invention described later and the accompanying drawings. In the present specification, the system is a logical set configuration of a plurality of devices, and the devices having each configuration are not limited to those in the same housing. Hereinafter, details of the information processing apparatus, the information processing method, and the computer program of the present invention will be described with reference to the drawings. [System Overview] First, an example of an applicable network configuration of the present invention will be described with reference to FIG. FIG. 1 shows a server 101 that executes processing in response to processing requests from various client devices, and a PC 121, a monitor 122, a mobile phone 123, a player 124, and a PDA 125 as client devices that make processing requests to the server 101. Indicates a configuration connected via the network 100, for example, a home network configuration. In addition to this, various electronic devices and home appliances can be connected as the client device. The process executed by the server 101 in response to a request from the client is, for example, data processing by providing contents stored in a storage means such as a hard disk owned by the server 101 or by executing an application program that can be executed by the server. Services etc. Although the server 101 and the client device are shown separately in FIG. 1, the device that provides the service for the request from the client is shown as the server, and each client device is its own. When the data processing service is provided to other clients, the function as a server can be provided. Therefore, the network-connected client device shown in FIG. 1 can also be a server. The network 100 is a wired or wireless network, and each connected device transmits / receives communication packets such as Ethernet (registered trademark) frames via the network 100. That is, the client executes the data processing request to the server 101 by transmitting the frame in which the processing request information is stored in the data unit of the Ethernet frame to the server 101. The server 101 executes data processing in response to the reception of the processing request frame, stores the result data as the data processing result in the data unit of the communication packet as necessary, and transmits the result data to each client.

Webgroup CZ a.s. Ex. 1002, Page 583 of 1406

332 The network connection device is composed of, for example, a universal plug and play (UPnP: Universal Plug and Play) compatible device. Therefore, it is easy to add or delete connected devices to the network. Devices newly connected to the network are (1) an addressing process that acquires their own device ID such as an IP address. (2) A discovery process that searches for each device on the network, receives a response from each device, and acquires information such as the device type and function included in the response. (3) Service request processing that requests a service from each device based on the information acquired in the discovery processing. By performing the above processing procedure, it is possible to receive the service to which the device connected to the network is applied. As an example of the information processing device constituting the server and the client device shown in FIG. 1, a hardware configuration example of a PC will be described with reference to FIG. The CPU (Central Processing Unit) 201 executes various processes according to a program stored in the ROM (Read Only Memory) 202, the HDD 204, or the like, and functions as a data processing means or a communication control processing means. .. The program and data executed by the CPU 201 are appropriately stored in the RAM 203. The CPU 201, ROM 202, RAM 203, and HDD 204 are connected to each other via the bus 205. An input / output interface 206 is connected to the bus 205, and the input / output interface 206 is connected to, for example, an input unit 207 composed of a keyboard, a switch, a button, a mouse, or the like operated by a user. An output unit 208 composed of an LCD, a CRT, a speaker, or the like that presents various information to the user is connected. Further, a communication unit 209 that functions as a data transmission / reception means, and a removable recording medium 211 such as a magnetic disk, an optical disk, a magneto-optical disk, or a semiconductor memory can be mounted, and data reading or writing processing from these removable recording media 211 can be attached. Drive 210 is connected to execute. The configuration shown in FIG. 2 is an example of a server and a personal computer (PC) as an example of the network-connected device shown in FIG. 1, but the network-connected device is not limited to the PC and is portable as shown in FIG. It can be configured by a mobile communication terminal such as a telephone or a PDA, other various electronic devices such as a playback device and a display, and an information processing device.

362 Therefore, it is possible to have a hardware configuration unique to each device, and the processing according to the hardware is executed. [Metadata] Next, the metadata held by the server that stores the content to be provided to the client will be described. The server has attribute information as metadata corresponding to each content such as still images, image data such as moving images, and audio data such as music stored in its own storage unit. The components of the metadata are called property information. Contents such as still images, image data such as moving images, and audio data such as music owned by the server are collectively referred to as AV contents. In the server, the AV content is managed by a content directory having a hierarchical structure. The content directory has a hierarchical structure composed of individual AV contents or folders storing a plurality of AV contents. Each element of the content directory, that is, each of the individual AV contents or the folder containing the plurality of AV contents, is called an object. The object is a general term for a

Webgroup CZ a.s. Ex. 1002, Page 584 of 1406

data unit processed by a server, and there are various objects other than individual AV contents or folders storing a plurality of AV contents. Further, a set of objects is called a container, and the unit of the set is, for example, a set based on the physical storage position of each object, a set based on the logical relationship of each object, a set based on a category, or the like. It can be set in various ways. The smallest unit of AV content, that is, one piece of music data, one piece of video data, one piece of still image data, or the like is called an item. Objects are classified into classes according to their type, such as music (Audio), video (Video), photograph (Photo), and the like, and class labeling is performed. The client can, for example, specify a specific class to request and execute a "search" targeting only objects belonging to a specific classification. It is also possible to specify an object such as a specific folder, request "browsing" to request only information about the folder, and perform an acquisition process of information about the specific folder. In the server, the classes are also managed in a hierarchical structure, and subclasses can be set under one class.

388 The metadata is various management information including attribute information corresponding to the content of the server, class definition information, information on the hierarchical structure constituting the content directory, and the like. The metadata as the attribute information of the content defined in association with each object includes various information such as the content identifier (ID), data size, resource information, title, artist name, copyright information, and the like. .. The individual information contained in the metadata is called a property. It should be noted that it is predetermined in advance what kind of property metadata is possessed for each of the above-mentioned classes such as music (Audio), video (Video), and photo (Photo). [Content Reproduction Process by Client] For example, a client who intends to reproduce a content can make a content request to a server, receive the requested content from the server, and reproduce the content. A general content reproduction procedure will be described with reference to FIG. First, in step S11, the client requests the acquisition of the content information held by the server. In step S12, the server generates content information such as a title and an artist name as XML (eXteded Markup Language) data based on the content-corresponding metadata according to the client's request and transmits the content information to the client. In step S13, the client displays the content information on the display according to the received XML information. For example, in the case of music content, it is displayed as a list consisting of song names, artist names, playback times, etc. corresponding to a plurality of music held by the server. Next, in step S14, the client selects a song to be received and played from the server in the client device, and transmits the content designation information (for example, the content ID) to the server. The server acquires the content from the storage means based on the received content specification information and transmits the content. In step S16, the client reproduces the content received from the server. If the content is compressed by ATRAC, MPEG, etc., the content is decrypted on the client side and then played back. The normal content reproduction procedure is as described above. The client acquires various content attribute information, that is, property information included in the metadata corresponding to the content held by the server, displays a UI such as a content list on the client based on

the property information, selects the content, and the server. Can be requested.

417 The process in step S11 shown in FIG. 3, that is, when the client acquires the content information held by the server, the client requests the content information containing "Christmas" as a word in the title, for example. It is possible to select and acquire specific content information by so-called search processing. Alternatively, the content of a plurality of contents stored in a specific folder, for example, a folder created by collecting only favorite songs by the user, or a folder containing a plurality of music contents such as a specific artist or genre, is specified and stored in the folder. It is possible to obtain information. As described above, in the server, the object as the management content is classified into various categories (types) such as music (Audio), video (Video), photo (Photo), artist, album, and the like.) Is used to classify and manage the classes, and the classes are managed in a hierarchical structure. FIG. 4 shows an example of the management class in the server. The example of FIG. 4 is an example of a class related to music contents. As shown in FIG. 4, various classes such as songs, albums, genres, and album cabinets in which a plurality of albums are integrated are set, and the server sets the content in each class, metadata as content attribute information, and property information. I am managing it. FIG. 5 shows an example of a hierarchical configuration of classes managed by the server. The hierarchical structure can be shown as a branched tree-like diagram as shown in FIG. Each of the circles shown in FIG. 5 corresponds to an individual class. This hierarchical structure shows a logical management structure corresponding to the contents stored and managed by the server in the storage unit. Metadata as attribute information is set corresponding to each class. In FIG. 5, the top level is called the root container 301. For example, music (music) class 302, moving image class 303, still image class 304, and the like are set under the root container. A class such as genre 305 is set at the lower level of the music class 302, and an artist 306 or the like is set at the lower level of the genre. [0073] A client who intends to execute a content search can specify a class and request and execute a search targeting only objects belonging to a specific classification.

443 In addition, it is possible to specify a specific object, for example, a folder in which a plurality of contents are stored, and acquire information on the contents stored in the folder. The client displays the content information on the display based on the XML data that describes the content information received from the server. FIG. 6 shows an example of display processing of the content information list. In the example shown in FIG. 6, a content information list 357 having a data structure listing the content numbers, titles, artist names, and the like is displayed on the display 350. These content information is generated based on the property information as a component of the content-corresponding metadata managed by the server. The server acquires property information in the metadata of the content that matches the conditions based on the search or browse request received from the client, generates XML data based on the acquired property information, and sends it to the client. The client receives the XML data based on the property information corresponding to the content extracted by the server, generates the display data as shown in FIG. 6 based on the received XML data, and displays it on the display of the client. The user on the client side selects the content to be played from these lists and transmits the selected content

information to the server, so that the content, that is, various contents such as music, movies, and photographs are transmitted from the server to the client. Playback and output are executed on the side. [Content playback sequence setting process] As described above, the client selects the content stored in the server by browsing or searching, and then specifies the playback request content to the server, that is, the actual content, that is, music or an image. It is possible to acquire data, etc., and play and output it on the client. For example, when the client selects only one music content as a playback target, a content transmission request including an identifier of the one music content is transmitted to the server, and the server acquires the designated content from the storage unit. Is sent to the client and played on the client, and the process ends. When a plurality of music contents are selected by the client as a playback target, a transmission request is transmitted from the client to the server for each content, and each music content is sequentially provided from the server to the client and played on the client side. Become.

471 The content folder stored in the server includes a content folder containing a plurality of music contents, for example, a folder generated by collecting only favorite songs by the user, or a plurality of music contents such as a specific artist and genre. The stored folders and the like can be set, and the user on the client side can obtain a list of contents stored in these specific folders from the server by the above-mentioned browse or search. By displaying the content list on the display and setting the client to sequentially send content requests to the server in the order according to the list, continuous playback of a plurality of contents is possible. However, as described in the section of the prior art, when playing back a plurality of contents in a folder, if the playing order of the songs is always in a fixed order, the enjoyment of the user who listens to the contents is reduced. do. Therefore, a process of changing the order of playing a plurality of contents, that is, shuffling the order of playing a plurality of contents to change the playing order is performed. Conventionally, the content playback sequence change process is executed by shuffling the content list sent from the server to the client on the user side, changing the order of the list, and sending the content request to the server according to the changed list. Was there. However, this process creates a burden on the user or client side. In the configuration of the present invention, for example, when a client requests a content list in which a specific folder is specified, content information including content playback list information set in a random sequence is generated on the server side and transmitted to the client. do. The client displays a content playlist (content playlist) on the client-side display based on the content information (XML data) received from the server. The content playback list in random order order set on the server side is displayed on the client side display. Therefore, on the client side, the content can be shuffled, that is, the content can be reproduced in a random sequence only by making the content reproduction requests in the order according to the content playlist received from the server. [0083] With reference to FIG. 7, a processing procedure in the case of executing the random sequence reproduction processing of the content will be described. First, in step S31, the client executes the content information acquisition process from the server.

499 The client identifies a folder in which a plurality of contents are stored by searching or

browsing, and requests an acquisition process of the content information in which the folder is specified. In this content information request, the client requests that the setting of the content playlist in the folder is set in a random sequence and transmitted together with the specified information of the folder in which the plurality of contents are stored. FIG. 8 shows an example of request data for transmitting by setting the setting of the content playlist to be transmitted from the client to the server in a random sequence. The example shown in FIG. 8 shows an example of data transmitted by the client in response to a browse request specifying a specific folder. In the transmission data, the request identifier 401 indicating that the request is a browse request, the folder identification information 402, and the sort designation information 403 indicating that sorting in a random order is desired as the sorting process of the content playback list. In addition, list information 404 indicating the range of list data to be included in the content playback list is included. As the sorting method, it is possible to specify the order of artists, the order of song titles, etc. in addition to the random order. The range of the list data to be included in the content playback list specified in the list information 404 can be arbitrarily set. For example, in the case of a folder in which 100 songs of music content are stored, 10 songs are specified as the list data and the sort process is performed. When a random order is specified, the first 10 songs are selected from the 100 songs of the random sequence content set on the server side, a list is generated, and the list is sent to the client. Returning to the sequence of FIG. 7, and continuing the description, in step S31, as shown in FIG. 8, a sort designation indicating that the client desires sorting in a random order as the sorting process of the content playback list. When a content information acquisition request including information is transmitted and the server receives the request, in step S32, the server acquires the property information corresponding to the content stored in the folder specified by the client and sets it in the property information. Random order No. Set. [089] With reference to FIG. 9, the property information corresponding to the content held by the server and the random order No. Will be described. The server stores the attribute information (property information) corresponding to the content stored in the storage means in the storage unit corresponding to the content.

529 For example, when the server holds a content folder 420 storing a plurality of contents of the contents A421, the contents B422, ... The contents N423 in a storage unit such as a hard disk in the server, the server causes the contents A to N. The property information 425, 426, 427 corresponding to the content is stored in the storage unit in association with the content. The property information is information corresponding to the content, and is attribute information of the content including various information such as a creator, an artist, and a playback time of the content. In the configuration of the present invention, as shown in the figure as property information corresponding to the content, the random order No. Is set. 【００９２】ランダムオーダＮｏ． Is numbering data (number) as random order information set for each content. This is rewritable random order information corresponding to the list order setting information of the content playlist. When the server receives from the client a content information acquisition request including sort specification information indicating that the content playback list is to be sorted in a random order as shown in FIG. 8 described

Webgroup CZ a.s. Ex. 1002, Page 588 of 1406

above, the server receives the content information acquisition request. Random order No. in the property information of the content included in the specified folder. Is replaced and reset.

【００９３】ランダムオーダＮｏ．　Is numbering data as a number set for each property information corresponding to the content included in the content folder set as a set of a plurality of contents, and n pieces for the number n of the contents included in the content folder. Random order numbers of are the information set without duplication. For example, in a content folder containing 100 music contents, numbers 1 to 100 are random order numbers in the property information of each content. Is set as. This is executed for each sort request in random order from the client, and random order Nos. 1 to 100 are executed for each process. Is reset as the property information of each content. [0995] The set random order No. Is the sequence of the content playlist and is set as the playback sequence. Returning to FIG. 7, the description of the content reproduction sequence setting will be continued. In step S32, the server uses the random order No. 1 in the property information corresponding to the content included in the folder specified by the client as described above.

557 Shuffle the random order No. And set the random order No. The XML information as the configuration information for generating the content playlist is generated based on the above, and the content information including the list information is transmitted to the client in step S33. The content information transmitted to the client includes content information such as the title and artist name of the content, as well as URL (Uniform Resource Location) information of the content as address information indicating the location of the content. These are generated by XML (eXted Markup Language) data and transmitted to the client. In step S34, the client displays the content playlist on the display based on the content information received from the server. The client receives XML data based on the property information corresponding to the content extracted by the server, generates a content playback list as shown in FIG. 10 based on the received XML data, and displays it on the client's display. As shown in FIG. 10, the content playlist is displayed as a list showing content information in the order of reproduction. In the example shown in the figure, an example is shown in which a content information list 481 having a data structure in which the playback sequence number, content name, title, artist name, and playback time are listed in the playback order as display information is displayed on the display 480. There is. [0100] These content information is generated based on the property information as a component of the content-corresponding metadata managed by the server. The playback sequence number is a random order No. set by the server. Will be set as a value corresponding to. [0101] The client can reproduce the content according to the content playlist as shown in FIG. For example, by clicking the playback button 482 shown in FIG. 10, playback is started, and by clicking the continuous playback setting button 483 to set it to the enabled state, the list is controlled in consideration of the playback time of each playback content. Content requests are sequentially sent to the server in order, and the client side can receive and play the contents in the order of the list from the server. [0102] A series of sequences such as a content transmission request, content reception, content decoding, and output processing executed in the content reproduction process are executed according to the content

reproduction program on the client side.

585 The content playback program sends a HTTP (Hyper Text Transfer Protocol) GET method, which is a content request for which a content identifier is set as content information received from the server together with the list, for example, a content acquisition request for which a content URL is set, to the server according to the list. The contents are sequentially transmitted, the contents are sequentially received from the server according to the order of the list, and the reproduction process is executed. The user can also specify only specific content from the list and play only the specified content. [0103] When the continuous playback process is enabled, the content playback program on the client side sequentially requests the content according to the list order in consideration of the playback time of the content, that is, HTTP (Hyper Text Transfer Protocol) in which the content URL is switched. Executes the process of generating the GET method and sending it to the server. The server transmits the content to the client based on the specified URL according to the content request (HTTP (HyperText Transfer Protocol) GET method) sent in the order of the list. In the sequence diagram shown in FIG. 7, the processes of step S35 on the client side and step S36 on the server side correspond to the above-mentioned series of processes. [0105] When the playback of the contents in the list is completed, the client can request the list corresponding to the remaining contents in the same folder and receive it from the server. In the server, the random order No. of each content is set while the content reproduction process is being executed on the client side, that is, within the time considering the content transmission to the client and the reproduction time on the client. The setting of is kept unchanged. [0106] In a new content playlist request from a client, for example, in the data shown in FIG. 8, the playlist No. = When there is a list request with a designation such as 11 to 20, the random order No. set in the property information (see FIG. 9) of each content. Based on No. Random order Nos. 11 to 20 Set the content playlist information based on the property information of the content with and send it to the client. [0107] The client can display the newly transmitted content playlist on the display and play the content according to the displayed content playlist.

612 [0108] As described above, in the configuration of the present invention, a list in which the playback order of the contents is randomly set is generated on the server side based on the request from the client, and the list is transmitted to the client. It is possible to enjoy the content reproduction according to a random reproduction sequence only by performing the reproduction processing according to the list received from, and the need for the shuffle processing on the user and the client side is eliminated. The processing sequences in each of the client and the server will be described with reference to the flowcharts of FIGS. 11 and 12. First, the processing procedure of the client will be described with reference to FIG. In step S101, the client requests a playlist from the server. This is done in response to a browse request that specifies a folder for the server, and as described earlier with reference to FIG. 8, it is possible to request that the request data for the server be sorted by a random order. .. In response to the client request, the server sets the random order No. 1 in the property information corresponding to the content included in the designated folder as described above. Shuffle the random order No. Was reset, and the set random order No. Generates a

Webgroup CZ a.s. Ex. 1002, Page 590 of 1406

content playlist based on and sends it to the client. In step S102, the client receives the content information including the playlist, and displays the received content playlist on the display. [0112] In step S103, the user on the client side starts playing the content. At this time, when continuous playback is specified as described above, the playback processing program on the client side sequentially transmits the content request in which the content URL is set to the server in the order of the content playlist. [0113] In step S104, the content is received from the server, and the received content is reproduced in step S105. If the received content is compressed by ATRAC, MPEG, etc., it is reproduced after the decryption processing is performed on the client side. [0114] In step S106, it is determined whether or not the reproduction of all the listed contents is completed, and if there is unreproduced content, the processing of step S103 or less, that is, the content request, reception, and reproduction are repeatedly executed.

638 Before the end of the playback time of the currently played content, the next content request in the content playlist is output to the server. When the playback of the contents in the list is completed, the process ends. After the playback of the content at the end of the list is completed, it is possible to return to the top of the list and perform repeated playback. These processes are executed based on the settings of the content reproduction processing program on the client side. Next, a processing procedure on the server side will be described based on the flowchart of FIG. When the server receives the content information request from the client in step S201, the server determines in step S202 whether or not the request is made to set the content playlist as a random sequence. [0116] If it is a request to set the content playlist setting to a random sequence and transmit it (see FIG. 8), the process proceeds to step S203, and if there is no such specification, the process proceeds to step S211. In step S211, the sequence No. preset in the content stored in the designated folder is set. The default playlist information according to the above is generated, and the process proceeds to step S205 to transmit the content information including the generated list information to the client. If it is a request to set the content playback list setting to a random sequence and transmit it (see FIG. 8), the process proceeds to step S203, and the server corresponds to the content stored in the folder specified by the client. Random order No. set in the property information after acquiring each property information. Set. That is, the random order No. in the property information of the contents included in the specified folder. Shuffle and reset. [0118] In step S204, the reset random order No. Random order No. based on Sequential content playlist information is generated, and in step S205, XML information as content playlist configuration information is generated and transmitted to the client. [0119] In step S206, when the server receives a content request including, for example, content designation information (for example, content URL) from the client, the server extracts the content according to the designated information and transmits the content in step S207. In content transmission, data conversion may be performed according to client-side specifications or requests.

665 [0120] The processes of steps S206 and S207 are repeatedly executed when the client is executing continuous playback according to the content playlist. [0121] Further, the server is set to the reset random order No. Random order No. based on After generating sequential

Webgroup CZ a.s. Ex. 1002, Page 591 of 1406

content playback list information and sending it to the client, the random order information is maintained and stored during content playback according to the content playback list on the client, and the content playback list from the client is stored during the storage retention period. When the request is re-requested, the process of generating the content playback list information based on the stored random order information and transmitting it to the client is executed. By this process, the client can play the contents in the specific folder without duplication according to a random sequence. [0122] In the above-described embodiment, the shuffling process for each content has been described, but the shuffling process for a folder storing a playlist of the content or a folder as a set of a plurality of contents is also possible. .. [0123] An example of shuffling processing for each folder will be described with reference to FIG. The server stores attribute information (property information) corresponding to a folder in which a playlist of contents is stored and a folder / folder as a set of a plurality of contents in a storage unit. In the example shown in FIG. 13, a plurality of folders A to N491 to 493 in which playlists of contents are stored, and property information 495,496,497 corresponding to each folder are shown. [0125] The property information is attribute information corresponding to a folder, and includes various information such as a folder creator, an artist, and a playback time. In the configuration of the present invention, as shown in the figure as property information corresponding to the folder, the random order No. Is set. 【０１２６】ランダムオーダＮｏ． Is numbering data (number) as random order information set in each folder. This is rewritable random order information that resets the content playlist included in each folder for each folder. When the server receives a content information acquisition request including sort specification information indicating that it wants to sort a plurality of folders from the client, the random order No. 1 in the property information of the specified plurality of folders.

692 Is replaced and reset. Specifically, the random order information of 1 to n corresponding to the number n of folders to be shuffled is shuffled, and the random order information set for each property information is replaced. For the request data from the client, in the configuration data shown in FIG. 8, a container identifier, that is, a container identifier information as a higher-level object of a plurality of content playback list folder objects is set instead of the folder identification information 402. It is a configuration in which a plurality of identifier information of a plurality of content playback list folder objects is set. 【０１２８】ランダムオーダＮｏ． Is numbering data as a number set for each property information corresponding to a plurality of folders included in the container, for example, which is set as a set of a plurality of folders, and is n for the number of folders n included in the container. Random order numbers of are the information set without duplication. [0129] For example, in a container containing 10 playlist folders, numbers 1 to 10 are random order Nos. In the property information of each playlist folder. Is set as. This is executed for each sort request in random order from the client, and random order Nos. 1 to 10 are executed for each process. Is reset as the property information of each folder. [0130] Random order No. reset for each folder. Based on, for example, when the playlist A folder 491 contains the content playlists of the contents a to f and the playlist N folder 493 contains the content playlists of the contents p to z, as shown in FIG. 13 by shuffling. In addition, the random

Webgroup CZ a.s. Ex. 1002, Page 592 of 1406

order No. of the playlist N folder 493. = 1, Random order No. of playlist A folder 491. When = 2, the playlist in which the contents p to z of the playlist N folder 493 are set ahead of the contents a to f of the playlist A folder 491 is set, and the content reproduction is executed. [0131] As described above, in the configuration of the present invention, not only the content but also various objects stored in the storage unit by the server, such as the content or the data folder, are set as object attribute information (metadata). Random order information is stored in the property information and shuffle is executed in response to the request from the client, so the list order can be reset for each content or folder.

718 [Functional Configuration of Server and Client] The hardware configuration of the server and client device is as described above with reference to FIG. 2, and the various processes described above are stored in the storage unit of each server and client. It is executed under the control of a control unit (CPU, etc.) according to the stored program. [0133] For example, on the server side, the process executed by the CPU is a process of acquiring metadata corresponding to the content and generating XML data based on the property information in accordance with a request from the client, a random order No. of the property information. Shuffle processing, and processing for transmitting content according to the requested data mode from the client. The processing on the client side is the processing of displaying the content playback list on the display based on the XML data consisting of the property information received from the server, the processing of sequentially transmitting the content request with the content URL set according to the content playback list, and the processing of sending the content request to the server. Processing for receiving content, data conversion of received content, playback processing, and the like. [0134] Basically, these processes are executed under the control of the CPU as a control unit of the server and the client device, but the functional configuration of the server and the functions of the client required to execute the above-described processes. The configuration will be described with reference to FIGS. 14 and 15. FIG. 14 is a block diagram showing a main functional configuration of the server. The packet transmission / reception unit 501 receives a packet for the client and a packet from the client. The packet generation and analysis unit 502 performs transmission packet generation processing and reception packet analysis processing. Packet address setting, address recognition, data storage for the data part, data acquisition processing from the data part, etc. The content storage unit 503 stores the content owned by the server. The metadata storage unit 504 is a storage unit that stores metadata as attribute information corresponding to the content. The metadata includes the random order No. described with reference to FIG. Contains other property information. The property information acquisition unit 505 meta-meta data corresponding to the designated folder based on the property information acquisition request received from the client, for example, the browse request having the data structure described with reference to FIG. The process of extracting from the data storage unit 504 is executed.

748 【０１３８】ランダムオーダＮｏ． When the request of the content property list from the client specifies a random order, the setting unit 506 sets the random order No. of the property information of the corresponding content. Shuffle process. [0139] The content information generation unit 507 has the metadata acquired by the property information

Webgroup CZ a.s. Ex. 1002, Page 593 of 1406

acquisition unit 505, the random order No. Based on the information set by the setting unit 506, XML data as content information including the configuration information of the content playlist is generated. The content information generation unit 507 shuffles the random order information of 1 to n corresponding to the number of contents n, and executes the random order information replacement process set for each property information. The data conversion unit 508 executes decoding processing such as coding processing of transmitted content data. For example, data conversion based on ATRAC3 and MPEG4 is executed. Next, the functional configuration of the client device will be described with reference to FIG. The packet transmission / reception unit 601 executes packet transmission to the server and packet reception processing from the server. The packet generation and analysis unit 602 performs transmission packet generation processing and reception packet analysis processing. It includes not only analysis of stored data in packets, but also packet address setting, address recognition, data storage for the data section, data acquisition processing from the data section, and the like. [0141] The content information request processing unit 603 generates request data (see FIG. 8) of the content playlist to be transmitted to the server. That is, a process of generating content information request data storing random order setting information as setting order sort information of the content playback list is executed together with the specification information of the content folder storing a plurality of contents. [0142] The storage unit 604 stores the content included in the packet received from the server, the content information including the content playlist, and the like. [0143] The output unit 605 includes a speaker and a display applied to the content reproduction process. The display is also used for outputting the content information list described above with reference to FIG. 7. The input unit 606 is used, for example, as a start / end of content reproduction, input of other reproduction control setting information, and other data input means. The content information analysis unit 607 analyzes the XML data composed of the property information received from the server, generates the content playback list described above with reference to FIG. 10 based on the analysis data, and serves as an output unit. Executes the process of outputting to the display of.

780 The content reproduction control unit 608 receives from the server and executes the content reproduction process according to the content playlist displayed on the display. The content request sequence is determined according to the content playlist, and the content URL according to the playlist is sequentially sent to the packet generation analysis unit 602. The packet generation analysis unit 602 generates a packet in which the content URL is set, and transmits the content request to the server via the packet transmission / reception unit 601. [0146] The data conversion unit 609 executes various data conversion processes such as decoding of the content data received from the server. For example, data conversion based on ATRAC3 and MPEG4 is executed. The decrypted data may be re-encoded and the re-encoded data may be stored in the storage unit 603. [0147] The server and the client functionally have the functions shown in FIGS. 14 and 15, and execute each of the above-described processes. However, the block diagrams shown in FIGS. 14 and 15 are block diagrams for explaining the functions, and in reality, various processing programs are executed under the control of the CPU in the hardware configuration of the PC or the like

Webgroup CZ a.s. Ex. 1002, Page 594 of 1406

shown in FIG. NS. [0148] The present invention has been described in detail with reference to the specific examples. However, it is self-evident that a person skilled in the art can modify or substitute the embodiment without departing from the gist of the present invention. That is, the present invention has been disclosed in the form of an example, and should not be construed in a limited manner. In order to judge the gist of the present invention, the column of claims described at the beginning should be taken into consideration. [0149] The series of processes described in the specification can be executed by hardware, software, or a composite configuration of both. When executing processing by software, install the program that records the processing sequence in the memory in the computer built in the dedicated hardware and execute it, or execute the program on a general-purpose computer that can execute various processing. It can be installed and run. [0150] For example, the program can be recorded in advance on a hard disk or ROM (Read Only Memory) as a recording medium. Alternatively, the program may be temporarily or permanently placed on a removable recording medium such as a flexible disc, a CD-ROM (Compact Disc Read Only Memory), an MO (Magnet optical) disc, a DVD (Digital Versailles Disc), a magnetic disc, or a semiconductor memory. It can be stored (recorded).

810 Such a removable recording medium can be provided as so-called package software. [0151] In addition to installing the program on the computer from the removable recording medium as described above, the program can be wirelessly transferred from the download site to the computer, or wired to the computer via a network such as LAN (Local Area Network) or the Internet. The computer can receive the program transferred in this way and install it on a recording medium such as a built-in hard disk. [0152] The various processes described in the specification are not only executed in chronological order according to the description, but also executed in parallel or individually as required by the processing capacity of the device that executes the processes. May be good. Further, in the present specification, the system is a logical set configuration of a plurality of devices, and the devices having each configuration are not limited to those in the same housing. [Effect of the Invention] As described above, according to the configuration of the present invention, a list in which the playback order of the contents is randomly set on the server side is generated based on the request from the client and transmitted to the client. Therefore, the client can enjoy the content playback according to a random playback sequence only by performing the playback process according to the list received from the server, and eliminates the need for the user and the client to perform the shuffle process. .. Further, according to the configuration of the present invention, rewritable random order information corresponding to the list order setting information of the content playback list is stored in the property information corresponding to the content held in the server, and browsed from the client. Acquiring content information such as requests Content that acquires property information corresponding to the content in the specified folder, executes shuffle replacement processing of random order information, and sets the list order corresponding to the replaced random order information. Since the playback list is generated and sent to the client, the client can set the content playback sequence depending on the processing on the server side without increasing the processing load on the server side. Further, according to the configuration of the present invention, the

Webgroup CZ a.s. Ex. 1002, Page 595 of 1406

server is set to the reset random order No. Random order No. based on After generating sequential content playback list information and sending it to the client, the random order information is maintained and stored during content playback according to the content playback list on the client, and the content playback list from the client is stored during the storage retention period. When the request is re-requested, the content playback list information based on the stored random order information is generated and sent to the client, so the client executes the process of sending the content in the specific folder to the random sequence. It becomes possible to reproduce without duplication according to.

844 BRIEF DESCRIPTION OF THE DRAWINGS FIG. 1 is a diagram showing an example of an applicable network configuration of the present invention. FIG. 2 is a diagram illustrating a configuration example of a network connection device. FIG. 3 is a diagram illustrating a processing sequence between a server and a client in content data reproduction processing. FIG. 4 is a diagram showing an example of a management class of retained content in a server. FIG. 5 is a diagram illustrating a hierarchical structure of setting classes in a server. FIG. 6 is a diagram showing an example of a content information list displayed on a display based on XML data composed of property information transmitted from a server to a client. FIG. 7 is a diagram showing a data communication sequence between a server and a client when content reproduction is executed by randomly setting the content reproduction order. FIG. 8 is a diagram showing a request data structure of a content playlist requested from a client to a server when executing content reproduction by randomly setting a content reproduction order. FIG. 9 is a diagram for explaining content-corresponding property information held by the server. FIG. 10 is a diagram showing a display example of a content playlist. FIG. 11 is a flowchart illustrating a client-side process when executing content reproduction by randomly setting the content reproduction order. FIG. 12 is a flowchart illustrating a server-side process when executing content reproduction by randomly setting the content reproduction order. FIG. 13 is a diagram illustrating property information corresponding to a folder held by the server. FIG. 14 is a block diagram illustrating a processing function of a server. FIG. 15 is a block diagram illustrating a processing function of a client. [Description of Code] 100 Network 101 Server 121 PC122 Monitor 123 Mobile Phone 124 Player 125 PDA201 CPU202 ROM203 RAM204 HDD205 Bus 206 Input / Output Interface 207 Input Unit 208 Output Unit 209 Communication Unit 210 Drive 211 Removable Recording Medium 301 Root Containers 302 to 306 Class 350 Display 357 Content information list 401 Request identifier 402 Folder identifier 403 Sort information 404 List information 420 Content folder 421-423 Content 425-427 Property information 480 Display 481 Content playback list 482 Play button 483 Continuous play setting button 491-493 Folder 495 ~ 497 Property information 501 Packet transmission / reception unit 502 Packet generation and analysis unit 503 Content storage unit 504 Metadata storage unit 505 Property information acquisition unit 506 Random order No.

874 Setting unit 507 Content information generation unit 508 Data conversion unit 601 Packet transmission / reception unit 602 Packet generation and analysis unit 603 Content information request processing unit 604 Storage unit 605 Output unit 606 Input unit 607 Content information analysis unit 608 Content playback control processing unit 609 Data

Webgroup CZ a.s. Ex. 1002, Page 596 of 1406

conversion Department

Webgroup CZ a.s. Ex. 1002, Page 597 of 1406

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CLAIMS JP2004295569A

1.

13 An information processing device that executes content information transmission processing, an object containing at least one of contents or a data folder, a storage unit that stores property information as attribute information of the object, and a client as a content information request device. It has a data transmission / reception unit that executes data transmission / reception processing and a content information generation unit that generates content information to be transmitted to the client based on the property information, and the property information is used as list order setting information of the content playback list. It has the corresponding rewritable random order information, and the content information generation unit executes an update process as a replacement reset process of the random order information in response to a content playback list request from the client, and converts the update information into the update information. An information processing device having a configuration for executing a process of generating content playback list information having the following list order information and transmitting it to a client.

2.

29 The random order information is numbering data as a number set for each property information corresponding to each content included in the content folder set as a set of a plurality of contents, and the number of contents n included in the content folder. N random order numbers are set without duplication with respect to the information, and the content information generation unit executes shuffle of 1 to n random order information corresponding to the number of contents n to execute each property information. The information processing apparatus according to claim 1, wherein the random order information exchange processing set for is executed.

3.

40 The random order information is numbering data as a number set for the property information corresponding to the content playback list folder storing the content playback list, and the content information generation unit sets the number of folders to be shuffled to n. Billing characterized in that the corresponding 1 to n random order information is shuffled, the random order information set for each property information is replaced, and the list order setting process is executed for each folder. Item 1. The information processing apparatus according to item 1.

4.

50 The information processing device determines whether or not there is a content playlist generation request by a random order in the content playlist generation request data from the client, and on condition that there is a content playlist generation request by a random order. The information processing apparatus according to claim 1, wherein the information processing apparatus is configured to execute the random order information update process.

5.

58 The information processing device is characterized in that, after executing the update process of the random order information, the information processing device maintains and stores the random order information during content reproduction according to the content reproduction list on the client. The information processing apparatus according to 1.

6.

65 After executing the update process of the random order information, the information processing apparatus maintains and stores the random order information during content reproduction according to the content reproduction list in the client, and also receives the random order information from the client during the storage retention period. The first aspect of claim 1, wherein the process of generating the content playback list information based on the stored random order information and transmitting the content playback list information to the client is executed in response to the re-request of the content playback list request. Information processing equipment.

7.

76 The information processing apparatus according to claim 1, wherein the content information generation unit is configured to execute a process of generating the content playlist information as XML (eXtended Markup Language) data.

Webgroup CZ a.s. Ex. 1002, Page 599 of 1406

8.

82 An information processing device that acquires content information, and executes data transmission / reception processing with the server that holds the content information, and requests processing for the content playback list set in random order for the server. A content information request processing unit, a content information analysis unit that generates a content playback list composed of a plurality of content information based on the content information received from the server via the data transmission / reception unit, and the content information analysis unit. A display unit that displays the generated content playback list, and a content playback control unit that sends a content acquisition request to the server according to the list order of the content playback list and executes a playback control process of the content received from the server. An information processing device characterized by having.

9.

96 The content information request processing unit is configured to execute a process of generating content information request data storing random order setting information as setting order sort information of the content playback list together with the specification information of the content folder storing a plurality of contents. The information processing apparatus according to claim 8, wherein the information processing device is provided.

10.

104 The content information request processing unit is configured to execute a process of generating content information request data in which random order setting information is stored as setting order sort information of the content playback list together with the specified information of a plurality of content playback list folders. 8. The information processing apparatus according to claim 8.

11.

112 The content reproduction control unit is characterized in that it executes a process of sequentially transmitting a content request set with a content corresponding URL included in the content information received from the server to the server according to the list order of the content reproduction list. The information processing apparatus according to claim 8.

12.

119 The content information received from the server is XML (eXteded Markup Language) data that describes property information corresponding to the content, and the content information analysis unit analyzes the XML data to perform a content reproduction list

Webgroup CZ a.s. Ex. 1002, Page 600 of 1406

composed of a plurality of content information. The information processing apparatus according to claim 8, wherein the information processing apparatus is configured to execute a process of generating the information.

13.

128 It is an information processing method that executes the content information transmission process, and the content information acquisition request reception step that receives the content information acquisition request from the client and the list order setting information of the content playback list stored in the property information corresponding to the content. The random order information update step that executes the update process of the random order information as, the list generation step that generates the content playback list information having the list order information according to the updated random order information, and the generation list are sent to the client. An information processing method characterized by having a step to perform.

14.

140 The random order information is numbering data as a number set for each property information corresponding to each content included in the content folder set as a set of a plurality of contents, and the number of contents included in the content folder n. N random order numbers are set without duplication with respect to the information, and the random order information update step executes shuffling of 1 to n random order information corresponding to the number of contents n to execute each property. The information processing method according to claim 13, wherein the random order information replacement process set for the information is executed.

15.

151 The random order information is numbering data as a number set for the property information corresponding to the content playback list folder storing the content playback list, and the random order information update step is the number of folders to be shuffled. It is characterized in that the random order information of 1 to n corresponding to is shuffled, the random order information set for each property information is replaced, and the list order setting process is executed for each folder. The information processing method according to claim 13.

16.

161 The information processing method further includes a step of determining whether or not there is a content playlist generation request by a random order in the content playlist generation request data from the client, and there is a content playlist generation request by

Webgroup CZ a.s. Ex. 1002, Page 601 of 1406

a random order. The information processing method according to claim 13, wherein the random order information update process is executed on condition of the determination of the above.

17.

170 The information processing method is further characterized by having a step of maintaining and storing the random order information during content reproduction according to the content reproduction list in the client after executing the update process of the random order information. The information processing method according to claim 13.

18.

177 The information processing method further maintains and stores the random order information during content reproduction according to the content reproduction list in the client after executing the update process of the random order information, and also during the storage retention period. The thirteenth aspect of claim 13, wherein the process of generating the content playback list information based on the stored random order information and transmitting the content playback list information to the client is executed in response to the re-request of the content playback list request from the client. Information processing method.

19.

188 The information processing method according to claim 13, wherein the content information generation step executes a process of generating the content playlist information as XML (eXtended Markup Language) data.

20.

194 It is an information processing method that performs content acquisition processing, and is based on a content information request processing step that executes request processing of a content playback list set in a random order for a server that holds content information, and content information received from the server. A content information analysis step for generating a content playback list composed of a plurality of content information, a display step for displaying the content playback list generated in the content information analysis step, and a content acquisition request according to the list order of the content playback list. An information processing method comprising: a content reproduction control step of transmitting to a server and executing a reproduction control process of the content received from the server.

Webgroup CZ a.s. Ex. 1002, Page 602 of 1406

21.

207 The content information request processing step executes a process of generating content information request data storing random order setting information as setting order sort information of the content playback list together with the specification information of the content folder storing a plurality of contents. The information processing method according to claim 20, wherein the information processing method is characterized.

22.

215 The content information request processing step is characterized in that it executes a process of generating content information request data in which random order setting information is stored as setting order sort information of the content playback list together with designation information of a plurality of content playback list folders. The information processing method according to claim 20.

23.

223 The content reproduction control step is characterized in that a process of sequentially transmitting a content request set with a content corresponding URL included in the content information received from the server to the server is executed according to the list order of the content reproduction list. Item 20. The information processing method according to Item 20.

24.

231 The content information received from the server is XML (eXteded Markup Language) data that describes property information corresponding to the content, and the content information analysis step is a content reproduction list composed of a plurality of content information by analyzing the XML data. The information processing apparatus according to claim 20, wherein the processing for generating the information processing is executed.

25.

239 A computer program that executes content information transmission processing, and the content information acquisition request reception step that receives the content information acquisition request from the client, and the list order setting information of the content playback list stored in the property information corresponding to the content. The random order information update step that executes the update process of the random order information as, the list generation step that generates the content playback list information having the list order information according to the updated random order information, and the generation list are sent to the client. A computer program characterized by having, and having steps to do.

Webgroup CZ a.s. Ex. 1002, Page 603 of 1406

26.

251 It is a computer program that performs content acquisition processing, and is based on the content information request processing step that executes the request processing of the content playback list set in random order for the server that holds the content information, and the content information received from the server. A content information analysis step for generating a content playback list composed of a plurality of content information, a display step for displaying the content playback list generated in the content information analysis step, and a content acquisition request according to the list order of the content playback list. A computer program comprising: a content reproduction control step of transmitting to a server and executing a reproduction control process of the content received from the server.

Webgroup CZ a.s. Ex. 1002, Page 604 of 1406

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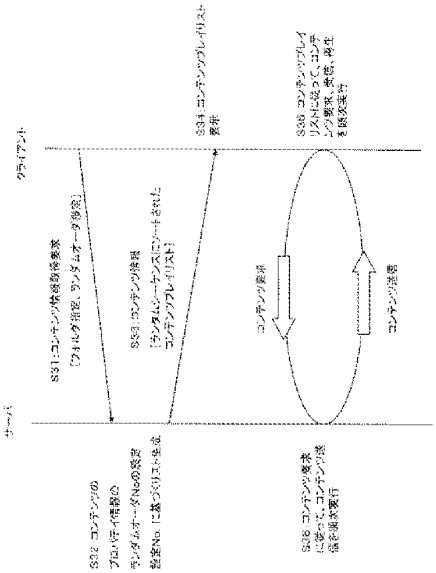
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(71)出願人　000002185
ソニー株式会社
東京都品川区北品川６丁目７番３５号
(74)代理人　100093241
弁理士　宮田　正昭
(74)代理人　100101801
弁理士　山田　英治
(74)代理人　100086531
弁理士　澤田　俊夫
(72)発明者　吉川　典史
東京都品川区北品川６丁目７番３５号　ソニー株式会社内
(72)発明者　本田　康晃
東京都品川区北品川６丁目７番３５号　ソニー株式会社内

最終頁に続く

(54)【発明の名称】情報処理装置、および情報処理方法、並びにコンピュータ・プログラム

(57)【要約】
【課題】ランダムオーダによるコンテンツ再生処理をクライアントの負担を減少させて効率的に実行する装置および方法を提供する。
【解決手段】クライアントからの要求に基づいてサーバ側でコンテンツの再生順をランダムに設定したリストを生成し、クライアントに送信する。サーバで保持するコンテンツに対応するプロパティ情報にコンテンツ再生リストのリスト順設定情報に対応するランダムオーダ情報を格納し、クライアントからのブラウズ要求等に応じて、指定フォルダ内のコンテンツのランダムオーダ情報のシャッフル入れ替え処理を実行して入れ替えたランダムオーダ情報に対応するリスト順を設定したコンテンツ再生リストを生成してクライアントに送信する。本構成により、ユーザおよびクライアント側でシャッフル処理を行う必要が排除される。
【選択図】　図7



【特許請求の範囲】
【請求項1】
コンテンツ情報送信処理を実行する情報処理装置であり、
コンテンツまたはデータフォルダの少なくともいずれかを含むオブジェクトと、前記オブジェクトの属性情報としてのプロパティ情報を記憶した記憶部と、
コンテンツ情報要求装置としてのクライアントとのデータ送受信処理を実行するデータ送受信部と、
前記プロパティ情報に基づいて、クライアントに送信するコンテンツ情報を生成するコンテンツ情報生成部とを有し、
前記プロパティ情報は、コンテンツ再生リストのリスト順設定情報に対応する書き換え可能なランダムオーダ情報を有し、
前記コンテンツ情報生成部は、
クライアントからのコンテンツ再生リスト要求に応じて、前記ランダムオーダ情報の入れ替え再設定処理としての更新処理を実行し、更新情報に従ったリスト順情報を持つコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成を有することを特徴とする情報処理装置。
【請求項2】
前記ランダムオーダ情報は、複数のコンテンツの集合として設定されるコンテンツフォルダに含まれる各コンテンツに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであり、コンテンツフォルダに含まれるコンテンツ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報であり、
前記コンテンツ情報生成部は、
コンテンツ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行することを特徴とする請求項１に記載の情報処理装置。
【請求項3】
前記ランダムオーダ情報は、コンテンツ再生リストを格納したコンテンツ再生リストフォルダに対応するプロパティ情報に対して設定された番号としてのナンバリングデータであり、
前記コンテンツ情報生成部は、
シャッフル対象となるフォルダ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行しフォルダ単位でのリスト順設定処理を実行することを特徴とする請求項１に記載の情報処理装置。
【請求項4】
前記情報処理装置は、
クライアントからのコンテンツ再生リストの要求データにランダムオーダによるコンテンツ再生リスト生成要求があるか否かを判定し、ランダムオーダによるコンテンツ再生リスト生成要求があるとの判定を条件として、前記ランダムオーダ情報の更新処理を実行する構成であることを特徴とする請求項１に記載の情報処理装置。
【請求項5】
前記情報処理装置は、
前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持する構成であることを特徴とする請求項１に記載の情報処理装置。
【請求項6】
前記情報処理装置は、
前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するとともに、該記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求に応じて、該

記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成であることを特徴とする請求項１に記載の情報処理装置。
【請求項7】
前記コンテンツ情報生成部は、
前記コンテンツ再生リスト情報をＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データとして生成する処理を実行する構成であることを特徴とする請求項１に記載の情報処理装置。
【請求項8】
コンテンツ情報の取得処理を行う情報処理装置であり、
コンテンツ情報を保有するサーバとのデータ送受信処理を実行するデータ送受信部と、
前記サーバに対してランダムオーダに設定したコンテンツ再生リストの要求処理を実行するコンテンツ情報要求処理部と、
前記データ送受信部を介して前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコンテンツ再生リストを生成するコンテンツ情報解析部と、
前記コンテンツ情報解析部の生成したコンテンツ再生リストを表示する表示部と、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御部と、
を有することを特徴とする情報処理装置。
【請求項9】
前記コンテンツ情報要求処理部は、
複数のコンテンツを格納したコンテンツフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行する構成であることを特徴とする請求項８に記載の情報処理装置。
【請求項10】
前記コンテンツ情報要求処理部は、
複数のコンテンツ再生リストフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行する構成であることを特徴とする請求項８に記載の情報処理装置。
【請求項11】
前記コンテンツ再生制御部は、
コンテンツ再生リストのリスト順に従って、サーバから受信したコンテンツ情報に含まれるコンテンツ対応ＵＲＬを設定したコンテンツ要求を前記サーバに、順次送信する処理を実行する構成であることを特徴とする請求項８に記載の情報処理装置。
【請求項12】
前記サーバから受信するコンテンツ情報は、コンテンツ対応のプロパティ情報を記述したＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データであり、
前記コンテンツ情報解析部は、
前記ＸＭＬデータの解析により、複数のコンテンツ情報からなるコンテンツ再生リストを生成する処理を実行する構成であることを特徴とする請求項８に記載の情報処理装置。
【請求項13】
コンテンツ情報送信処理を実行する情報処理方法であり、
クライアントからのコンテンツ情報取得要求を受信するコンテンツ情報取得要求受信ステップと、
コンテンツに対応するプロパティ情報中に格納されたコンテンツ再生リストのリスト順設定情報としてのランダムオーダ情報の更新処理を実行するランダムオーダ情報更新ステップと、
更新されたランダムオーダ情報に従ったリスト順情報を持つコンテンツ再生リスト情報を

生成するリスト生成ステップと、
生成リストをクライアントに送信するステップと、
を有することを特徴とする情報処理方法。
【請求項14】
前記ランダムオーダ情報は、複数のコンテンツの集合として設定されるコンテンツフォルダに含まれる各コンテンツに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであってコンテンツフォルダに含まれるコンテンツ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報であり、
前記ランダムオーダ情報更新ステップは、
コンテンツ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行することを特徴とする請求項１３に記載の情報処理方法。
【請求項15】
前記ランダムオーダ情報は、コンテンツ再生リストを格納したコンテンツ再生リストフォルダに対応するプロパティ情報に対して設定された番号としてのナンバリングデータであり、
前記ランダムオーダ情報更新ステップは、
シャッフル対象となるフォルダ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行しフォルダ単位でのリスト順設定処理を実行することを特徴とする請求項１３に記載の情報処理方法。
【請求項16】
前記情報処理方法は、さらに、
クライアントからのコンテンツ再生リストの要求データにランダムオーダによるコンテンツ再生リスト生成要求があるか否かを判定するステップを有し、
ランダムオーダによるコンテンツ再生リスト生成要求があるとの判定を条件として、前記ランダムオーダ情報の更新処理を実行することを特徴とする請求項１３に記載の情報処理方法。
【請求項17】
前記情報処理方法は、さらに、
前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するステップを有することを特徴とする請求項１３に記載の情報処理方法。
【請求項18】
前記情報処理方法は、さらに、
前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するとともに、該記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求に応じて、該記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行することを特徴とする請求項１３に記載の情報処理方法。
【請求項19】
前記コンテンツ情報生成ステップは、
前記コンテンツ再生リスト情報をＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データとして生成する処理を実行することを特徴とする請求項１３に記載の情報処理方法。
【請求項20】
コンテンツ取得処理を行う情報処理方法であり、
コンテンツ情報を保有するサーバに対してランダムオーダに設定したコンテンツ再生リストの要求処理を実行するコンテンツ情報要求処理ステップと、
前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコン

テンツ再生リストを生成するコンテンツ情報解析ステップと、
前記コンテンツ情報解析ステップにおいて生成したコンテンツ再生リストを表示する表示ステップと、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御ステップと、
を有することを特徴とする情報処理方法。
【請求項21】
前記コンテンツ情報要求処理ステップは、
複数のコンテンツを格納したコンテンツフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行することを特徴とする請求項２０に記載の情報処理方法。
【請求項22】
前記コンテンツ情報要求処理ステップは、
複数のコンテンツ再生リストフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行することを特徴とする請求項２０に記載の情報処理方法。
【請求項23】
前記コンテンツ再生制御ステップは、
コンテンツ再生リストのリスト順に従って、サーバから受信したコンテンツ情報に含まれるコンテンツ対応ＵＲＬを設定したコンテンツ要求を前記サーバに、順次送信する処理を実行することを特徴とする請求項２０に記載の情報処理方法。
【請求項24】
前記サーバから受信するコンテンツ情報は、コンテンツ対応のプロパティ情報を記述したＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データであり、
前記コンテンツ情報解析ステップは、
前記ＸＭＬデータの解析により、複数のコンテンツ情報からなるコンテンツ再生リストを生成する処理を実行することを特徴とする請求項２０に記載の情報処理装置。
【請求項25】
コンテンツ情報送信処理を実行するコンピュータ・プログラムであり、
クライアントからのコンテンツ情報取得要求を受信するコンテンツ情報取得要求受信ステップと、
コンテンツに対応するプロパティ情報中に格納されたコンテンツ再生リストのリスト順設定情報としてのランダムオーダ情報の更新処理を実行するランダムオーダ情報更新ステップと、
更新されたランダムオーダ情報に従ったリスト順情報を持つコンテンツ再生リスト情報を生成するリスト生成ステップと、
生成リストをクライアントに送信するステップと、
を有することを特徴とするコンピュータ・プログラム。
【請求項26】
コンテンツ取得処理を行うコンピュータ・プログラムであり、
コンテンツ情報を保有するサーバに対してランダムオーダに設定したコンテンツ再生リストの要求処理を実行するコンテンツ情報要求処理ステップと、
前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコンテンツ再生リストを生成するコンテンツ情報解析ステップと、
前記コンテンツ情報解析ステップにおいて生成したコンテンツ再生リストを表示する表示ステップと、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御ステップと、

を有することを特徴とするコンピュータ・プログラム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、情報処理装置、および情報処理方法、並びにコンピュータ・プログラムに関する。さらに、詳細には、コンテンツ提供サーバの有するコンテンツの再生をクライアント側で実行する場合に、クライアント側に負担を発生させることなく、コンテンツの再生シーケンスを適宜、変更して再生することを可能とした情報処理装置、および情報処理方法、並びにコンピュータ・プログラムに関する。
【０００２】
【従来の技術】
昨今のデータ通信ネットワークの普及に伴い、家庭内においても家電機器やコンピュータ、その他の周辺機器をネットワーク接続し、各機器間での通信を可能とした、いわゆるホームネットワークが浸透しつつある。ホームネットワークは、ネットワーク接続機器間で通信を行なうことにより各機器のデータ処理機能を共有したり、機器間でコンテンツの送受信を行なう等、ユーザに利便性・快適性を提供するものであり、今後、ますます普及することが予測される。
【０００３】
このようなホームネットワークの構成に適するプロトコルとしてユニバーサルプラグアンドプレイ（ＵＰｎＰ：Ｕｎｉｖｅｒｓａｌ　Ｐｌｕｇ　ａｎｄ　Ｐｌａｙ）が知られている。ユニバーサルプラグアンドプレイ（ＵＰｎＰ）は、複雑な操作を伴うことなく容易にネットワークを構築することが可能であり、困難な操作や設定を伴うことなくネットワーク接続された機器において各接続機器の提供サービスを受領可能とするものである。また、ＵＰｎＰはデバイス上のＯＳ（オペレーティングシステム）にも依存せず、容易に機器の追加ができるという利点を持つ。
【０００４】
ＵＰｎＰは、接続機器間で、ＸＭＬ（ｅＸｔｅｎｓｉｂｌｅ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）に準拠した定義ファイルを交換し、機器間において相互認識を行なう。ＵＰｎＰの処理の概要は、以下の通りである。
（１）ＩＰアドレス等の自己のデバイスＩＤを取得するアドレッシング処理。
（２）ネットワーク上の各デバイスの検索を行ない、各デバイスから応答を受信し、応答に含まれるデバイス種別、機能等の情報を取得するディスカバリ処理。
（３）ディスカバリ処理で取得した情報に基づいて、各デバイスにサービスを要求するサービス要求処理。
【０００５】
上記処理手順を行なうことで、ネットワーク接続された機器を適用したサービスの提供および受領が可能となる。ネットワークに新たに接続される機器は、上記のアドレッシング処理によりデバイスＩＤを取得し、ディスカバリ処理によりネットワーク接続された他のデバイスの情報を取得して、取得情報に基づいて他の機器にサービスの要求が可能となる。
【０００６】
例えばサーバに格納された音楽データ、画像データ等のコンテンツをクライアント側デバイスにおいて再生しようとする場合には、クライアントは、サーバの保有するコンテンツについての情報を取得する。サーバは、コンテンツを記憶部に格納するとともに、格納コンテンツに対する属性情報を併せて格納している。属性情報には、例えばコンテンツとしての例えば曲や映画のタイトル、アーティスト名、記録日時、さらにデータの圧縮態様等に関する情報など様々である。これらの属性情報はメタデータあるいはメタ情報と呼ばれる。
【０００７】
例えばサーバに格納された音楽データ、画像データ等のコンテンツをクライアント側デバ

イスにおいて再生しようとする場合には、クライアント側からサーバに対してサーバに格納されたコンテンツ情報、例えば曲や映画のタイトルやアーティスト名、さらにデータの圧縮態様情報（ＡＴＲＡＣ：ａｄａｐｔｉｖｅ　ｔｒａｎｓｆｏｒｍ　ａｃｏｕｓｔｉｃ　ｃｏｄｉｎｇ，　ＭＰＥＧ：ｍｏｖｉｎｇ　ｐｉｃｔｕｒｅ　ｅｘｐｅｒｔｓ　ｇｒｏｕｐ等）、さらに必要に応じて著作権情報などの様々なコンテンツの属性情報の取得要求を送信する。

【０００８】

サーバは、クライアントからの要求に応じてサーバの保有するコンテンツに関するメタデータ（属性情報）をクライアントに送信する。クライアントは、サーバから取得したメタデータに基づいて所定の表示プログラムに従ってクライアントデバイスのディスプレイにコンテンツ情報を表示する。例えばアーティスト名、タイトル等からなる曲目リストなどがディスプレイに表示される。ユーザは、表示情報に基づいて、再生対象コンテンツを確認あるいは選択して、コンテンツの送信要求をサーバに送信する。サーバはクライアントからのコンテンツリクエストを受信し、受信リクエストに応じてサーバからクライアントに対するコンテンツの送信が行われ、クライアント側において受信コンテンツの再生が行われる。

【０００９】

このようにサーバに格納されたコンテンツは、ネットワーク接続された他の機器（クライアント）から検索を行い、特定のコンテンツを指定して再生することが可能となる。

【００１０】

例えば、１つの音楽コンテンツのみを再生対象としてクライアントが選択した場合は、その１つの音楽コンテンツの識別子を含むコンテンツ送信要求がサーバに送信されて、サーバが指定コンテンツを記憶部から取得してクライアントに送信しクライアントにおいて再生され、処理が終了する。複数の音楽コンテンツが再生対象としてクライアントにより選択されると、コンテンツ毎に送信要求がクライアントからサーバに送信され、各音楽コンテンツがサーバからクライアントに順次、提供されて、クライアント側において再生されることになる。

【００１１】

サーバに格納されるコンテンツフォルダには、複数の音楽コンテンツを格納したコンテンツフォルダ、例えばユーザがお気に入りの曲のみを集めて生成したフォルダ、あるいは特定のアーティスト、ジャンル等の複数の音楽コンテンツを格納したフォルダ等を設定可能であり、クライアント側のユーザはこれらの特定のフォルダを指定してフォルダに格納された複数のコンテンツ（曲）をシーケンシャルに再生する処理が可能である。

【００１２】

複数の曲からなる集合体を記録再生装置から、携帯装置等の端末に転送する際に、コンテンツおよびその管理データを併せて送信する構成については、例えば特許文献１に記載されている。

【００１３】

複数コンテンツの格納されたフォルダをクライアントが再生対象としてフォルダ内の複数コンテンツ再生を実行する場合、曲の再生順が常に一定の順番で行われると、コンテンツを聞く側のユーザの楽しみが減退する。そこで、複数のコンテンツ再生の順番の変更処理、すなわち複数のコンテンツ再生順をシャッフルして再生順を変更することが行われる。

【００１４】

従来、このようなコンテンツ再生シーケンスの変更処理は、サーバからクライアントに送信されてきた複数コンテンツに関する曲目等のデータリストに基づいて、ユーザが再生順の決定処理を行うか、あるいは、クライアント側の機器に格納した再生シーケンス決定プログラムによって再生順を決定するなどの処理が行われていた。すなわち、クライアント側が主導的にコンテンツ再生順を決定し、決定したコンテンツ再生順に従ってクライアントがサーバにコンテンツ要求を送信する。サーバは、単にクライアントからの要求情報に基づいて、コンテンツを順次送信するという処理を行っているのが一般的であった。

【００１５】
このような構成では、コンテンツの再生順の設定あるいはシャッフル等、複数コンテンツの再生順を変更する処理をクライアント側で実行することが必要となり、ユーザまたはクライアント側の負担が発生するという問題があった。
【００１６】
【特許文献１】
特許公開２００１－２１６７６６号公報
【００１７】
【発明が解決しようとする課題】
本発明は、上述の問題点に鑑みてなされたものであり、ユーザまたはクライアント側に負担を発生させることなく、コンテンツの再生シーケンスを適宜、変更して再生することを可能とした情報処理装置、および情報処理方法、並びにコンピュータ・プログラムを提供することを目的とする。
【００１８】
【課題を解決するための手段】
本発明の第１の側面は、
コンテンツ情報送信処理を実行する情報処理装置であり、
コンテンツまたはデータフォルダの少なくともいずれかを含むオブジェクトと、前記オブジェクトの属性情報としてのプロパティ情報を記憶した記憶部と、
コンテンツ情報要求装置としてのクライアントとのデータ送受信処理を実行するデータ送受信部と、
前記プロパティ情報に基づいて、クライアントに送信するコンテンツ情報を生成するコンテンツ情報生成部とを有し、
前記プロパティ情報は、コンテンツ再生リストのリスト順設定情報に対応する書き換え可能なランダムオーダ情報を有し、
前記コンテンツ情報生成部は、
クライアントからのコンテンツ再生リスト要求に応じて、前記ランダムオーダ情報の入れ替え再設定処理としての更新処理を実行し、更新情報に従ったリスト順情報を持つコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成を有することを特徴とする情報処理装置にある。
【００１９】
さらに、本発明の情報処理装置の一実施態様において、前記ランダムオーダ情報は、複数のコンテンツの集合として設定されるコンテンツフォルダに含まれる各コンテンツに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであり、コンテンツフォルダに含まれるコンテンツ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報であり、前記コンテンツ情報生成部は、コンテンツ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行することを特徴とする。
【００２０】
さらに、本発明の情報処理装置の一実施態様において、前記ランダムオーダ情報は、コンテンツ再生リストを格納したコンテンツ再生リストフォルダに対応するプロパティ情報に対して設定された番号としてのナンバリングデータであり、前記コンテンツ情報生成部は、シャッフル対象となるフォルダ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行しフォルダ単位でのリスト順設定処理を実行することを特徴とする。
【００２１】
さらに、本発明の情報処理装置の一実施態様において、前記情報処理装置は、クライアントからのコンテンツ再生リストの要求データにランダムオーダによるコンテンツ再生リスト生成要求があるか否かを判定し、ランダムオーダによるコンテンツ再生リスト生成要求があるとの判定を条件として、前記ランダムオーダ情報の更新処理を実行する構成である

ことを特徴とする。
【００２２】
さらに、本発明の情報処理装置の一実施態様において、前記情報処理装置は、前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持する構成であることを特徴とする。
【００２３】
さらに、本発明の情報処理装置の一実施態様において、前記情報処理装置は、前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するとともに、該記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求に応じて、該記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成であることを特徴とする。
【００２４】
さらに、本発明の情報処理装置の一実施態様において、前記コンテンツ情報生成部は、前記コンテンツ再生リスト情報をＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データとして生成する処理を実行する構成であることを特徴とする。
【００２５】
さらに、本発明の第２の側面は、
コンテンツ情報の取得処理を行う情報処理装置であり、
コンテンツ情報を保有するサーバとのデータ送受信処理を実行するデータ送受信部と、
前記サーバに対してランダムオーダに設定したコンテンツ再生リストの要求処理を実行するコンテンツ情報要求処理部と、
前記データ送受信部を介して前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコンテンツ再生リストを生成するコンテンツ情報解析部と、
前記コンテンツ情報解析部の生成したコンテンツ再生リストを表示する表示部と、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御部と、
を有することを特徴とする情報処理装置にある。
【００２６】
さらに、本発明の情報処理装置の一実施態様において、前記コンテンツ情報要求処理部は、複数のコンテンツを格納したコンテンツフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行する構成であることを特徴とする。
【００２７】
さらに、本発明の情報処理装置の一実施態様において、前記コンテンツ情報要求処理部は、複数のコンテンツ再生リストフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行する構成であることを特徴とする。
【００２８】
さらに、本発明の情報処理装置の一実施態様において、前記コンテンツ再生制御部は、コンテンツ再生リストのリスト順に従って、サーバから受信したコンテンツ情報に含まれるコンテンツ対応ＵＲＬを設定したコンテンツ要求を前記サーバに、順次送信する処理を実行する構成であることを特徴とする。
【００２９】
さらに、本発明の情報処理装置の一実施態様において、前記サーバから受信するコンテンツ情報は、コンテンツ対応のプロパティ情報を記述したＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データであり、前記コンテンツ情報解析部は、前記ＸＭＬデータの解析により、複数のコンテンツ情報からなるコンテンツ再生リストを生成する処

理を実行する構成であることを特徴とする。
【００３０】
さらに、本発明の第３の側面は、
コンテンツ情報送信処理を実行する情報処理方法であり、
クライアントからのコンテンツ情報取得要求を受信するコンテンツ情報取得要求受信ステップと、
コンテンツに対応するプロパティ情報中に格納されたコンテンツ再生リストのリスト順設定情報としてのランダムオーダ情報の更新処理を実行するランダムオーダ情報更新ステップと、
更新されたランダムオーダ情報に従ったリスト順情報を持つコンテンツ再生リスト情報を生成するリスト生成ステップと、
生成リストをクライアントに送信するステップと、
を有することを特徴とする情報処理方法にある。
【００３１】
さらに、本発明の情報処理方法の一実施態様において、前記ランダムオーダ情報は、複数のコンテンツの集合として設定されるコンテンツフォルダに含まれる各コンテンツに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであってコンテンツフォルダに含まれるコンテンツ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報であり、前記ランダムオーダ情報更新ステップは、コンテンツ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行することを特徴とする。
【００３２】
さらに、本発明の情報処理方法の一実施態様において、前記ランダムオーダ情報は、コンテンツ再生リストを格納したコンテンツ再生リストフォルダに対応するプロパティ情報に対して設定された番号としてのナンバリングデータであり、前記ランダムオーダ情報更新ステップは、シャッフル対象となるフォルダ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行しフォルダ単位でのリスト順設定処理を実行することを特徴とする。
【００３３】
さらに、本発明の情報処理方法の一実施態様において、前記情報処理方法は、さらに、クライアントからのコンテンツ再生リストの要求データにランダムオーダによるコンテンツ再生リスト生成要求があるか否かを判定するステップを有し、ランダムオーダによるコンテンツ再生リスト生成要求があるとの判定を条件として、前記ランダムオーダ情報の更新処理を実行することを特徴とする。
【００３４】
さらに、本発明の情報処理方法の一実施態様において、前記情報処理方法は、さらに、前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するステップを有することを特徴とする。
【００３５】
さらに、本発明の情報処理方法の一実施態様において、前記情報処理方法は、さらに、前記ランダムオーダ情報の更新処理を実行後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持するとともに、該記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求に応じて、該記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行することを特徴とする。
【００３６】
さらに、本発明の情報処理方法の一実施態様において、前記コンテンツ情報生成ステップは、前記コンテンツ再生リスト情報をＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データとして生成する処理を実行することを特徴とする。

【００３７】
さらに、本発明の第４の側面は、
コンテンツ取得処理を行う情報処理方法であり、
コンテンツ情報を保有するサーバに対してランダムオーダに設定したコンテンツ再生リストの要求処理を実行するコンテンツ情報要求処理ステップと、
前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコンテンツ再生リストを生成するコンテンツ情報解析ステップと、
前記コンテンツ情報解析ステップにおいて生成したコンテンツ再生リストを表示する表示ステップと、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御ステップと、
を有することを特徴とする情報処理方法にある。
【００３８】
さらに、本発明の情報処理方法の一実施態様において、前記コンテンツ情報要求処理ステップは、複数のコンテンツを格納したコンテンツフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行することを特徴とする。
【００３９】
さらに、本発明の情報処理方法の一実施態様において、前記コンテンツ情報要求処理ステップは、複数のコンテンツ再生リストフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行することを特徴とする。
【００４０】
さらに、本発明の情報処理方法の一実施態様において、前記コンテンツ再生制御ステップは、コンテンツ再生リストのリスト順に従って、サーバから受信したコンテンツ情報に含まれるコンテンツ対応ＵＲＬを設定したコンテンツ要求を前記サーバに、順次送信する処理を実行することを特徴とする。
【００４１】
さらに、本発明の情報処理方法の一実施態様において、前記サーバから受信するコンテンツ情報は、コンテンツ対応のプロパティ情報を記述したＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データであり、前記コンテンツ情報解析ステップは、前記ＸＭＬデータの解析により、複数のコンテンツ情報からなるコンテンツ再生リストを生成する処理を実行することを特徴とする。
【００４２】
さらに、本発明の第５の側面は、
コンテンツ情報送信処理を実行するコンピュータ・プログラムであり、
クライアントからのコンテンツ情報取得要求を受信するコンテンツ情報取得要求受信ステップと、
コンテンツに対応するプロパティ情報中に格納されたコンテンツ再生リストのリスト順設定情報としてのランダムオーダ情報の更新処理を実行するランダムオーダ情報更新ステップと、
更新されたランダムオーダ情報に従ったリスト順情報を持つコンテンツ再生リスト情報を生成するリスト生成ステップと、
生成リストをクライアントに送信するステップと、
を有することを特徴とするコンピュータ・プログラムにある。
【００４３】
さらに、本発明の第６の側面は、
コンテンツ取得処理を行うコンピュータ・プログラムであり、
コンテンツ情報を保有するサーバに対してランダムオーダに設定したコンテンツ再生リス

トの要求処理を実行するコンテンツ情報要求処理ステップと、
前記サーバから受信するコンテンツ情報に基づいて、複数のコンテンツ情報からなるコンテンツ再生リストを生成するコンテンツ情報解析ステップと、
前記コンテンツ情報解析ステップにおいて生成したコンテンツ再生リストを表示する表示ステップと、
コンテンツ再生リストのリスト順に従ってコンテンツ取得要求を前記サーバに送信するとともに、該サーバから受信したコンテンツの再生制御処理を実行するコンテンツ再生制御ステップと、
を有することを特徴とするコンピュータ・プログラムにある。
【００４４】
【作用】
本発明の構成によれば、クライアントからの要求に基づいてサーバ側でコンテンツの再生順をランダムに設定したリストを生成し、クライアントに送信する構成としたので、クライアントは、サーバから受信するリストに従って再生処理を行うのみで、ランダムな再生シーケンスに従ってコンテンツ再生を楽しむことが可能となり、ユーザおよびクライアント側でシャッフル処理を行う必要が排除される。
【００４５】
さらに、本発明の構成によれば、サーバで保持するコンテンツに対応するプロパティ情報中にコンテンツ再生リストのリスト順設定情報に対応する書き換え可能なランダムオーダ情報を格納し、クライアントからのブラウズ要求等のコンテンツ情報取得要求に応じて、指定フォルダ内のコンテンツに対応するプロパティ情報を取得してランダムオーダ情報のシャッフル入れ替え処理を実行して入れ替えたランダムオーダ情報に対応するリスト順を設定したコンテンツ再生リストを生成してクライアントに送信する構成としたので、サーバ側の処理負担も大きくすることなく、クライアントは、サーバ側の処理に依存したコンテンツ再生シーケンス設定を行うことが可能となる。
【００４６】
さらに、本発明の構成によれば、サーバは、再設定されたランダムオーダＮｏ．に基づいてランダムオーダＮｏ．順のコンテンツ再生リスト情報を生成してクライアントに送信後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持し、記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求があった場合は、記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成としたので、クライアントは特定フォルダ内のコンテンツを、ランダムシーケンスに従って重複なく再生することが可能となる。
【００４７】
なお、本発明のコンピュータ・プログラムは、例えば、様々なプログラム・コードを実行可能な汎用コンピュータ・システムに対して、コンピュータ可読な形式で提供する記憶媒体、通信媒体、例えば、ＣＤやＦＤ、ＭＯなどの記憶媒体、あるいは、ネットワークなどの通信媒体によって提供可能なコンピュータ・プログラムである。このようなプログラムをコンピュータ可読な形式で提供することにより、コンピュータ・システム上でプログラムに応じた処理が実現される。
【００４８】
本発明のさらに他の目的、特徴や利点は、後述する本発明の実施例や添付する図面に基づく、より詳細な説明によって明らかになるであろう。なお、本明細書においてシステムとは、複数の装置の論理的集合構成であり、各構成の装置が同一筐体内にあるものには限らない。
【００４９】
【発明の実施の形態】
以下、図面を参照しながら、本発明の情報処理装置、および情報処理方法、並びにコンピュータ・プログラムの詳細について説明する。

【００５０】
［システム概要］
まず、図１を参照して、本発明の適用可能なネットワーク構成例について説明する。図１は、様々なクライアント装置からの処理要求に応じて処理を実行するサーバ１０１と、サーバ１０１に対して処理要求を行なうクライアント装置としてのＰＣ１２１，モニター１２２，携帯電話１２３、再生機１２４、ＰＤＡ１２５がネットワーク１００を介して接続された構成、例えばホームネットワーク構成を示している。クライアント装置としては、この他にも様々な電子機器、家電機器が接続可能である。
【００５１】
サーバ１０１がクライアントからの要求に応じて実行する処理は、例えばサーバ１０１の保有するハードディスク等の記憶手段に格納されたコンテンツの提供、あるいはサーバの実行可能なアプリケーションプログラムの実行によるデータ処理サービス等である。なお、図１においては、サーバ１０１と、クライアント装置とを区別して示しているが、クライアントからの要求に対するサービスを提供する機器をサーバとして示しているものであり、いずれのクライアント装置も、自己のデータ処理サービスを他のクライアントに提供する場合には、サーバとしての機能を提供可能となる。従って、図１に示すネットワーク接続されたクライアント装置もサーバとなり得る。
【００５２】
ネットワーク１００は、有線、無線等いずれかのネットワークであり、各接続機器は、例えばイーサネット（登録商標）フレーム等の通信パケットをネットワーク１００を介して送受信する。すなわち、クライアントは、イーサネットフレームのデータ部に処理要求情報を格納したフレームをサーバ１０１に送信することにより、サーバ１０１に対するデータ処理要求を実行する。サーバ１０１は、処理要求フレームの受信に応じて、データ処理を実行し、必要に応じてデータ処理結果としての結果データを通信パケットのデータ部に格納し、各クライアントに送信する。
【００５３】
ネットワーク接続機器は、例えばユニバーサルプラグアンドプレイ（ＵＰｎＰ：Ｕｎｉｖｅｒｓａｌ　Ｐｌｕｇ　ａｎｄ　Ｐｌａｙ）対応機器によって構成される。従って、ネットワークに対する接続機器の追加、削除が容易な構成である。ネットワークに新たに接続する機器は、
（１）ＩＰアドレス等の自己のデバイスＩＤを取得するアドレッシング処理。
（２）ネットワーク上の各デバイスの検索を行ない、各デバイスから応答を受信し、応答に含まれるデバイス種別、機能等の情報を取得するディスカバリ処理。
（３）ディスカバリ処理で取得した情報に基づいて、各デバイスにサービスを要求するサービス要求処理。
上記処理手順を行なうことで、ネットワーク接続された機器を適用したサービスを受領することが可能となる。
【００５４】
図１に示すサーバおよびクライアント装置を構成する情報処理装置の一例としてＰＣのハードウェア構成例について図２を参照して説明する。
【００５５】
ＣＰＵ（Ｃｅｎｔｒａｌ　Ｐｒｏｃｅｓｓｉｎｇ　Ｕｎｉｔ）２０１は、ＲＯＭ（Ｒｅａｄ　Ｏｎｌｙ　Ｍｅｍｏｒｙ）２０２、またはＨＤＤ２０４等に記憶されているプログラムに従って、各種の処理を実行し、データ処理手段、あるいは通信制御処理手段として機能する。ＲＡＭ２０３には、ＣＰＵ２０１が実行するプログラムやデータが適宜記憶される。ＣＰＵ２０１、ＲＯＭ２０２、およびＲＡＭ２０３、ＨＤＤ２０４は、バス２０５を介して相互に接続されている。
【００５６】
バス２０５には、入出力インタフェース２０６が接続されており、この入出力インタフェース２０６には、例えば、ユーザにより操作されるキーボード、スイッチ、ボタン、ある

いはマウス等により構成される入力部２０７、ユーザに各種の情報を提示するＬＣＤ、ＣＲＴ、スピーカ等により構成される出力部２０８が接続される。さらに、データ送受信手段として機能する通信部２０９、さらに、磁気ディスク、光ディスク、光磁気ディスク、または半導体メモリなどのリムーバブル記録媒体２１１を装着可能で、これらのリムーバブル記録媒体２１１からのデータ読み出しあるいは書き込み処理を実行するドライブ２１０が接続される。

【００５７】

図２に示す構成は、図１に示すネットワーク接続機器の一例としてのサーバ、パーソナルコンピュータ（ＰＣ）の例であるが、ネットワーク接続機器はＰＣに限らず、図１に示すように携帯電話、ＰＤＡ等の携帯通信端末、その他、再生装置、ディスプレイ等の様々な電子機器、情報処理装置によって構成することが可能である。従って、それぞれの機器固有のハードウェア構成を持つことが可能であり、そのハードウェアに従った処理を実行する。

【００５８】

［メタデータ］

次にクライアントに提供するコンテンツを格納したサーバが保有するメタデータについて説明する。サーバは、自己の記憶部に格納した静止画、動画等の画像データ、音楽等の音声データ等のコンテンツ各々に対応する属性情報をメタデータとして保有している。なお、メタデータの構成要素をプロパティ情報と呼ぶ。

【００５９】

なお、サーバの保有する静止画、動画等の画像データ、音楽等の音声データ等のコンテンツを総称してＡＶコンテンツと呼ぶ。サーバにおいて、ＡＶコンテンツは、階層構成を有するコンテンツディレクトリによって管理される。

【００６０】

コンテンツディレクトリは、個々のＡＶコンテンツあるいは複数のＡＶコンテンツを格納したフォルダによって構成される階層構成を持つ。コンテンツディレクトリの個々の要素、すなわち、個々のＡＶコンテンツあるいは複数のＡＶコンテンツを格納したフォルダの各々はオブジェクト（Ｏｂｊｅｃｔ）と呼ばれる。なお、オブジェクトとは、サーバによって処理されるデータ単位の総称であり、個々のＡＶコンテンツあるいは複数のＡＶコンテンツを格納したフォルダ以外にも様々なオブジェクトが存在する。

【００６１】

また、オブジェクトの集合をコンテナ（Ｃｏｎｔａｉｎｅｒ）と呼ぶ、集合の単位は、例えば各オブジェクトの物理的な記憶位置に基づく集合、各オブジェクトの論理的関係に基づく集合、カテゴリに基づく集合等、様々に設定され得る。なお、ＡＶコンテンツの最小単位、すなわち１つの楽曲データ、１つの動画データ、１つの静止画データ等をアイテム（ｉｔｅｍ）とよぶ。

【００６２】

オブジェクトは、その種類、例えば音楽（Ａｕｄｉｏ）、ビデオ（Ｖｉｄｅｏ）、写真（Ｐｈｏｔｏ）等、その種類によりクラスに分類されクラスラベリングがなされる。クライアントは、例えば特定のクラスを指定して、特定の分類に属するオブジェクトのみを対象とした「サーチ」を要求し実行することができる。また特定のフォルダ等のオブジェクトを指定して、そのフォルダに関する情報のみを要求する「ブラウズ」を要求し特定フォルダに関する情報の取得処理をすることが可能である。なお、サーバにおいては、クラスも階層構成で管理されており、１つのクラスの下にサブクラスの設定が可能である。

【００６３】

メタデータは、サーバの持つコンテンツに対応した属性情報、クラスの定義情報、コンテンツディレクトリを構成する階層構成に関する情報等を含むさまざまな管理情報である。個々のオブジェクトに対応付けて定義されたコンテンツの属性情報としてのメタデータには、コンテンツの識別子（ＩＤ）、データサイズ、リソース情報、タイトル、アーティスト名、著作権情報等、様々な情報が含まれる。メタデータに含まれる個々の情報をプロパ

ティと呼ぶ。なお、音楽（Ａｕｄｉｏ）、ビデオ（Ｖｉｄｅｏ）、写真（Ｐｈｏｔｏ）等、前述したクラス毎にどのようなプロパティからなるメタデータを持つかが予め規定されている。

【００６４】

［クライアントによるコンテンツ再生処理］

例えばコンテンツを再生しようとするクライアントは、サーバに対してコンテンツ要求を行い、要求コンテンツをサーバから受信してコンテンツの再生を行うことができる。一般的なコンテンツ再生の手順について図３を参照して説明する。まず、ステップＳ１１において、クライアントは、サーバの保有するコンテンツ情報の取得要求を行う。ステップＳ１２で、サーバは、クライアントの要求に従ってコンテンツ対応のメタデータに基づいて、タイトル、アーティスト名などのコンテンツ情報をＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データにより生成してクライアントに送信する。

【００６５】

クライアントは、ステップＳ１３において、受信ＸＭＬ情報に従って、コンテンツ情報をディスプレイに表示する。例えば音楽コンテンツであれば、サーバの保有する複数の音楽に対応する曲名、アーティスト名、再生時間等からなるリストとして表示される。

【００６６】

次に、クライアントはステップＳ１４において、クライアント装置において、サーバから受信し再生する曲を選択し、コンテンツ指定情報（例えばコンテンツＩＤ）をサーバに送信する。サーバは受信したコンテンツ指定情報に基づいてコンテンツを記憶手段から取得して、送信する。ステップＳ１６において、クライアントはサーバから受信したコンテンツを再生する。なお、コンテンツがＡＴＲＡＣ、ＭＰＥＧ等の圧縮処理がなされている場合は、クライアント側で復号処理を行った後に再生処理を行う。

【００６７】

通常のコンテンツ再生手順は、上述したとおりである。クライアントは、様々なコンテンツ属性情報、すなわち、サーバの保有するコンテンツ対応のメタデータに含まれるプロパティ情報を取得し、プロパティ情報に基づいてクライアントにコンテンツリスト等のＵＩを表示し、コンテンツを選択しサーバに要求することができる。

【００６８】

図３に示すステップＳ１１における処理、すなわち、クライアントがサーバの保有するコンテンツ情報を取得する際、クライアントは、例えばタイトルにワードとして「クリスマス」の入ったコンテンツ情報を要求するといったコンテンツ検索、いわゆるサーチ処理により、特定のコンテンツ情報を選択して取得することが可能である。あるいは、特定のフォルダ、例えばユーザがお気に入りの曲のみを集めて生成したフォルダ、あるいは特定のアーティスト、ジャンル等の複数の音楽コンテンツを格納したフォルダ等を指定してフォルダに格納された複数コンテンツのコンテンツ情報を取得することが可能である。

【００６９】

前述したように、サーバでは、管理コンテンツとしてのオブジェクトを、その種類、例えば音楽（Ａｕｄｉｏ）、ビデオ（Ｖｉｄｅｏ）、写真（Ｐｈｏｔｏ）等、さらに、アーティスト、アルバムなど、様々なカテゴリ（種類）によりクラスに分類して管理しており、階層構成でクラスの管理を行っている。

【００７０】

サーバにおける管理クラスの一例を図４に示す。図４の例は音楽コンテンツ関連のクラス例である。図４に示すように、曲、アルバム、ジャンル、複数のアルバムを集積したアルバムキャビネットなど、様々なクラスが設定され、サーバは、各クラスでのコンテンツおよびコンテンツ属性情報としてのメタデータ、プロパティ情報の管理を行っている。

【００７１】

サーバの管理するクラスの階層構成例を図５に示す。階層構成は図５に示すように分岐ツリー状の図として示すことができる。図５に示す各円の各々が個々のクラスに対応する。この階層構成は、サーバが記憶部に格納し管理するコンテンツに対応する論理的な管理構

成を示すものである。各クラスに対応して属性情報としてのメタデータが設定される。
【００７２】
図５において、最上位はルートコンテナ３０１と呼ばれる。ルートコンテナの下位に例えば音楽（ミュージック）クラス３０２、動画クラス３０３、静止画クラス３０４等が設定される。音楽（ミュージック）クラス３０２の下位には、ジャンル３０５、ジャンルの下位には、アーティスト３０６などのクラス設定がなされる。
【００７３】
コンテンツ検索を実行しようとするクライアントは、クラスを指定して、特定のクラス分類に属するオブジェクトのみを対象としたサーチを要求し実行することができる。また、特定のオブジェクトの指定、例えば複数コンテンツを格納したフォルダ等を指定してフォルダに格納されたコンテンツの情報を取得することが可能である。クライアントは、サーバから受信するコンテンツ情報を記述したＸＭＬデータに基づいてコンテンツ情報をディスプレイに表示する。
【００７４】
コンテンツ情報リストの表示処理例を図６に示す。図６に示す例では、コンテンツＮｏ、タイトル、アーティスト名・・をリスト化したデータ構成を持つコンテンツ情報リスト３５７をディスプレイ３５０に表示した例を示している。
【００７５】
これらのコンテンツ情報は、サーバの管理するコンテンツ対応のメタデータの構成要素としてのプロパティ情報に基づいて生成される。サーバはクライアントから受信したサーチまたはブラウズ要求に基づいて条件に一致するコンテンツのメタデータ中のプロパティ情報を取得し、取得したプロパティ情報に基づいてＸＭＬデータを生成し、クライアントに送信する。
【００７６】
クライアントは、サーバによって抽出されたコンテンツに対応するプロパティ情報に基づくＸＭＬデータを受信し、受信ＸＭＬデータに基づいて図６に示すような表示データを生成し、クライアントのディスプレイに表示する。
【００７７】
クライアント側のユーザはこれらのリストから再生対象コンテンツを選択し、選択コンテンツ情報をサーバに送信することで、サーバからコンテンツ、すなわち音楽や映画、あるいは写真等、様々なコンテンツが送信されクライアント側で再生、出力が実行される。
【００７８】
［コンテンツ再生シーケンス設定処理］
上述したように、クライアントは、サーバに格納されたコンテンツをブラウズまたはサーチにより選択した後、再生要求コンテンツをサーバに指定してコンテンツの実体、すなわち音楽や画像データ等を取得し、クライアントにおいて再生、出力することが可能となる。
【００７９】
例えば、１つの音楽コンテンツのみを再生対象としてクライアントが選択した場合は、その１つの音楽コンテンツの識別子を含むコンテンツ送信要求がサーバに送信されて、サーバが指定コンテンツを記憶部から取得してクライアントに送信しクライアントにおいて再生され、処理が終了する。複数の音楽コンテンツが再生対象としてクライアントにより選択されると、コンテンツ毎に送信要求がクライアントからサーバに送信され、各音楽コンテンツがサーバからクライアントに順次、提供されて、クライアント側において再生されることになる。
【００８０】
サーバに格納されるコンテンツフォルダには、複数の音楽コンテンツを格納したコンテンツフォルダ、例えばユーザがお気に入りの曲のみを集めて生成したフォルダ、あるいは特定のアーティスト、ジャンル等の複数の音楽コンテンツを格納したフォルダ等を設定可能であり、クライアント側のユーザはこれらの特定のフォルダに格納されたコンテンツのリ

ストを上述したブラウズまたはサーチによりサーバから取得することができる。クライアントは、ディスプレイにコンテンツリストを表示して、リストに従った順に順次コンテンツ要求をサーバに送信する設定とすることで、複数コンテンツの連続再生が可能となる。

【００８１】

しかし、従来技術の欄で説明したように、フォルダ内の複数コンテンツ再生を実行する場合、曲の再生順が常に一定の順番で行われると、コンテンツを聞く側のユーザの楽しみが減退する。そこで、複数のコンテンツ再生の順番の変更処理、すなわち複数のコンテンツ再生順をシャッフルして再生順を変更することが行われる。従来、コンテンツ再生シーケンスの変更処理は、サーバからクライアントに送信されてきたコンテンツリストをユーザ側でシャッフルして、リストの順番を変更し、変更したリストに従ってコンテンツ要求をサーバに送信することで実行していた。しかし、この処理はユーザまたはクライアント側における負担を発生させることになる。

【００８２】

本発明の構成においては、例えばクライアントから特定フォルダを指定したコンテンツリストの要求に際し、サーバ側において、ランダムなシーケンスに設定したコンテンツ再生リスト情報を含むコンテンツ情報を生成して、クライアントに送信する。クライアントは、サーバから受信するコンテンツ情報（ＸＭＬデータ）に基づいてコンテンツ再生リスト（コンテンツプレイリスト）をクライアント側ディスプレイに表示する。クライアント側ディスプレイには、サーバ側で設定したランダムオーダ順のコンテンツ再生リストが表示される。従って、クライアント側では、サーバから受信したコンテンツ再生リストに従った順番でコンテンツ再生要求を行うのみで、シャッフルされた、すなわちランダムシーケンスでのコンテンツ再生が可能となる。

【００８３】

図７を参照して、コンテンツのランダムシーケンス再生処理を実行する場合の処理手順について説明する。まず、ステップＳ３１において、クライアントは、サーバからのコンテンツ情報取得処理を実行する。

【００８４】

クライアントは、複数コンテンツを格納したフォルダをサーチまたはブラウズによって特定して、フォルダを指定したコンテンツ情報の取得処理を要求するものとする。このコンテンツ情報要求において、クライアントは、複数コンテンツを格納したフォルダの指定情報とともにフォルダ内のコンテンツ再生リストの設定をランダムシーケンスに設定して送信することを要求する。

【００８５】

図８に、クライアントからサーバに対して送信するコンテンツ再生リストの設定をランダムシーケンスに設定して送信することの要求データ例を示す。図８に示す例は、クライアントが特定のフォルダを指定したブラウズ要求に際して送信するデータ例を示している。

【００８６】

送信データには、要求がブラウズ要求であることを示す要求識別子４０１、フォルダ識別情報４０２、コンテンツ再生リストのソート処理としてランダムオーダでのソートを希望していることを示すソート指定情報４０３、さらにコンテンツ再生リストに含めるリストデータの範囲を示すリスト情報４０４が含まれる。

【００８７】

ソート方式としては、ランダムオーダの他にアーティスト順、曲名順などの指定も可能である。リスト情報４０４に指定するコンテンツ再生リストに含めるリストデータの範囲は任意に設定可能であり、例えば１００曲の音楽コンテンツが格納されたフォルダであれば、リストデータとして１０曲を指定し、ソート処理としてランダムオーダを指定した場合は、サーバ側で設定したランダムシーケンスのコンテンツ１００曲から先頭の１０曲が選択されてリストが生成されクライアントに送信されることになる。

【００８８】

図７のシーケンスに戻り、説明を続ける、ステップＳ３１において、クライアントから、

図８に示すように、コンテンツ再生リストのソート処理としてランダムオーダでのソートを希望していることを示すソート指定情報を含むコンテンツ情報取得要求が送信され、サーバがこれを受信すると、ステップＳ３２において、サーバは、クライアントから指定されたフォルダに格納されたコンテンツに対応するプロパティ情報をそれぞれ取得し、プロパティ情報に設定されたランダムオーダＮｏ．の設定を行う。

【００８９】

図９を参照してサーバの保有するコンテンツ対応のプロパティ情報、およびランダムオーダＮｏ．について説明する。サーバは、記憶手段に格納したコンテンツに対応する属性情報（プロパティ情報）をコンテンツに対応して記憶部に格納している。

【００９０】

例えばサーバが、コンテンツＡ４２１、コンテンツＢ４２２、・・コンテンツＮ４２３の複数コンテンツを格納したコンテンツフォルダ４２０をサーバ内のハードディスク等の記憶部に保持している場合、サーバは、各コンテンツＡ～Ｎに対応するプロパティ情報４２５，４２６，４２７をコンテンツに対応付けて記憶部に保持している。

【００９１】

プロパティ情報は、コンテンツに対応する情報であり、コンテンツのクリエータ、アーティスト、再生時間等の様々な情報を含んだコンテンツの属性情報である。本発明の構成では、コンテンツに対応するプロパティ情報として図に示すように、ランダムオーダＮｏ．が設定される。

【００９２】

ランダムオーダＮｏ．は、各コンテンツ各々に設定されるランダムオーダ情報としてのナンバリングデータ（番号）である。これは、コンテンツ再生リストのリスト順設定情報に対応する書き換え可能なランダムオーダ情報である。サーバは、クライアントから、先に説明した図８に示すような、コンテンツ再生リストのソート処理としてランダムオーダでのソートを希望していることを示すソート指定情報を含むコンテンツ情報取得要求を受信すると、指定フォルダに含まれるコンテンツのプロパティ情報中のランダムオーダＮｏ．の入れ替え、再設定処理を行う。

【００９３】

ランダムオーダＮｏ．は、複数のコンテンツの集合として設定されるコンテンツフォルダに含まれるコンテンツに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであり、コンテンツフォルダに含まれるコンテンツ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報である。

【００９４】

例えば１００曲の音楽コンテンツが含まれるコンテンツフォルダでは、１～１００の番号が、各コンテンツのプロパティ情報中のランダムオーダＮｏ．として設定される。これは、クライアントからのランダムオーダでのソート要求毎に実行され、処理毎に１～１００のランダムオーダＮｏ．が各コンテンツのプロパティ情報として再設定される。

【００９５】

設定されたランダムオーダＮｏ．がコンテンツ再生リストのシーケンスとなり、再生シーケンスとして設定される。

【００９６】

図７に戻り、コンテンツ再生シーケンス設定について説明を続ける。ステップＳ３２において、サーバは、上述したようにクライアントから指定されたフォルダに含まれるコンテンツに対応するプロパティ情報中のランダムオーダＮｏ．のシャッフルを実行してランダムオーダＮｏ．を設定し、設定したランダムオーダＮｏ．に基づいてコンテンツ再生リストを生成するための構成情報としてのＸＭＬ情報を生成し、ステップＳ３３においてリスト情報を含むコンテンツ情報をクライアントに送信する。

【００９７】

クライアントに送信されるコンテンツ情報には、コンテンツのタイトル、アーティスト名などのコンテンツ情報に加え、コンテンツの所在を示すアドレス情報としてのコンテンツ

のＵＲＬ（Ｕｎｉｆｏｒｍ　Ｒｅｓｏｕｒｃｅ　Ｌｏｃａｔｏｒｓ）情報等が含まれる。これらをＸＭＬ（ｅＸｔｅｎｄｅｄ　Ｍａｒｋｕｐ　Ｌａｎｇｕａｇｅ）データにより生成してクライアントに送信する。

【００９８】

ステップＳ３４で、クライアントは、サーバから受信したコンテンツ情報に基づいて、コンテンツ再生リストをディスプレイに表示する。クライアントは、サーバによって抽出されたコンテンツに対応するプロパティ情報に基づくＸＭＬデータを受信し、受信ＸＭＬデータに基づいて図１０に示すようなコンテンツ再生リストを生成し、クライアントのディスプレイに表示する。

【００９９】

図１０に示すように、コンテンツ再生リストは、再生順にコンテンツ情報を示したリストとして表示される。図に示す例では、表示情報として、再生シーケンス番号、コンテンツ名、タイトル、アーティスト名・・再生時間を、再生順にリスト化したデータ構成を持つコンテンツ情報リスト４８１をディスプレイ４８０に表示した例を示している。

【０１００】

これらのコンテンツ情報は、サーバの管理するコンテンツ対応のメタデータの構成要素としてのプロパティ情報に基づいて生成される。再生シーケンス番号は、サーバが設定したランダムオーダＮｏ．に相当する値として設定されることになる。

【０１０１】

クライアントは、図１０に示すようなコンテンツ再生リストに従ったコンテンツ再生を行うことが可能となる。例えば図１０に示す再生ボタン４８２をクリックすることで、再生が開始され、連続再生設定ボタン４８３をクリックして有効状態に設定することで、各再生コンテンツの再生時間を考慮した制御の下にリスト順にコンテンツ要求がサーバに、順次送信され、クライアント側では、サーバからリスト順にコンテンツを受信し再生することが可能となる。

【０１０２】

なお、コンテンツの再生処理において実行するコンテンツ送信要求、コンテンツの受信、コンテンツの復号、出力処理等の一連のシーケンスは、クライアント側のコンテンツ再生プログラムに従って実行される。コンテンツ再生プログラムは、サーバからのコンテンツ情報としてリストとともに受信しているコンテンツ識別子を設定したコンテンツ要求、例えばコンテンツＵＲＬを設定したコンテンツ取得要求であるＨＴＴＰ（Ｈｙｐｅｒ　Ｔｅｘｔ　Ｔｒａｎｓｆｅｒ　Ｐｒｏｔｏｃｏｌ）ＧＥＴメソッドをサーバにリストに従って順次、送信し、リストの順番に従ってコンテンツを順次サーバから受信し、再生処理を実行する。なお、ユーザはリストから特定のコンテンツのみを指定して指定コンテンツのみを再生することも可能である。

【０１０３】

連続再生処理を有効にした場合は、クライアント側のコンテンツ再生プログラムが、コンテンツの再生時間を考慮してリスト順に従って、順次コンテンツ要求、すなわちコンテンツＵＲＬを切り替えたＨＴＴＰ（Ｈｙｐｅｒ　Ｔｅｘｔ　Ｔｒａｎｓｆｅｒ　Ｐｒｏｔｏｃｏｌ）ＧＥＴメソッドを生成してサーバに送信する処理を実行する。サーバは、リスト順に送られてくるコンテンツ要求（ＨＴＴＰ（Ｈｙｐｅｒ　Ｔｅｘｔ　Ｔｒａｎｓｆｅｒ　Ｐｒｏｔｏｃｏｌ）ＧＥＴメソッド）に従って指定ＵＲＬに基づいてコンテンツをクライアントに送信する。

【０１０４】

図7に示すシーケンス図において、クライアント側のステップＳ３５およびサーバ側のステップＳ３６の処理が、上述の一連の処理に対応する。

【０１０５】

クライアントは、リストにあるコンテンツの再生が終了した場合には、同一フォルダ内の残りのコンテンツに対応するリストを要求し、サーバから受信することができる。サーバでは、クライアント側でコンテンツ再生処理が実行されている間、すなわち、クライアン

トに対するコンテンツ送信およびクライアントでの再生時間を考慮した時間内において、各コンテンツのランダムオーダＮｏ．の設定を変更せずに保持している。

【０１０６】

クライアントからの新たなコンテンツ再生リスト要求、例えば、図８に示すデータにおいて、プレイリストＮｏ．＝１１～２０等の指定のあるリスト要求があった場合に、各コンテンツのプロパティ情報（図９参照）に設定済みのランダムオーダＮｏ．に基づいて、Ｎｏ．１１～２０のランダムオーダＮｏ．を持つコンテンツのプロパティ情報に基づいてコンテンツ再生リスト情報を設定してクライアントに送信する。

【０１０７】

クライアントは、新たに送信されたコンテンツ再生リストをディスプレイに表示して表示したコンテンツ再生リストに従って、コンテンツの再生を行うことが可能となる。

【０１０８】

このように、本発明の構成では、クライアントからの要求に基づいてサーバ側でコンテンツの再生順をランダムに設定したリストを生成し、クライアントに送信する構成としたので、クライアントは、サーバから受信するリストに従って再生処理を行うのみで、ランダムな再生シーケンスに従ってコンテンツ再生を楽しむことが可能となり、ユーザおよびクライアント側でシャッフル処理を行う必要が排除される。

【０１０９】

クライアントおよびサーバ各々における処理シーケンスについて、図１１、図１２のフローチャートを参照して説明する。

【０１１０】

まず、図１１を参照して、クライアントの処理手順について説明する。ステップＳ１０１において、クライアントは、サーバに対して再生リストを要求する。これは、サーバに対するフォルダを指定したブラウズ要求に伴って行われ、先に図８を参照して説明したように、サーバに対する要求データにソート処理をランダムオーダとして実行することを要求することができる。

【０１１１】

サーバは、クライアント要求に応じて、上述したように指定フォルダに含まれるコンテンツに対応するプロパティ情報中のランダムオーダＮｏ．のシャッフルを実行してランダムオーダＮｏ．を再設定し、設定したランダムオーダＮｏ．に基づいてコンテンツ再生リストを生成しクライアントに送信する。クライアントは、ステップＳ１０２において、この再生リストを含むコンテンツ情報を受信し、受信したコンテンツ再生リストをディスプレイに表示する。

【０１１２】

ステップＳ１０３において、クライアント側のユーザは、コンテンツの再生を開始する。この際、上述したように連続再生を指定した場合は、クライアント側の再生処理プログラムがコンテンツ再生リスト順に、順次コンテンツＵＲＬを設定したコンテンツ要求をサーバに送信する。

【０１１３】

ステップＳ１０４では、サーバからコンテンツを受信し、ステップＳ１０５において受信コンテンツを再生する。なお、受信コンテンツがＡＴＲＡＣ、ＭＰＥＧ等の圧縮処理がなされている場合は、クライアント側で復号処理を行った後に再生を行う。

【０１１４】

ステップＳ１０６において、リストされた全コンテンツの再生が終了したか否かを判定し、未再生コンテンツがある場合は、ステップＳ１０３以下の処理、すなわちコンテンツ要求、受信、再生を繰り返し実行する。現再生コンテンツの再生時間の終了前に、コンテンツ再生リストの次のコンテンツ要求がサーバに対して出力される。リスト中のコンテンツ再生が終了すると処理を終了する。なお、リストの末尾のコンテンツの再生が終了した後、さらにリストの先頭に戻って、繰り返し再生を行う処理も可能である。これらの処理は、クライアント側のコンテンツ再生処理プログラムの設定に基づいて実行される。

【０１１５】
次に、図１２のフローチャートに基づいて、サーバ側の処理手順について説明する。ステップＳ２０１において、サーバが、クライアントからのコンテンツ情報要求を受信すると、サーバは、ステップＳ２０２において、コンテンツ再生リストの設定をランダムシーケンスとする要求をしているか否かを判定する。
【０１１６】
コンテンツ再生リストの設定をランダムシーケンスに設定して送信することの要求（図８参照）であれば、ステップＳ２０３に進み、そのような指定がない場合は、ステップＳ２１１に進む。ステップＳ２１１では、指定フォルダに格納されたコンテンツに予め設定されたシーケンスＮｏ．に従ったデフォルトの再生リスト情報を生成してステップＳ２０５に進み生成したリスト情報を含むコンテンツ情報をクライアントに送信する。
【０１１７】
コンテンツ再生リストの設定をランダムシーケンスに設定して送信することの要求（図８参照）であれば、ステップＳ２０３に進み、サーバは、クライアントから指定されたフォルダに格納されたコンテンツに対応するプロパティ情報をそれぞれ取得し、プロパティ情報に設定されたランダムオーダＮｏ．の設定を行う。すなわち、指定フォルダに含まれるコンテンツのプロパティ情報中のランダムオーダＮｏ．をシャッフルして再設定処理を行う。
【０１１８】
ステップＳ２０４では、再設定されたランダムオーダＮｏ．に基づいてランダムオーダＮｏ．順のコンテンツ再生リスト情報を生成し、ステップＳ２０５において、コンテンツ再生リスト構成情報としてのＸＭＬ情報を生成しクライアントに送信する。
【０１１９】
ステップＳ２０６において、サーバは、クライアントから例えばコンテンツ指定情報（例えばコンテンツＵＲＬ）を含むコンテンツ要求を受信すると、指定情報に従ってコンテンツを抽出してステップＳ２０７においてコンテンツを送信する。なお、コンテンツ送信においては、クライアント側の仕様または要求に応じたデータ変換を行う場合もある。
【０１２０】
なお、ステップＳ２０６、ステップＳ２０７の処理は、クライアントがコンテンツ再生リストに従った連続再生を実行している場合には、繰り返し実行される。
【０１２１】
また、サーバは、再設定されたランダムオーダＮｏ．に基づいてランダムオーダＮｏ．順のコンテンツ再生リスト情報を生成してクライアントに送信後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持し、記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求があった場合は、記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する。この処理により、クライアントは特定フォルダ内のコンテンツを、ランダムシーケンスに従って重複なく再生することが可能となる。
【０１２２】
なお、上述した実施例においては、コンテンツ個々のシャッフル処理について説明したが、コンテンツのプレイリストを格納したフォルダや、複数のコンテンツの集合としてのフォルダを単位としたシャッフル処理も可能である。
【０１２３】
図１３を参照してフォルダ単位としたシャッフル処理例について説明する。サーバは、コンテンツのプレイリストを格納したフォルダや、複数のコンテンツの集合としてのフォルダフォルダに対応する属性情報（プロパティ情報）を記憶部に格納している。
【０１２４】
図１３に示す例では、コンテンツのプレイリストを格納したフォルダＡ～Ｎ４９１～４９３の複数フォルダ、および各フォルダに対応するプロパティ情報４９５，４９６，４９７を示している。

【０１２５】
プロパティ情報は、フォルダに対応する属性情報であり、フォルダのクリエータ、アーティスト、再生時間等の様々な情報を含んでいる。本発明の構成では、フォルダに対応するプロパティ情報として図に示すように、ランダムオーダＮｏ．が設定される。
【０１２６】
ランダムオーダＮｏ．は、各フォルダ各々に設定されるランダムオーダ情報としてのナンバリングデータ（番号）である。これは、各フォルダに含まれるコンテンツ再生リストをフォルダ単位で再設定する書き換え可能なランダムオーダ情報である。サーバは、クライアントから、複数のフォルダのソートを希望していることを示すソート指定情報を含むコンテンツ情報取得要求を受信すると、指定された複数のフォルダのプロパティ情報中のランダムオーダＮｏ．の入れ替え、再設定処理を行う。具体的には、シャッフル対象となるフォルダ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行する。
【０１２７】
なお、クライアントからの要求データは、図８に示す構成データにおいて、フォルダ識別情報４０２の変わりにコンテナ識別子、すなわち、複数のコンテンツ再生リストフォルダオブジェクトの上位オブジェクトとしてのコンテナの識別子情報を設定した構成、あるいは、複数のコンテンツ再生リストフォルダオブジェクトの複数の識別子情報を設定した構成となる。
【０１２８】
ランダムオーダＮｏ．は、複数のフォルダの集合として設定されるたとえばコンテナに含まれる複数フォルダに対応する各プロパティ情報に対して設定された番号としてのナンバリングデータであり、コンテナに含まれるフォルダ数ｎに対してｎ個のランダムオーダ番号が重複することなく設定された情報である。
【０１２９】
例えば１０のプレイリストフォルダが含まれるコンテナでは、１～１０の番号が、各プレイリストフォルダのプロパティ情報中のランダムオーダＮｏ．として設定される。これは、クライアントからのランダムオーダでのソート要求毎に実行され、処理毎に１～１０のランダムオーダＮｏ．が各フォルダのプロパティ情報として再設定される。
【０１３０】
フォルダ単位で再設定されたランダムオーダＮｏ．に基づいて、例えば、プレイリストＡフォルダ４９１にコンテンツａ～ｆのコンテンツプレイリストが含まれ、プレイリストＮフォルダ４９３にコンテンツｐ～ｚのコンテンツプレイリスト含まれる場合、シャッフルにより、図１３に示すように、プレイリストＮフォルダ４９３のランダムオーダＮｏ．＝１、プレイリストＡフォルダ４９１のランダムオーダＮｏ．＝２として設定された場合は、プレイリストＮフォルダ４９３のコンテンツｐ～ｚをプレイリストＡフォルダ４９１のコンテンツａ～ｆの先に設定したプレイリストが設定されて、コンテンツ再生が実行される。
【０１３１】
このように、本発明の構成においては、コンテンツのみならず、コンテンツまたはデータフォルダ等、サーバが記憶部に格納している様々なオブジェクトについて、オブジェクトの属性情報（メタデータ）として設定されるプロパティ情報に、ランダムオーダ情報を格納し、クライアントからの要求に応じてシャッフルを実行する構成としたので、コンテンツまたはフォルダ単位でのリスト順の再設定が可能となる。
【０１３２】
［サーバおよびクライアントの機能構成］
サーバおよびクライアント装置のハードウェア構成については、先に図２を参照して説明した通りであり、上述した各種の処理は、サーバクライアントそれぞれの記憶部に格納されたプログラムに従って制御部（ＣＰＵ等）の制御の下に実行される。
【０１３３】

ＣＰＵによって実行される処理は、例えばサーバ側では、クライアントからの要求に従って、コンテンツ対応のメタデータを取得しプロパティ情報に基づくＸＭＬデータを生成する処理、プロパティ情報のランダムオーダＮｏ．のシャッフル処理、さらにクライアントからの要求データ態様に応じたコンテンツを送信する処理等である。クライアント側の処理としては、サーバから受信するプロパティ情報からなるＸＭＬデータに基づいてディスプレイにコンテンツ再生リストを表示する処理、コンテンツ再生リストに従って、順次コンテンツＵＲＬを設定したコンテンツ要求をサーバに送信する処理、コンテンツを受信する処理、受信コンテンツのデータ変換、再生処理などである。

【０１３４】

基本的にこれらの処理は、サーバ、クライアント装置の制御部としてのＣＰＵの制御の下に実行されるが、上述した処理を実行するために必要となるサーバの機能構成とクライアントの機能構成について図１４および図１５を参照して説明する。

【０１３５】

図１４は、サーバの主要機能構成を示すブロック図である。パケット送受信部５０１は、クライアントに対するパケット、クライアントからのパケットを受信する。パケット生成、解析部５０２は、送信パケットの生成処理、受信パケットの解析処理を行う。パケットのアドレス設定、アドレス認識、データ部に対するデータ格納、データ部からのデータ取得処理などである。

【０１３６】

コンテンツ記憶部５０３は、サーバの保有するコンテンツを格納する。メタデータ記憶部５０４は、コンテンツに対応する属性情報としてのメタデータを格納した記憶部である。メタデータには、図９を参照して説明したランダムオーダＮｏ．他のプロパティ情報が含まれる。

【０１３７】

プロパティ情報取得部５０５は、クライアントから受信したプロパティ情報取得要求、例えば、先に図８を参照して説明したデータ構成を持つブラウズ要求に基づいて、指定フォルダに対応するメタデータをメタデータ記憶部５０４から取り出す処理を実行する。

【０１３８】

ランダムオーダＮｏ．設定部５０６は、クライアントからのコンテンツプロパティリストの要求にランダムオーダの指定がある場合に、対応コンテンツのプロパティ情報のランダムオーダＮｏ．のシャッフル処理を実行する。

【０１３９】

コンテンツ情報生成部５０７は、プロパティ情報取得部５０５の取得したメタデータ、ランダムオーダＮｏ．設定部５０６の設定した情報に基づいて、コンテンツ再生リストの構成情報を含むコンテンツ情報としてのＸＭＬデータを生成する。コンテンツ情報生成部５０７は、例えばコンテンツ数ｎに対応する１～ｎのランダムオーダ情報のシャッフルを実行して各プロパティ情報に対して設定されたランダムオーダ情報の入れ替え処理を実行する。データ変換部５０８は、送信コンテンツデータの符号化処理等、復号処理を実行する。例えばＡＴＲＡＣ３、ＭＰＥＧ４に基づくデータ変換を実行する。

【０１４０】

次に、クライアント装置の機能構成について、図１５を参照して説明する。パケット送受信部６０１は、サーバに対するパケット送信および、サーバからのパケット受信処理を実行する。パケット生成、解析部６０２は、送信パケットの生成処理、受信パケットの解析処理を行う。パケット内の格納データ解析のみならず、パケットのアドレス設定、アドレス認識、データ部に対するデータ格納、データ部からのデータ取得処理なども含む。

【０１４１】

コンテンツ情報要求処理部６０３は、サーバに対して送信するコンテンツ再生リストの要求データ（図８参照）を生成する。すなわち、複数のコンテンツを格納したコンテンツフォルダの指定情報とともに、コンテンツ再生リストの設定順ソート情報としてランダムオーダ設定情報を格納したコンテンツ情報要求データを生成する処理を実行する。

【０１４２】
記憶部６０４は、サーバから受信したパケットに含まれるコンテンツ、およびコンテンツ再生リストを含むコンテンツ情報等を格納する。
【０１４３】
出力部６０５は、コンテンツ再生処理に適用するスピーカ、ディスプレイを含む。なお、ディスプレイは、先に図７を参照して説明したコンテンツ情報リストの出力にも利用される。入力部６０６は、例えば、コンテンツ再生の開始、終了、その他再生制御設定情報の入力、その他のデータ入力手段として利用される。
【０１４４】
コンテンツ情報解析部６０７は、サーバから受信したプロパティ情報からなるＸＭＬデータを解析し、解析データに基づいて、先に図１０を参照して説明したコンテンツ再生リストを生成し、出力部としてのディスプレイに出力する処理を実行する。
【０１４５】
コンテンツ再生制御部６０８は、サーバから受信し、ディスプレイに表示したコンテンツ再生リストに従ったコンテンツ再生処理を実行する。コンテンツの要求シーケンスをコンテンツ再生リストに従って決定し、再生リストに従ったコンテンツＵＲＬを順次パケット生成解析部６０２に送る。パケット生成解析部６０２では、コンテンツＵＲＬを設定したパケットを生成し、パケット送受信部６０１を介してサーバにコンテンツ要求を送信する。
【０１４６】
データ変換部６０９は、サーバから受信したコンテンツデータの復号当、各種データ変換処理を実行する。例えばＡＴＲＡＣ３、ＭＰＥＧ４に基づくデータ変換を実行する。なお、復号データの再符号化処理を実行し、再符号化データを記憶部６０３に格納する処理を実行する構成としてもよい。
【０１４７】
サーバ、およびクライアントは、機能的には図１４、図１５に示す各機能を有し、上述した各処理を実行する。ただし、図１４、図１５に示すブロック図は、機能を説明するブロック図であり、実際には、図２に示すＰＣ等のハードウェア構成におけるＣＰＵの制御の下に各種の処理プログラムが実行される。
【０１４８】
以上、特定の実施例を参照しながら、本発明について詳解してきた。しかしながら、本発明の要旨を逸脱しない範囲で当業者が該実施例の修正や代用を成し得ることは自明である。すなわち、例示という形態で本発明を開示してきたのであり、限定的に解釈されるべきではない。本発明の要旨を判断するためには、冒頭に記載した特許請求の範囲の欄を参酌すべきである。
【０１４９】
なお、明細書中において説明した一連の処理はハードウェア、またはソフトウェア、あるいは両者の複合構成によって実行することが可能である。ソフトウェアによる処理を実行する場合は、処理シーケンスを記録したプログラムを、専用のハードウェアに組み込まれたコンピュータ内のメモリにインストールして実行させるか、あるいは、各種処理が実行可能な汎用コンピュータにプログラムをインストールして実行させることが可能である。
【０１５０】
例えば、プログラムは記録媒体としてのハードディスクやＲＯＭ（Ｒｅａｄ　Ｏｎｌｙ　Ｍｅｍｏｒｙ）に予め記録しておくことができる。あるいは、プログラムはフレキシブルディスク、ＣＤ－ＲＯＭ（Ｃｏｍｐａｃｔ　Ｄｉｓｃ　Ｒｅａｄ　Ｏｎｌｙ　Ｍｅｍｏｒｙ），ＭＯ（Ｍａｇｎｅｔｏ　ｏｐｔｉｃａｌ）ディスク，ＤＶＤ（Ｄｉｇｉｔａｌ　Ｖｅｒｓａｔｉｌｅ　Ｄｉｓｃ）、磁気ディスク、半導体メモリなどのリムーバブル記録媒体に、一時的あるいは永続的に格納（記録）しておくことができる。このようなリムーバブル記録媒体は、いわゆるパッケージソフトウエアとして提供することができる。
【０１５１】

なお、プログラムは、上述したようなリムーバブル記録媒体からコンピュータにインストールする他、ダウンロードサイトから、コンピュータに無線転送したり、ＬＡＮ（Ｌｏｃａｌ　Ａｒｅａ　Ｎｅｔｗｏｒｋ）、インターネットといったネットワークを介して、コンピュータに有線で転送し、コンピュータでは、そのようにして転送されてくるプログラムを受信し、内蔵するハードディスク等の記録媒体にインストールすることができる。

【０１５２】

なお、明細書に記載された各種の処理は、記載に従って時系列に実行されるのみならず、処理を実行する装置の処理能力あるいは必要に応じて並列的にあるいは個別に実行されてもよい。また、本明細書においてシステムとは、複数の装置の論理的集合構成であり、各構成の装置が同一筐体内にあるものには限らない。

【０１５３】

【発明の効果】

以上、説明したように、本発明の構成によれば、クライアントからの要求に基づいてサーバ側でコンテンツの再生順をランダムに設定したリストを生成し、クライアントに送信する構成としたので、クライアントは、サーバから受信するリストに従って再生処理を行うのみで、ランダムな再生シーケンスに従ってコンテンツ再生を楽しむことが可能となり、ユーザおよびクライアント側でシャッフル処理を行う必要が排除される。

【０１５４】

さらに、本発明の構成によれば、サーバで保持するコンテンツに対応するプロパティ情報中にコンテンツ再生リストのリスト順設定情報に対応する書き換え可能なランダムオーダ情報を格納し、クライアントからのブラウズ要求等のコンテンツ情報取得要求に応じて、指定フォルダ内のコンテンツに対応するプロパティ情報を取得してランダムオーダ情報のシャッフル入れ替え処理を実行して入れ替えたランダムオーダ情報に対応するリスト順を設定したコンテンツ再生リストを生成してクライアントに送信する構成としたので、サーバ側の処理負担も大きくすることなく、クライアントは、サーバ側の処理に依存したコンテンツ再生シーケンス設定を行うことが可能となる。

【０１５５】

さらに、本発明の構成によれば、サーバは、再設定されたランダムオーダＮｏ．に基づいてランダムオーダＮｏ．順のコンテンツ再生リスト情報を生成してクライアントに送信後、クライアントにおけるコンテンツ再生リストに従ったコンテンツ再生中、該ランダムオーダ情報を維持して記憶保持し、記憶保持期間に、クライアントからのコンテンツ再生リスト要求の再要求があった場合は、記憶保持したランダムオーダ情報に基づくコンテンツ再生リスト情報を生成してクライアントに送信する処理を実行する構成としたので、クライアントは特定フォルダ内のコンテンツを、ランダムシーケンスに従って重複なく再生することが可能となる。

【図面の簡単な説明】

【図１】本発明の適用可能なネットワーク構成例を示す図である。

【図２】ネットワーク接続機器の構成例について説明する図である。

【図３】コンテンツデータ再生処理におけるサーバクライアント間の処理シーケンスについて説明する図である。

【図４】サーバにおける保持コンテンツの管理クラスの一例を示す図である。

【図５】サーバにおける設定クラスの階層構成について説明するズである。

【図６】サーバからクライアントに送信されるプロパティ情報からなるＸＭＬデータに基づいてディスプレイに表示されるコンテンツ情報リストの例を示す図である。

【図７】コンテンツ再生順をランダムに設定してコンテンツ再生を実行する際のサーバクライアント間のデータ通信シーケンスを示す図である。

【図８】コンテンツ再生順をランダムに設定してコンテンツ再生を実行する際のクライアントからサーバに要求するコンテンツ再生リストの要求データ構成示す図である。

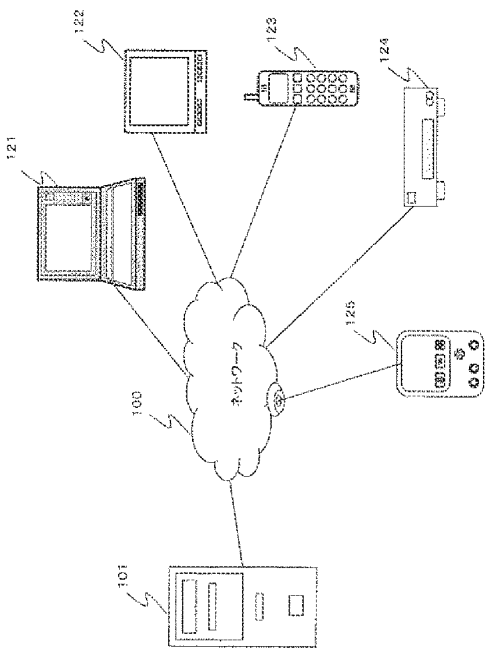
【図９】サーバの保有するコンテンツ対応のプロパティ情報について説明する図である。

【図１０】コンテンツ再生リストの表示例を示す図である。

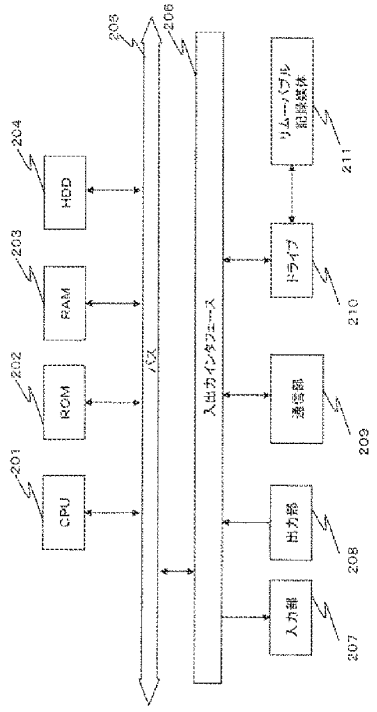
【図１１】コンテンツ再生順をランダムに設定してコンテンツ再生を実行する際のクライアント側の処理を説明するフローチャートである。
【図１２】コンテンツ再生順をランダムに設定してコンテンツ再生を実行する際のサーバ側の処理を説明するフローチャートである。
【図１３】サーバの保有するフォルダ対応のプロパティ情報について説明する図である。
【図１４】サーバの処理機能を説明するブロック図である。
【図１５】クライアントの処理機能を説明するブロック図である。
【符号の説明】
１００　ネットワーク
１０１　サーバ
１２１　ＰＣ
１２２　モニター
１２３　携帯電話
１２４　再生機
１２５　ＰＤＡ
２０１　ＣＰＵ
２０２　ＲＯＭ
２０３　ＲＡＭ
２０４　ＨＤＤ
２０５　バス
２０６　入出力インタフェース
２０７　入力部
２０８　出力部
２０９　通信部
２１０　ドライブ
２１１　リムーバブル記録媒体
３０１　ルートコンテナ
３０２～３０６　クラス
３５０　ディスプレイ
３５７　コンテンツ情報リスト
４０１　要求識別子
４０２　フォルダ識別子
４０３　ソート情報
４０４　リスト情報
４２０　コンテンツフォルダ
４２１～４２３　コンテンツ
４２５～４２７　プロパティ情報
４８０　ディスプレイ
４８１　コンテンツ再生リスト
４８２　再生ボタン
４８３　連続再生設定ボタン
４９１～４９３　フォルダ
４９５～４９７　プロパティ情報
５０１　パケット送受信部
５０２　パケット生成、解析部
５０３　コンテンツ記憶部
５０４　メタデータ記憶部
５０５　プロパティ情報取得部
５０６　ランダムオーダＮｏ．設定部
５０７　コンテンツ情報生成部

５０８　データ変換部
６０１　パケット送受信部
６０２　パケット生成、解析部
６０３　コンテンツ情報要求処理部
６０４　記憶部
６０５　出力部
６０６　入力部
６０７　コンテンツ情報解析部
６０８　コンテンツ再生制御処理部
６０９　データ変換部

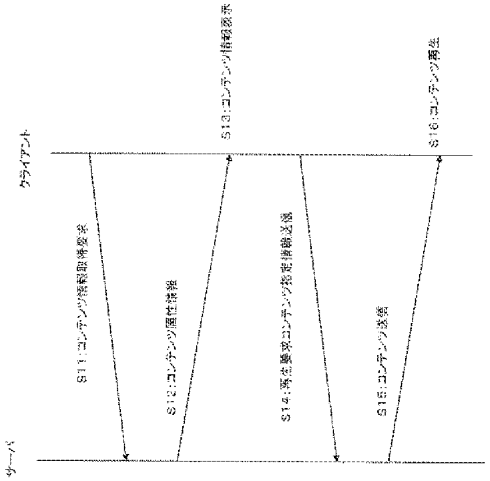
【図1】



【図2】



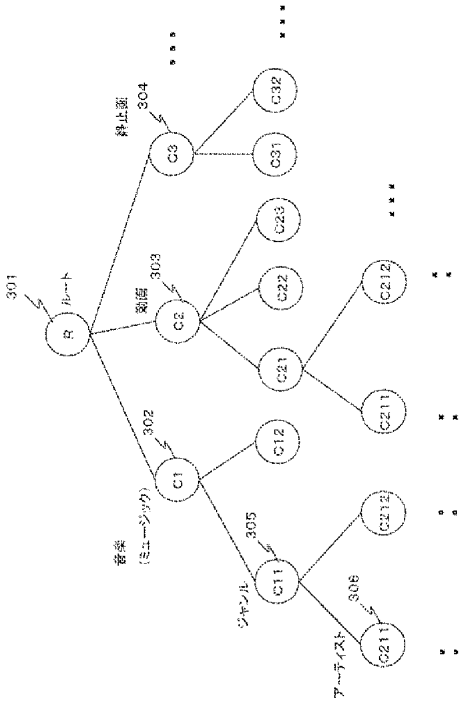
【図3】



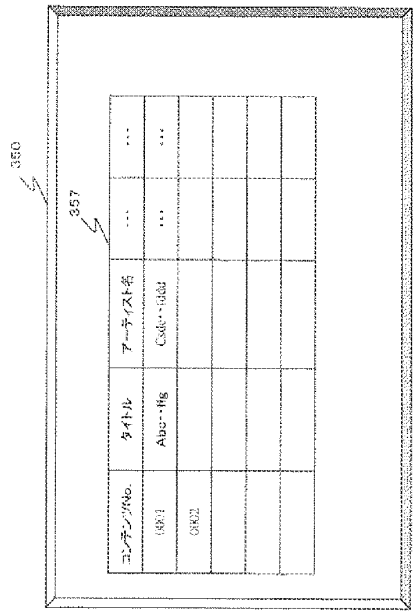
【図4】

class name	説明
avMusicTrack	曲
avMusicAlbum	アルバム 子として、avMusicTrackを持つ。
avMusicGenre	「ジャンル一覧」の中の各ジャンル 子として、avMusicArtistやavMusicAlbumや avMusicTrackを持つ。
avMusicArtist	「アーティスト一覧」の中の各アーティスト 子として、avMusicAlbumやavMusicTrackを持つ。
avMusicPlaylist	「プレイリスト一覧」コンテナの中のプレイリスト 子として、プレイリストを構成するavMusicTrackを持つ。
avMusicSearch/av MusicSearch	「いろいろな検索」コンテナの中のサーバの対応生成するプレイリスト 子として、プレイリストを構成するavMusicTrackを持つ。
avMusicPlaylistFolder	プレイリストコンテナ 子として、avMusicPlaylistFolderやavMusicPlaylistを持つ "playlistContainer"を廃止しないのは、文字列でマッチングでavMusicPlaylistとの区別のみを避けるため
avMusicAlbumCabinet	アルバムキャビネット 子として、avMusicAlbumを持つ
avAllavAllMusicTracks	「すべての曲」コンテナ 子は、avMusicTrack
avAllavAllMusicAlbums	「アルバム一覧」コンテナ 子はavMusicAlbum
avAllavAllMusicArtists	「アーティスト一覧」コンテナ 子はavMusicArtist
avAllavAllMusicGenre	「ジャンル一覧」コンテナ 子はavMusicGenre
avAllavAllMusicPlaylists	「プレイリスト一覧」コンテナ 子は、avMusicPlaylistやavMusicPlaylistFolder.
avAllMusicSearch	「いろいろな検索」コンテナ 子は、avMusicSearchavMusicSearch
avAllMusicAlbumsCabinets	「アルバムキャビネット一覧」コンテナ 子は、avMusicAlbumCabinet

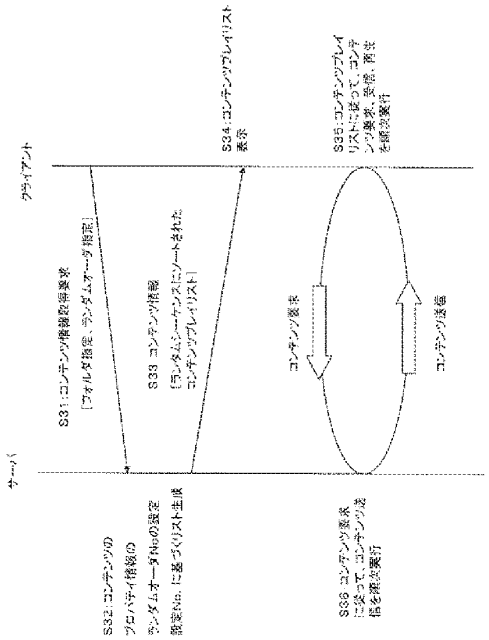
【図5】



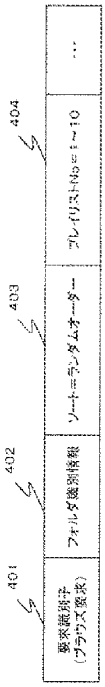
【図6】



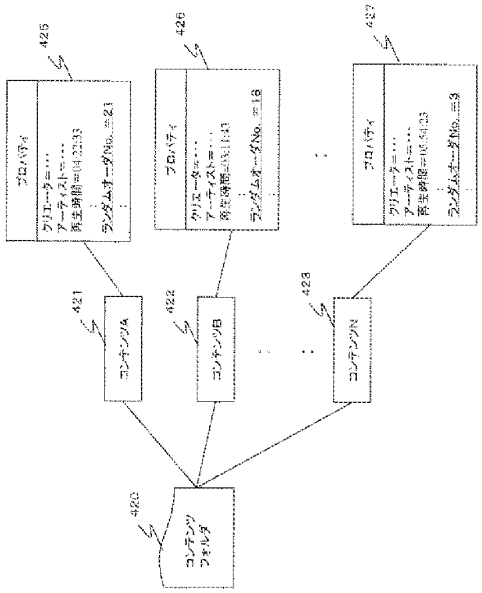
【図7】


クライアント
サーバ
S31:コンテンツ情報取得要求
[フォルダ指定、ランダムオーダ指定]
S32:コンテンツのプロパティ情報のランダムオーダNo.の設定
設定No.に基づくリスト生成
S33:コンテンツ情報
[ランダムシーケンスにソートされたコンテンツプレイリスト]
S34:コンテンツプレイリスト表示
コンテンツ要求
コンテンツ送信
S35:コンテンツプレイリストに従って、コンテンツ要求、受信、再生を順次実行
S36:コンテンツ要求に従って、コンテンツ送信を順次実行

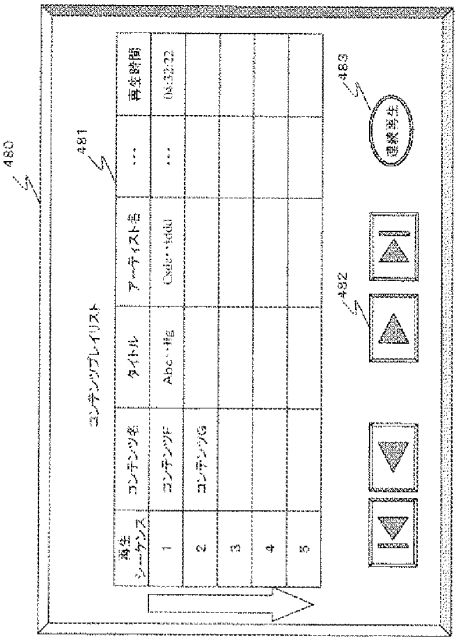
【図8】


401
要求識別子
(プロパティ要求)
402
フォルダ識別情報
403
ソート＝ランダムオーダー
404
プレイリストNo.i＝1～10
…

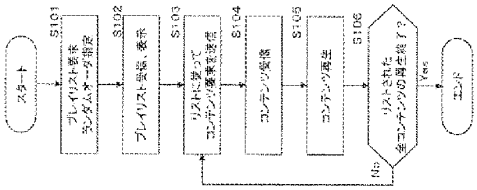
【図9】


425
プロパティ
クリエータ＝…
アーティスト＝…
再生時間＝04:32:33
ランダムオーダNo.＝21
426
プロパティ
クリエータ＝…
アーティスト＝…
再生時間＝05:11:43
ランダムオーダNo.＝18
427
プロパティ
クリエータ＝…
アーティスト＝…
再生時間＝05:54:03
ランダムオーダNo.＝3
421
コンテンツA
422
コンテンツB
428
コンテンツN
420
コンテンツフォルダ

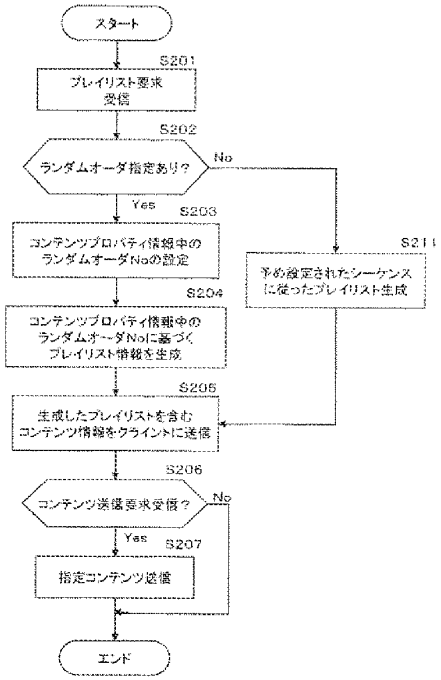
【図10】


480
481
コンテンツプレイリスト
再生シーケンス
コンテンツ名
タイトル
アーティスト名
…
再生時間
1
コンテンツF
Abc・・fg
Cde・・hkl
…
04:32:32
2
コンテンツG
3
4
5
482
483
連続再生

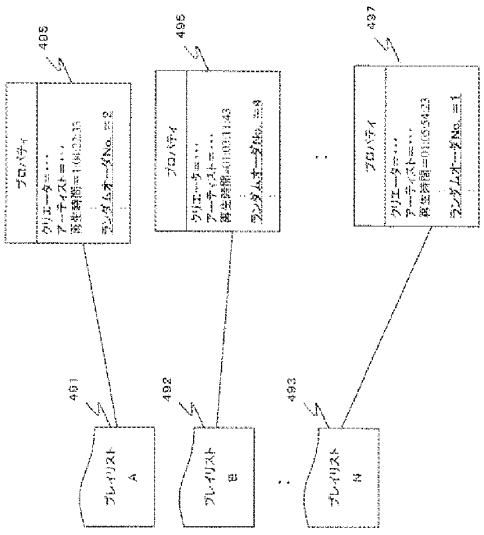
【図11】



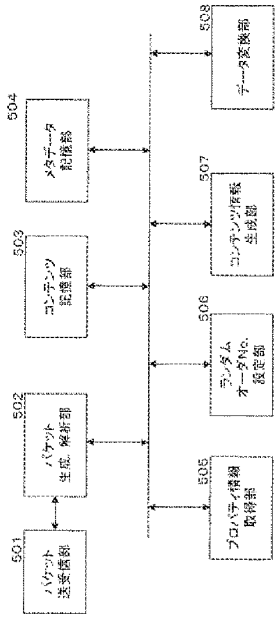
【図12】



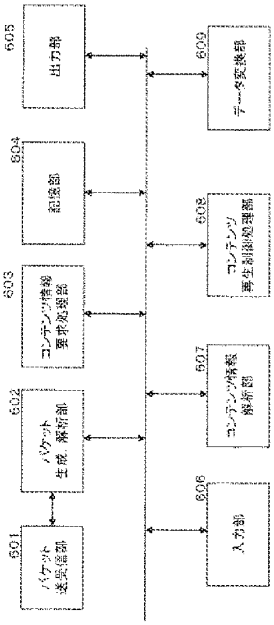
【図13】



【図14】



【図15】


605
出力部
609
データ変換部
604
記憶部
608
コンテンツ
再生制御処理部
603
コンテンツ情報
重畳処理部
607
コンテンツ解析
解析部
602
パケット
生成・解析部
606
入力部
601
パケット
送受信部

(72)発明者　森田　利広
東京都品川区北品川６丁目７番３５号　ソニー株式会社内
(72)発明者　日下部　俊昭
東京都品川区北品川６丁目７番３５号　ソニー株式会社内
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(71) Applicant: AEROCAST.COM, INC. [US/US]; 5744 Pacific Center Boulevard, Suite 301, San Diego, CA 92121 (US).

(72) Inventor: KAUFFMAN, Marc, W.; 961 Olive Crest Drive, Encinitas, CA 92024 (US).

(74) Agents: KULAS, Charles, J. et al.; TOWNSEND AND TOWNSEND AND CREW LLP, 2 Embarcadero Center, 8th Floor, San Francisco, CA 94111 (US).

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Declarations under Rule 4.17:

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(54) Title: QUALITY OF SERVICE CONTROL OF STREAMED CONTENT DELIVERY

(57) Abstract: According to the invention, a method for distributing a content object over a broadband connection to an end-user location is disclosed. In one step, an amount of bandwidth for adequate quality of service (QOS) to transport the content object is determined. A period for transporting the content object is also determined. A check for availability of the amount of bandwidth to the end-user location over the period is performed. If available, the bandwidth is reserved. The content object is streamed to the end-user location.

QUALITY OF SERVICE CONTROL OF STREAMED CONTENT DELIVERY

This application claims priority to US Application Serial No. 10/002,469 filed on November 14, 2001.

BACKGROUND OF THE INVENTION

This invention relates in general to streamed content delivery and, more specifically, to streaming audio or video content originating across a wide area network.

Currently, audio and video is streamed from the Internet to a computer using proprietary formats and transport protocols to proprietary players that are available from Microsoft™, Apple™ and Real Media™. There are also standard transport protocols such as those defined with MPEG-4 and RTSP/RTP that may be used with some proprietary players. The players run on computers such that a user can listen to audio or watch video streamed from a content provider. Cable modems, DSL modems and other broadband modems interface the computer to the Internet to allow reception of the content streams. Because of the so-called digital-divide, families that cannot afford computers and Internet connections cannot take advantage of audio and video over the Internet.

As part of a cable television subscription, many homes today are provided with cable system set top boxes for little or no additional cost to the consumer. Many of the set top boxes, such as the DCT-2000™ available from Motorola™, allow decoding and displaying programs sent in MPEG-2 format using MPEG-2 transport protocols. Program feeds or tapes are supplied to the headend of the cable operator for distribution to the set top boxes using a hybrid fiber / cable (HFC) plant. The programs are provided in a linear schedule such that the user can select any program for viewing.

[01] Telephone companies are beginning to offer very high speed digital subscriber line (VDSL) service to consumers. VDSL provides an approximately 6 Mbps connection to computers and set top boxes. The computers use the bandwidth to connect to the Internet and the set top boxes use the bandwidth to provide video programs from a linear schedule or in a video on demand (VOD) menu along with services such as VOD. Users of the VDSL set top boxes are limited to selecting programs from the linear schedule or VOD menu.

BRIEF SUMMARY OF THE INVENTION

In one embodiment, the present invention provides a method for distributing a content object over a broadband connection to an end-user location. In one step, an amount of bandwidth for adequate quality of service (QOS) to transport the content object is determined. A period for transporting the content object is also determined. A check for availability of the amount of bandwidth to the end-user location over the period is performed. If available, the bandwidth is reserved. The content object is streamed to the end-user location.

In another embodiment, the present invention provides a method for distributing a content object over a broadband connection to an end-user location. In one step, an amount of bandwidth for adequate quality of service (QOS) to transport the content object is determined. A period for transporting the content object is determined. A check for availability of the amount of bandwidth to the end-user location over the period is performed. The bandwidth is reserved if available. A lower bitrate version of the content object is chosen if the check for availability is unsuccessful. The content object is streamed to the end-user location.

In yet another embodiment, the present invention provides a software product embodied on a computer-readable medium for distributing a content object over a broadband connection to an end-user location. The software product comprises: code for determining an amount of bandwidth for adequate quality of service (QOS) to transport the content object; code for determining a period for transporting the content object; code for checking for availability of the amount of bandwidth to the end-user location over the period; code for reserving the bandwidth if available; code for converting the content object to a lower bitrate if the check for availability is unsuccessful; and code for streaming the content object to the end-user location.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is described in conjunction with the appended figures:

FIG. 1A is a block diagram of an embodiment of a content distribution system;

FIG. 1B is a block diagram of another embodiment of a content distribution system that uses video digital subscriber line (VDSL) technology;

Webgroup CZ a.s. Ex. 1002, Page 639 of 1406

FIG. 2A is a block diagram of an embodiment of a hybrid fiber / coax (HFC) plant interfaced with a headend and content receivers;

FIG. 2B is a block diagram of an embodiment of a hybrid fiber / twisted pair (HFTP) plant interfaced with a point of presence and content receivers;

FIG. 3A is a block diagram of an embodiment of a portion of a headend, which is coupled to content receivers with the HFC plant;

FIG. 3B is a block diagram of an embodiment of another portion of the headend, which is coupled to set top boxes;

FIG. 3C is a block diagram of another embodiment of a portion of the headend, which is coupled to set top boxes;

FIG. 4A is a block diagram of a prior art unassociated content provider;

FIG. 4B is a block diagram of an embodiment of an associated content provider;

FIG. 5A is a block diagram of an embodiment of a content exchange;

FIG. 5B is a block diagram of another embodiment of the content exchange that includes transcoding capability;

FIG. 6A is a block diagram of an embodiment of an associated client computer;

FIG. 6B is a block diagram of an embodiment of an enhanced set top box;

FIG. 6C is a block diagram of an embodiment of a standard set top box that can tune to a channel package for viewing;

FIG. 7 is a flow diagram of an embodiment of a process for streaming a content object to a standard set top box;

FIG. 8 is a flow diagram of an embodiment of a process for streaming a content object to a content receiver; and

FIG. 9 is a flow diagram of an embodiment of a process for controlling quality of service for a streamed content object.

In the appended figures, similar components and/or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

Webgroup CZ a.s. Ex. 1002, Page 640 of 1406

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

The ensuing description provides preferred exemplary embodiment(s) only, and is not intended to limit the scope, applicability or configuration of the invention. Rather, the ensuing description of the preferred exemplary embodiment(s) will provide those skilled in the art with an enabling description for implementing a preferred exemplary embodiment of the invention. It being understood that various changes may be made in the function and arrangement of elements without departing from the spirit and scope of the invention as set for in the appended claims.

The present invention allows controlling quality of service (QOS) for the so-called "last mile" of content delivery. For example, a set amount of bandwidth is reserved between the headend and a content receiver. The reservation avoids oversubscription of the last mile such that a desired QOS is interrupted. Where a reservation is not possible, the content object may be transcoded to a lower datarate or buffered.

Referring initially to FIG. 1A, a block diagram is shown of an embodiment of a content distribution system 100. In this embodiment, a cable television (TV) system is used to distribute content objects to users. Content objects from either unassociated content providers 108 or associated content providers 112 may be distributed through the Internet 120 or a quality of service (QOS) network 122. Both unassociated and associated content exchanges 116, 124 allow cacheing of content objects before transport of the objects through a headend and hybrid fiber / coaxial plant 132 to the user. Viewing of or listening to the content object is provided by one of a standard set top box 138, an enhanced set top box 136 and an associated client computer 140.

The network operation center 104 provides many functions used by the system 100. Associated client computers 140 sign-up and download viewer object proxy and other software from the network operation center 104. Some billing and logging for the system 100 is also performed in the network operation center 104. Directory information for the system 100 is maintained in the network operation center 104 such that users can see the various content objects registered in the system 100. Requests for those registered objects are routed to the appropriate content provider 108, 112 who originated the content object. Encryption key distribution and management are also performed by the network operation center 104.

A content object can originate from either associated or unassociated content providers 112, 108. Unassociated content providers 108 include any computer

visible from the Internet 120 that supplies content objects that are streamable. Associated content providers 112 have the ability to use the QOS network 122 in addition to the Internet 120. Further, the associated content providers 112 can route a content object query to various content exchanges 116, 124 for better QOS and can publish directory information to the network operation center 104.

Content exchanges 116, 124 source content objects to users to provide enhanced QOS. When a content object is requested from a content provider 108, 112, either the content provider 108, 112, the network operation center 104 or the viewer object proxy may redirect that request to a content exchange 116, 124 for fulfillment. Under some circumstances, the associated content provider 112 may choose to fulfill the request itself rather than passing fulfillment to a content exchange 116, 124. Content objects requested from content exchanges 116, 124 are located by first, searching the content exchange 116, 124; second, searching other interconnected content exchanges 116, 124; and, third, a request to the originating content provider 108, 112.

Unassociated content exchanges 116 are available to any user in the system 100, but associated content exchanges 124 primarily benefit any enhanced set top box (STB) 136, standard STB 138 or associated client computer 140 linked to those associated content exchanges 124. With the proper software, unassociated client computers 142 can receive content objects from the unassociated content exchanges 116.

Receiving a content object at a desired data-rate that does not exceed the data-rate of the client computer's connection to the Internet 120 is defined as adequate QOS. The maximum QOS a user can expect is defined by the speed, delay, jitter and error rate of their network connection, the processing power of their computer and other factors. The minimum QOS is subjectively defined by the user based upon the quality they desire within certain limits. For example, a user with a 400 Kbps network connection and a fast computer may have a choice of a 28 Kbps, 56 Kbps, or 128 Kbps stream for an audio clip from which the user chooses the 128 Kbps stream. So long as the datarate provided to the client computer is in the range of 128 - 400 Kbps, adequate QOS is possible for that stream.

Typically, an associated content exchange 124 is tightly integrated with a particular headend 128 to provide low latency and fewer hops between the associated content exchange 124 and a content receiver. In this way, the associated content exchange 124 is usually the highest QOS source of a content object for the user. Each associated content exchange 124 is assigned to a group of content receivers associated

with the headend 128. The content objects sourced by the users of the content receivers are stored in the associated content exchange 124 along with any content objects they request. Associated content exchanges 124 provide their content objects or portions thereof to other content exchanges 116, 124, however, associated content exchanges 124 do not normally stream content objects not originating from its users to unassociated client computers 142.

The cable operator aggregates network traffic and MPEG-2 transported content objects in the headend 128. For example, a cable operator of a large metropolitan area may have one or more headends 128. Network traffic is sent to and received from a wide area network, which is defined to include the Internet 120 and/or the QOS network. The headend 128 interfaces with the Internet 120 and QOS network 122 to send and receive network traffic. Other program feeds are used by the headend to provide a linear schedule of programs to each STB 136, 138. The HFC plant 132 transports the program feeds and network traffic to each STB 136, 138 and each associated client computer 140.

Each set top box 136, 138 receives channel packages of elementary streams in MPEG-2 format with MPEG-2 transport. In MPEG-2 transport, programs are separated into constituent parts or elementary streams and compressed into packets with timestamps for transport in a multiplexed datastream. The multiplexed datastream may include a number of different MPEG-2 program parts for various channel packages distinguished in the datastream by program identifiers (PIDs). By filtering for the PIDs the elemenary stream, channel package is gathered and aligned, where the time stamp is used for alignment. The datastream is transported in an analog TV channel on a carrier signal.

In the above embodiment, the content providers 108, 112 are located remotely to the content exchanges 116, 124. Some embodiments could co-locate the content providers 108, 112 and content exchanges 116, 124. An intranet could link them together.

With reference to FIG. 1B, a block diagram of another embodiment of a content distribution system 150 is shown that uses video digital subscriber line (VDSL) technology. VDSL uses a high bandwidth data link to send and receive data that could include video channels, phone conversations and/or Internet traffic. A point of presence 154 performs the functions of a headend 128 and communicates with VDSL set tops 136 and associated client computers 140. A hybrid fiber / twisted pair (HFTP) plant 158 is

used for the VDSL data channel and may include fiber and/or twisted pair wire to convey the data where some embodiments could be all twisted pair or all fiber.

Referring next to FIG. 2A, a block diagram of an embodiment of a HFC plant 132 is shown interfaced with the headend 128 and content receivers 216. In this embodiment, the content receivers 216 could include the enhanced STBes 136, the standard STBes 138 and the associated client computers 140. The HFC plant 132 can include a multitude of different configurations to support a unique menu channel for each standard STB 136. The unique menu channel allows the user to choose content objects from a directory supplied by the network operation center 104 or could allow web browsing to find content objects. The menu channel is formulated in the headend 128 and supplied by the HFC plant to the user who can interact with the menu channel to select content objects.

Included for this embodiment of the HFC plant 132 are a neighborhood hub 204 and a number of nodes 208 that receive their content objects from optical fibers. Nodes 208 typically serve around 500 users and interface the optical fibers to coaxial cables. Neighborhood hubs 204 typically serve around 10,000-20,000 users and do the same interfacing of optical fibers to coaxial cables as the nodes 208, but may also include an associated content exchange 124. Further, the neighborhood hubs 204 may serve optical fiber connections to nodes 208. The coaxial cable from either a neighborhood hub 20 or node 208 to a group of content exchanges 216 share a set amount of bandwidth in such a manner that the QOS can be greatly reduced by oversubscription.

With reference to FIG. 2B, a block diagram of an embodiment of a HFTP plant 158 interfaced with a point of presence 154 and content receivers 216 is shown. In this embodiment, the content receivers 216 include VDSL STBes 136 and associated client computers 140 that receive their IP traffic from a twisted pair phone line. Each content receiver 216 gets its own twisted pair conductor from either the central office 254 or neighborhood node 258. Optical fiber feeds the neighborhood nodes 258 and central offices 254. Typically, the central office 254 would include an associated content exhange 124.

Referring next to FIG. 3A, a block diagram of an embodiment 300 of a portion of a headend 128 coupled to content receivers with the HFC plant 132 is shown. The associated content exchange 124 is coupled to a cable modem termination system (CMTS) 304. The depicted embodiment 300 routes network traffic that is IP packet based. The enhanced STBes 136 of this embodiment behaves like a client computer 140

to allow browsing and to run player software. Some embodiments may have multiple associated content exchanges 124 and/or multiple CMTS with a router to direct network traffic between them. Additionally, a single headend 128 could serve any number of HFC plants 132.

The CMTS 304 includes a router to allow routing traffic to the appropriate enhanced STB 136 or associated client computer 140 by way of a DOCSIS or other cable modem. Data is modulated onto and demodulated off the HFC plant 132 by the CMTS. The CMTS also controls media access and other configuring for the DOCSIS cable modems. Reservations for bandwidth are made with the CMTS to guarantee a particular data rate or QOS between the associated content exchange 124 and content receiver 136, 140. Where a reservation is not possible, the datalink between the CMTS 304 and a content receiver 216 may proceed in a best efforts mode where any non reserved bandwidth is shared among many content receivers 136, 140 sharing a common datachannel.

With reference to FIG. 3B, a block diagram of an embodiment 320 of another portion of the headend 128 is shown coupled to set top boxes 136, 138. This embodiment 320 uses MPEG-2 formatted content objects transported in a multiplexed MPEG-2 data stream carried in a TV channel to each STB 138, 136. The enhanced STB 136 of this embodiment 320 can receive content objects from either the DOCSIS port or the MPEG-2 datastream.

In the case where the STB 136, 138 receives content objects through the MPEG-2 datastream, the navigational proxy 322 provides a menu channel for that purpose. The menu channel can be a list or grid showing available content objects or can be a web browser interface that allows selecting any content objects even if those content objects are not registered with the system 100. By having the menu or browser functionality in the navigation proxy 322 instead of the STB 136, 138, the footprint of the client software for the STB 136, 138 may be reduced. Requested content objects are downloaded to the associated content exchange 124 for buffering and/or cacheing before being streamed in a MPEG-2 datastream.

Once the content object is ready for streaming in the associated content exchange 124, the channel controller 324 configures the MPEG-2 transport to the STB 136, 138 such that the content object is transported in a channel package of elementary streams. To accomplish the transfer, the content object is routed to a transcoder 332 and encrypter 334 corresponding to a chosen channel package. The multiplexer 336 and

modulator 340 are used to combine a number of channel packages together into a multiplexed datastream and modulate that datastream onto a carrier frequency for the selected TV channel. The channel controller 324 communicates the index of PIDs for the elementary stream and the selected TV channel to the client on the STB 136, 138 by way of a control data transceiver 328 such that the content object can be received and decoded. The channel controller 324 also records usage by STB 136, 138 such that costs associated with the service can be determined. In various embodiments, the usage could be determined based upon the number of reservations made, the amount of bandwidth reserved, the length of the reservation, and/or the portion of the reserved bandwidth that was used.

The transcoder 332 does any required format conversion on the content object. Format conversion may include changing the bit rate and/or the encoding for the content object. For example, the associated content exchange 124 could store a content object that is Quicktime™ encoded at 1 Mbps and the transcoder 332 could convert the content object to a MPEG-2 encoding at 400 Kbps. In this embodiment, some of the set top boxes 138 can only decode content objects in MPEG-2 format so most content objects are transcoded into MPEG-2 format.

The encrypter 334 scrambles a channel package such that it can only be decoded by the STB 136, 138 with the proper key. Although many STBes 136, 138 may receive the channel package, only the one(s) with the key can decode and view the program. Control through encryption allows conditional access of the content object. In some embodiments, encryption is not activated or keys are given to multiple STB 136, 138 such that many can play the content object.

Referring next to FIG. 3C, a block diagram of another embodiment 350 of the portion of the headend 132 is shown coupled to the standard set top box 136, 138. This embodiment does not have external transcoders 332. Any transcoding in this embodiment could be performed on a content exchange 116, 124 or at the content provider 108, 112.

Referring next to FIG. 4A, a block diagram of an unassociated content provider 108 is shown. The unassociated content provider 108 is simply any web site on the Internet 120 that serves web pages from a web server 404 that includes streamable content objects. The content objects are stored on a content server 408 and originate from a content source 416. The content source 416 could be a web cam, tape drive or any other

mechanism for loading a content object. The web server 404, content server 408 and Internet 120 are all coupled together with a backbone 424.

With reference to FIG. 4B, a block diagram of an embodiment of an associated content provider 112 is shown. This embodiment adds functions to allow the content objects to be cataloged by the system 100 and to allow routing the content receivers 216 to a content source with adequate QOS for fulfillment of a request for a content object.

The Internet 120 and the QOS network 122 interface to a layer 4 switch 412. Requests to the web server 404 are redirected to the system interface 420 by the layer 4 switch 412. The system interface 420 requests the web page from the web server 404 and rewrites the content object links in the web page before presentment to the content receiver 216. The links are rewritten based upon the system interface 420 knowing where the content objects are distributed among the content exchanges 116, 124 and/or knowing which content exchanges 116, 124 are preferred by the content receiver 216.

Once the content receiver is redirected to a content exchange 116, 124 for fulfillment of the request for the content object, the content exchange 116, 124 may request the content object or portions thereof from the associated content provider 112 if no other content exchanges 116, 124 have the content object or portions thereof. Any request to the associated content provider 112 for the content object is intercepted by the system interface 420. After the system interface requests the content object from the content server 408, it may be processed by the system interface 420. The system interface 420 may transcode the content object to different coding formats or bitrates as it is streamed or all-at-once before streaming. Additionally, the content object may be encrypted to avoid illicit interception before reaching the content exchange 124.

The system interface 420 also supplies directory information to the network operation center 104. When content objects are added, removed or otherwise become unavailable on the content server 408 and/or at predetermined intervals, the system interface 420 reports that directory information back to the network operation center 104. A dynamic directory is maintained in the network operation center 104 that is constantly updated by the reports from the associated content providers 112. The directory may be used in generating the directory menu channel or may be browsed to determine the registered content objects available for streaming by the system 100.

With reference to FIG. 5A, a block diagram of an embodiment of an unassociated or associated content exchange 116, 124 is shown connected to both the Internet 120 and the QOS Network 122 by way of the backbone 424. The content exchange 116, 124 includes a cache node 504 and a software subsystem 508. The cache node 504 is part of a distributed network of content exchanges 116, 124 interconnected by a high-speed link 528. This high-speed link 528 could include satellite, microwave, optical fiber, Internet, or other network technologies to allow quick sharing of content objects or portions thereof.

The cache node 504 stores content objects and portions thereof for spooling to multiple users. Buffering is provided even if multiple users do not request the content object. Included in the cache node 504 are a tracking server 502 and a content node 506. The content node 506 stores content objects in a cache or a file system and requests missing portions of a content object from other content exchanges 116, 124. Where the content object cannot be found in any of the content exchanges 116, 124, the tracking server 502 is used to get the content object from the content server 108, 112.

The tracking server 502 determines the content objects stored in the content node 506. Additionally, a list of all associated content providers 112 is maintained by the tracking server 502. All the associated content providers 112 are periodically notified by the tracking server 502 of which content objects are currently cached such that the associated content provider 112 knows where all its content objects are stored in the system 100. The tracking server 502 makes queries to the network operation center 104 to determine which content object portions in the content node 506 or requested by the content node 506 originated from which content providers 108. Health check information is also maintained in the tracking server 502.

Access to content objects may be controlled for billing, among other, purposes. The rights management application 512 manages conditional access to the content object. Conditional access is used to prevent others from using a content object that is not free to distribute. The traffic management application 510 tracks usage by content receiver 216. In various situations, either the user, the content provider or other parties are billed for the content object. The billing management application 520 works with the rights management and traffic management applications 512, 510 to bill the appropriate parties for usage.

The network management application 516 gives the network operation center 104 the ability to manage the content exchange 124 and otherwise collect

Webgroup CZ a.s. Ex. 1002, Page 648 of 1406

information. The network management application 516 may track health information and utilization for network maintenance and other purposes. Also, billing information and rights information may be monitored and reported to the network operation center 104 by the network management application 516.

Referring next to FIG. 5B, a block diagram of another embodiment of the content exchange 116, 124 with transcoding capability is shown. The transcoding function 526 could include hardware and/or software to perform transcoding of bit rates and coding formats for content objects. This processing could be performed while streaming the content object or before a content object is streamed. For example, a VOD movie could be distributed in Quicktime™ format with a 2 Mbps datarate which is transcoded to MPEG-2 format at a 1 Mbps datarate for distribution to a STB 136, 138.

With reference to FIG. 6A, a block diagram of an embodiment of an associated client computer 140 is shown. A network interface 616, such as a cable modem, connects the associated client computer 140 to the HFC plant 132 to send and receive IP packet information. A viewer object proxy 604, a content processing program 620, a digital rights management function 612, and a customizable player skin 624 all run in an application layer 608. The video and/or audio associated with the content object is sent to a player output interface 614 which could include a video function and/or audio function.

The viewer object proxy 604 interfaces with the network interface 616 to determine QOS for content exchanges 116, 124. Suitable content exchanges 116, 124 are ranked in a list and that list is maintained until it is requested by an associated content provider 112. Typically, any associated content exchange 124 would be at the top of the ranked list. Where content objects are sourced from places other than an associated content exchange 124, the unassociated content exchange 116 may receive some compensation.

The digital rights management function 612 works with the content objects to protect copyrighted content objects from unauthorized use. Content objects authorized for use are played by the content processing program 620. Examples of content processing programs 620 include Windows Media Player™, Real Player™, etc. The customizable player skin 624 overlays the content processing program 620 to change the look and feel.

Referring next to FIG. 6B, a block diagram of an embodiment of an enhanced STB 136 is shown. This enhanced STB 136 operates in a mode similar to the associated client computer 140 of Fig. 6A where an IP packet datalink transports the content objects by way of a DOCSIS modem that may be embedded in the enhanced STB 136. Although not shown in this embodiment, the enhanced STB 136 could also receive content objects from channel package of elementary streams sent on an MPEG channel. This embodiment, does not include a customizable player skin 624, but other embodiments could include one.

With reference to FIG. 6C, a block diagram of an embodiment of a standard set top box 138 is shown that can tune to TV channel for decoding a multiplexed datastream with a channel package for a content object to play that content object. This embodiment receives control data information and datastreams embedded in TV channels or out of band channels. Other embodiments could use a DOCSIS modem or equivalent to receive control data information.

The navigation function 686 is a client application that supports receiving content objects sent as channel package of elemental streams on a TV channel arranged by the channel controller 324. Preference information for a user may also be stored in the navigation function 686 such that content objects are coded at specified data rates or streamed in various preferred modes.

Menu or browser interaction information from the user is gathered by a navigation function 686 from a wireless receiver. The user may have, for example, a keyboard that communicates with infrared to the wireless receiver 682. The menuing or browser interaction information is sent by the control data transceiver 650 back to the navigational proxy 322.

Control data information such as the channel package index is sent to a control data transceiver 650 for decoding. Once the PIDs and TV channel are known from that index, the standard STB is 138 is configured to receive the content object. The TV channel information is sent to a tuner 658 to change its receiver frequency to that channel. A digital datastream is recovered from the carrier signal in the TV channel by a digital demodulator 662. The channel package is recovered by the digital channel select circuit 670 by filtering the packets based upon PIDs. Presuming receiving the content object is authorized, a decryption engine has a key that allows decoding the channel package into plain text.

A MPEG-2 decoder 674 converts the plain text channel package into a NTSC, PAL or similar video signal. A TV interface 678 provides the video signal to an external monitor for viewing by the user. The above embodiment produces a video program on a TV, but those skilled in the art can appreciate that the invention is easily implemented for audio programs as well.

Referring next to FIG. 7, a flow diagram of an embodiment of a process 700 for streaming a content object to a standard STB 138 is shown. The depicted process picks-up in step 704 where a menu channel is presented by the navigational proxy 322 to the user with a list of possible content objects. The user uses a remote control to select one of the menu choices. The selection is detected by the wireless receiver 682 and relayed to the navigation function 686 in step 708.

In step 712, preparations are made to transport the content object to the standard STB 138. A request is made by the navigational proxy 322 to the content provider 108, 112 that originated the content object. An associated content provider 112 receives a ranking of the content exchanges 116, 124 that could source the content object, whereafter the system interface 420 redirects the request to a content exchange 116, 124 with adequate QOS.

If an unassociated content provider 116 is the source of the content object, the navigational proxy 322 redirects that request to a content exchange 116, 124 with adequate QOS. The content exchange 116, 124 that the request is redirected to will first try to find the content object locally, then request the content object from other content exchanges 116, 124, and last request the content object from the unassociated content provider 116.

The channel controller 324 arranges the transport between the headend 128 and the STB 138 in steps 720 and 724. The multiplexer 336 and modulator 340 for a TV channel with bandwidth available in the datastream for another channel package is determined in step 720. The channel package index of PIDs is communicated with the control data transceivers 328, 650 to the controller 654 in the STB 138. To receive the channel package, the controller 654 configures the STB 138 to tune to the TV channel, demodulate the datastream, filter out the channel package, decrypt that package, and display the content object.

Once the conduit between the headend 128 and the STB 138 is ready, this embodiment uses a transcoder 332 to change the coding format and/or datarate of the

content object in step 728. For example, a content object in Real™ format could be changed to MPEG-2 format. As the channel package stream is converted to MPEG-2 format, it is streamed to the STB 138 in step 732. The content object is processed and played for the user in step 736. In various embodiments, the navigational proxy 322 may arrange the transcoding at either the headend 128, the content exchange 116, 124 or the associated content provider 112.

With reference to FIG. 8, a flow diagram of an embodiment of a process 800 for streaming a content object to a content receiver 216 is shown. This embodiment uses a browser interface in either the enhanced STB 136 or the associated client computer 140 to select the content object. The depicted process takes-up in step 804 where the user browses for possible content objects. The browsing may be done with the directory information stored in the network operation center 104 or could be done by browsing of content providers 108, 112 directly.

Once a content object is located by the user, the link for that object is selected. Where the content object is from an unassociated content provider 108, the viewer object proxy 604 determines the content exchange 116, 124 to redirect the request to and makes the request from that content exchange 116, 124. Alternatively, a request for a content object from an associated content provider 112 is redirected by that associated content provider 112 based upon preference information to a content exchange 116, 124 with adequate QOS.

In step 816, the selected content exchange 116, 124 gathers the content object. After a local check, the high-speed link 528 to other content exchanges 116, 124 is next used to query for any missing portions of the content object. Where peer content exchanges 116, 124 cannot locate the missing portions, a request is made back to the content provider 108, 112 that originated the content object.

Once the initial portions of the content object are found, streaming of the content object begins in step 828. The content object is streamed using IP packet transport over a broadband connection such as a satellite link, a DSL modem, a cable modem, a power line data modem, a microwave dish, cellular data modem, line-of-sight laser modem, etc. In some embodiments, a reservation may be made to guarantee an amount of bandwidth to support the stream or, alternatively, allow "best efforts" streaming of the content object. The content processing program 620 decodes and plays the streamed content object so long as the digital rights management function 612

determines viewing is authorized and provides appropriate decryption of the streamed content.

Referring next to FIG. 9, a flow diagram of an embodiment of a process 900 for controlling QOS for a streamed content object is shown. In step 904, a request for a content object is detected by the CMTS 304. The duration, format and bandwidth for the content object is determined by the CMTS 304 such that the bandwidth and duration of a data channel reservation can be discerned. An attempt is made in step 912 to reserve the data channel. If the data channel can be accommodated as determined in step 916, the data channel reservation is negotiated between the CMTS 304 and DOCSIS modem associated with the content receiver 216. The CMTS 304 and DOCSIS modem are capable of arranging a datalink that cannot normally be oversubscribed as is possible when only "best efforts" bandwidth is available.

Where the datalink cannot be reserved, an attempt to located a lower bitrate version of the content object is performed in step 924. If the lower bitrate version is available, a determination is made as to whether the lower QOS version is acceptable to the user in step 928. Preference information previously stored may be used for this determination. If the lower bitrate version is determined acceptable in step 928, processing loops back to step 916 to determine if a reservation is possible.

Returning to step 924, in some cases a lower bitrate version of the content object is not readily available. In those cases, the next smaller bit rate that could be produced by the transcoding function 526 is determined in step 932. Some embodiments could store a content object in a number of transcoded formats and datarates to anticipate the desire for different encoding. A determination is made in step 928 to see if the reduced QOS is acceptable to the user. If so, the reservation is once again attempted. Presuming the reservation is fulfilled, the transcoding is performed to comply with the reservation.

Under some circumstances, the user may be unwilling to accept a reservation with lower QOS in step 928. If so, a determination is made in step 940 to see if the user will accept a delayed start time. If accepted, a buffer in the content receiver 216 is populated with enough of the content object to overcome interruptions or bandwidth bottlenecks. In some circumstances, "best efforts" delivery may be used and a determination is made on the system 100 loading such that an appropriate buffer size is chosen. In other situations, a reservation for a datarate less than the desired datarate of

the content object is made and the buffer size required is determined such that the content object can be played from beginning to end without interruption.

In some circumstances, the user may further decide that a delayed start is not acceptable in step 940. The user can accept "best efforts" delivery in step 942 and receive the content object in step 922. In "best efforts" mode, there may be skips and other QOS issues experienced during playback. The user would always have the option of pausing playback when QOS deteriorates too far such that buffering is done. Resuming playback after buffering in pause mode results in better QOS. If the user decides that "best efforts" mode is not desired back in step 942, a busy message is displayed in step 944.

In some embodiments, a service plan for the content receiver 216 may limit the amount of bandwidth that can be reserved. Different service levels could allow for differing amounts of reserved bandwidth. These service levels could correspond to service tiers. Various service levels could limit the reservation authority of the user based upon the time of day requested for the reservation, the length of reservation, the bandwidth requested for the reservation, how many other reservations are pending, total time requested for other pending reservations, prioritization of all reservations, etc. Further, the service levels could restrict the duration and/or data rate that can be reserved. Some embodiments could impose a charge to the content receiver 216 for each reservation made, the bandwidth reserved, the length of time for the reservation and/or the amount used of the reserved bandwidth.

The above embodiment attempts to reserve bandwidth as the content object is requested. Other embodiments could allow the user to reserve bandwidth for use at a particular future time. For example, a two-hour block of bandwidth could be reserved for 8:00 on Saturday night in anticipation of watching a movie. In an alternative example, a live event could be selected from a program guide for viewing at the top of the hour.

Some embodiments may include the facilities to record performance statistics. These statistics could include success rate in receiving the content object, bandwidth usage per reservation, actual wait time before receiving a reservation versus expected wait time, actual versus granted bandwidth for a reservation, duration of delayed start, rate at which a content object viewing session is abandoned by users, etc. Information such as this could be used for the purposes of billing, maintenance, capacity engineering, etc.

A number of variations and modifications of the invention can also be used. For example, a reservation for bandwidth may be enlarged in period to accommodate pausing and rewinding of the content object during playback. Other embodiments may buffer the remainder such that the reservation period can remain the same. In still other embodiments, the reserved data rate between a headend and a content receiver can dynamically change along with the encoded bitrate within defined QOS ranges.

In the above embodiments, a HFC or HFTP plant is used to distribute the streamed objects to the set top boxes or client computers that play the streamed objects. Other embodiments could use other distribution plants. For example, a wireless plant could be used that provides wireless data transmission using UHF, microwave, satellite, cellular, or other wireless technologies.

While the principles of the invention have been described above in connection with specific apparatuses and methods, it is to be clearly understood that this description is made only by way of example and not as limitation on the scope of the invention.

Webgroup CZ a.s. Ex. 1002, Page 655 of 1406

WHAT IS CLAIMED IS:

1. A method for distributing a content object over a broadband connection to an end-user location, the method comprising step of:

determining an amount of bandwidth for adequate quality of service (QOS) to transport the content object;

determining a period for transporting the content object;

checking for availability of the amount of bandwidth to the end-user location over the period;

reserving the bandwidth if available; and

streaming the content object to the end-user location.

2. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising a step of beginning to buffer the content object before the streaming step.

3. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising a step of beginning to cache the content before the streaming step.

4. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising a step of converting the content object to a lower bitrate if the check for availability is unsuccessful.

5. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising a step of determining if a lower QOS is acceptable to an end-user if the check for availability is unsuccessful.

6. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising steps of:

determining the amount of bandwidth available over the period, where the amount of bandwidth is less than that required for adequate QOS;

determining a buffer amount to provide adequate QOS; and

storing the buffer amount corresponding to a portion of the content object proximate to the end user location.

Webgroup CZ a.s. Ex. 1002, Page 656 of 1406

7. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 1, further comprising a step of determining usage by the end-user location based upon at least one of a number of reservations made, an amount of bandwidth reserved, a length of a reservation, and a portion of bandwidth used for the amount of bandwidth reserved.

8. A method for distributing a content object over a broadband connection to an end-user location, the method comprising step of:

determining an amount of bandwidth for adequate quality of service (QOS) to transport the content object;

determining a period for transporting the content object;

checking for availability of the amount of bandwidth to the end-user location over the period;

reserving the bandwidth if available;

choosing a lower bitrate version of the content object if the check for availability is unsuccessful; and

streaming the content object to the end-user location.

9. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of beginning to buffer the content object before the streaming step.

10. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of beginning to cache the content before the streaming step.

11. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of determining if a lower QOS is acceptable to an end-user if the check for availability is unsuccessful.

12. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising steps of:

determining the amount of bandwidth available over the period, where the amount of bandwidth is less than that required for adequate QOS;

determining a buffer amount to provide adequate QOS; and

storing the buffer amount corresponding to a portion of the content object proximate to the end user location.

13. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of reserving the bandwidth at a future time.

14. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of checking the service plan associated with the end-user location before allowing the reserving of bandwidth.

15. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of checking the service tier associated with the end-user location before allowing the reserving of bandwidth.

16. The method for distributing the content object over the broadband connection to the end-user location as recited in claim 8, further comprising a step of converting the content object into versions that have different bit rates.

17. A software product embodied on a computer-readable medium for distributing a content object over a broadband connection to an end-user location, the software product comprising code for:

determining an amount of bandwidth for adequate quality of service (QOS) to transport the content object;

determining a period for transporting the content object;

checking for availability of the amount of bandwidth to the end-user location over the period;

reserving the bandwidth if available;

converting the content object to a lower bitrate if the check for availability is unsuccessful; and

streaming the content object to the end-user location.

Webgroup CZ a.s. Ex. 1002, Page 658 of 1406

18. The software product embodied on a computer-readable medium for distributing the content object over the broadband connection to the end-user location as recited in claim 17, further comprising code for beginning to buffer the content object before the streaming step.

19. The software product embodied on a computer-readable medium for distributing the content object over the broadband connection to the end-user location as recited in claim 17, further comprising code for beginning to cache the content before the streaming step.

20. The software product embodied on a computer-readable medium for distributing the content object over the broadband connection to the end-user location as recited in claim 17, further comprising code for determining if a lower QOS is acceptable to an end-user if the check for availability is unsuccessful.

21. The software product embodied on a computer-readable medium for distributing the content object over the broadband connection to the end-user location as recited in claim 17, further comprising code for:

determining the amount of bandwidth available over the period, where the amount of bandwidth is less than that required for adequate QOS;

determining a buffer amount to provide adequate QOS; and

storing the buffer amount corresponding to a portion of the content object proximate to the end user location.

Webgroup CZ a.s. Ex. 1002, Page 659 of 1406

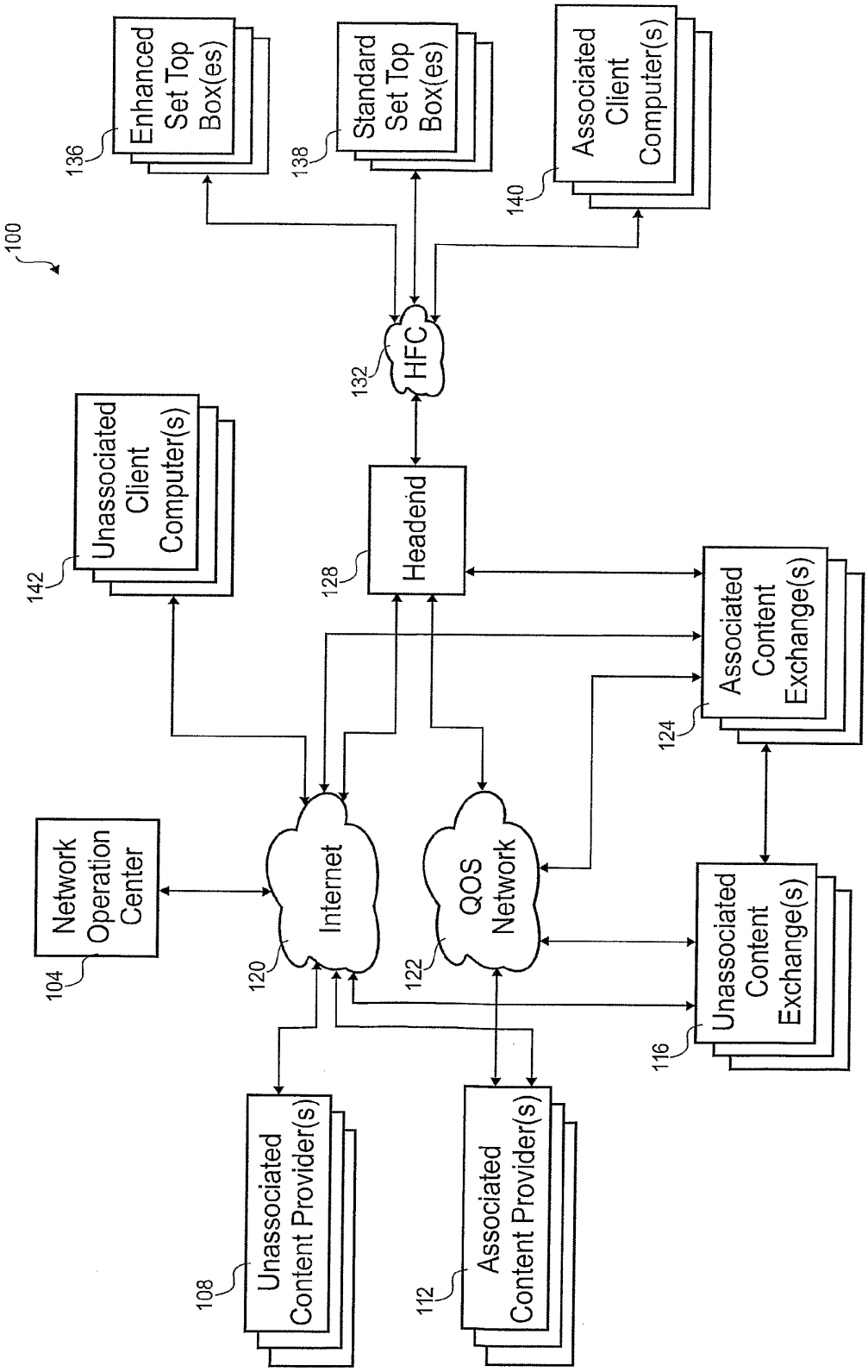

100
Enhanced Set Top Box(es)
136
Standard Set Top Box(es)
138
Associated Client Computer(s)
140
HFC
132
Unassociated Client Computer(s)
142
Headend
128
Associated Content Exchange(s)
124
Network Operation Center
104
Internet
120
QOS Network
122
Unassociated Content Exchange(s)
116
Unassociated Content Provider(s)
108
Associated Content Provider(s)
112

Fig. 1A

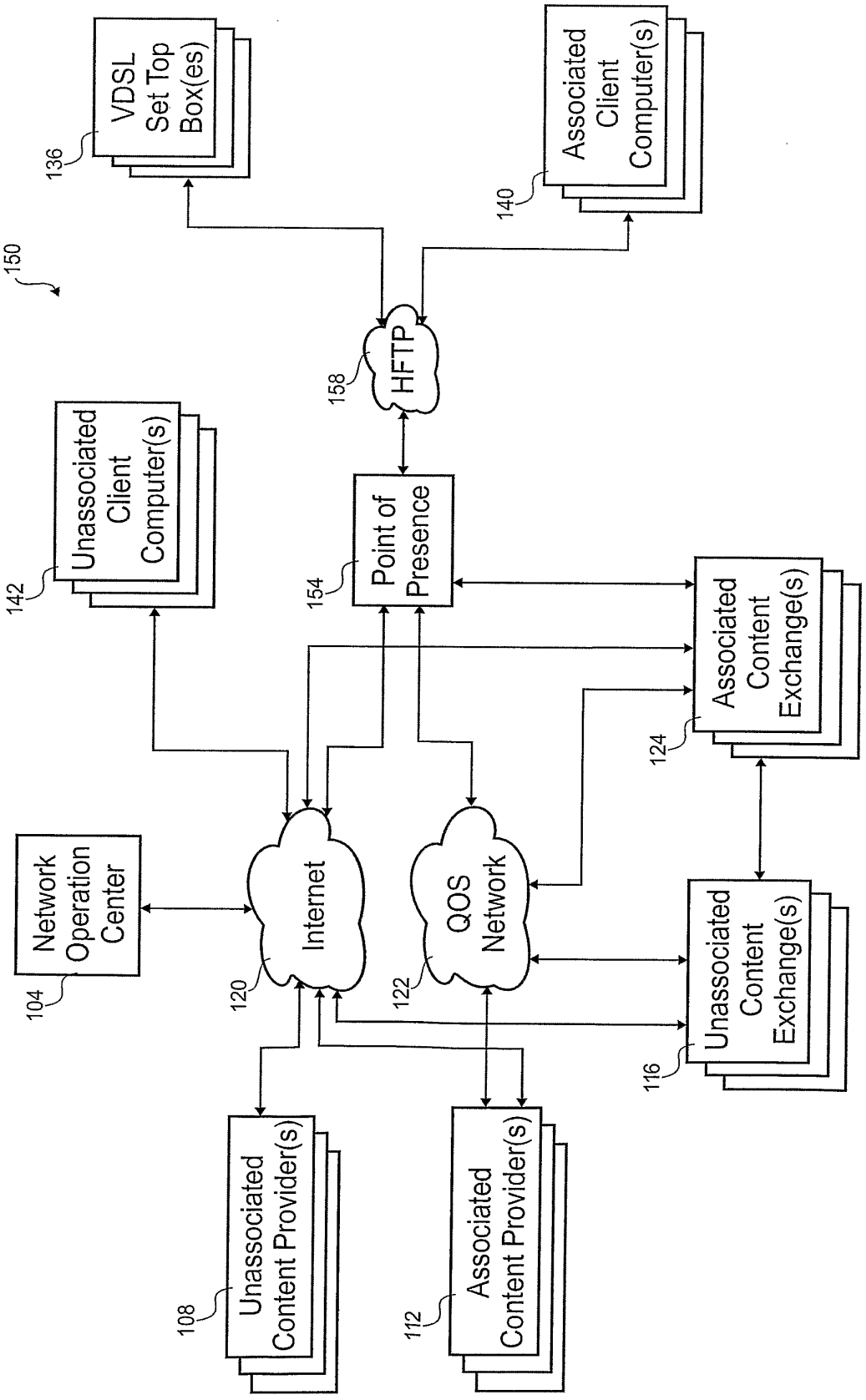

VDSL Set Top Box(es)
136
Associated Client Computer(s)
140
150
HFTP
158
Unassociated Client Computer(s)
142
Point of Presence
154
Associated Content Exchange(s)
124
Network Operation Center
104
Internet
120
QOS Network
122
Unassociated Content Exchange(s)
116
Unassociated Content Provider(s)
108
Associated Content Provider(s)
112

Fig. 1B

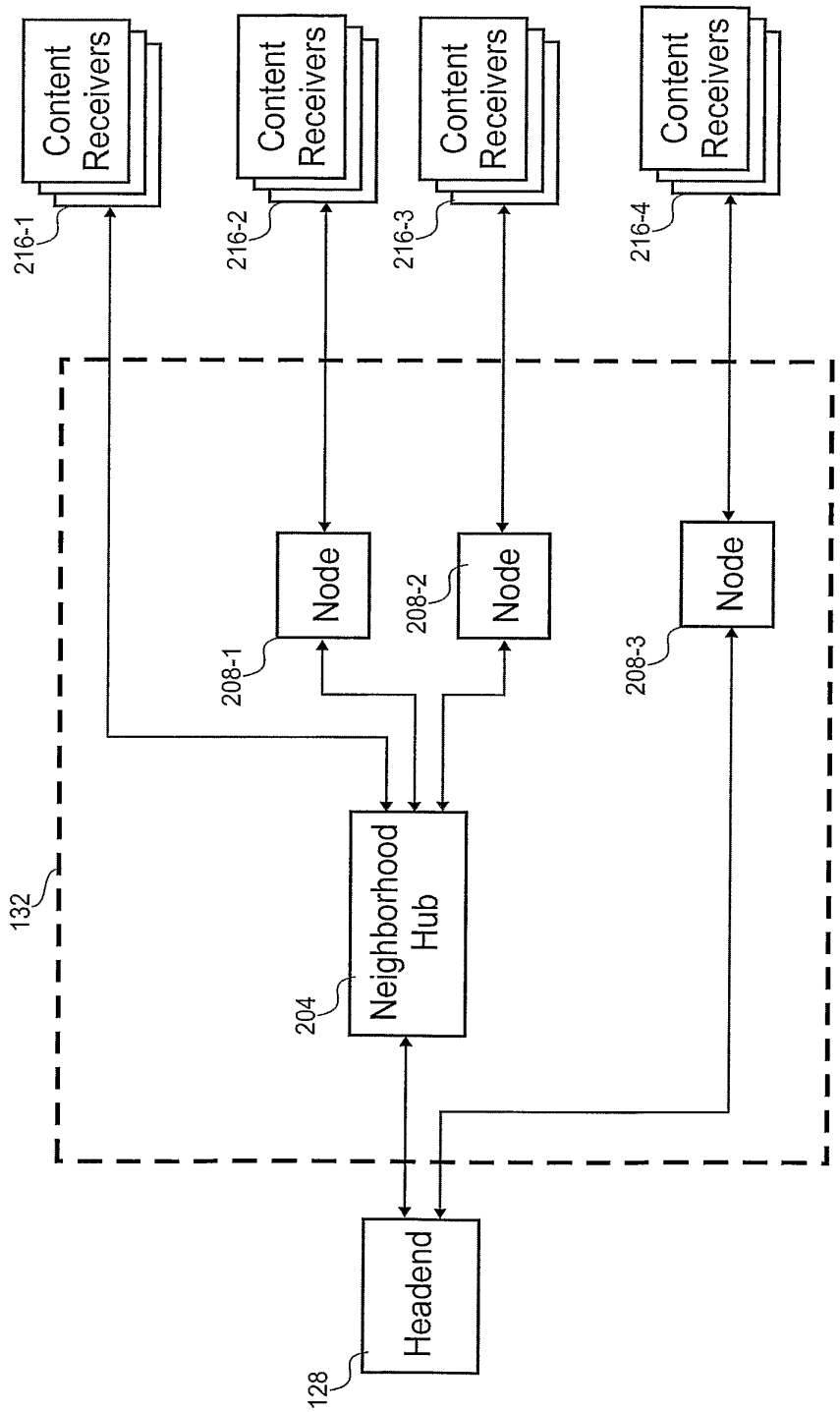

Content Receivers
Content Receivers
Content Receivers
Content Receivers
216-1
216-2
216-3
216-4
Node
Node
Node
208-1
208-2
208-3
Neighborhood Hub
204
132
Headend
128

Fig. 2A

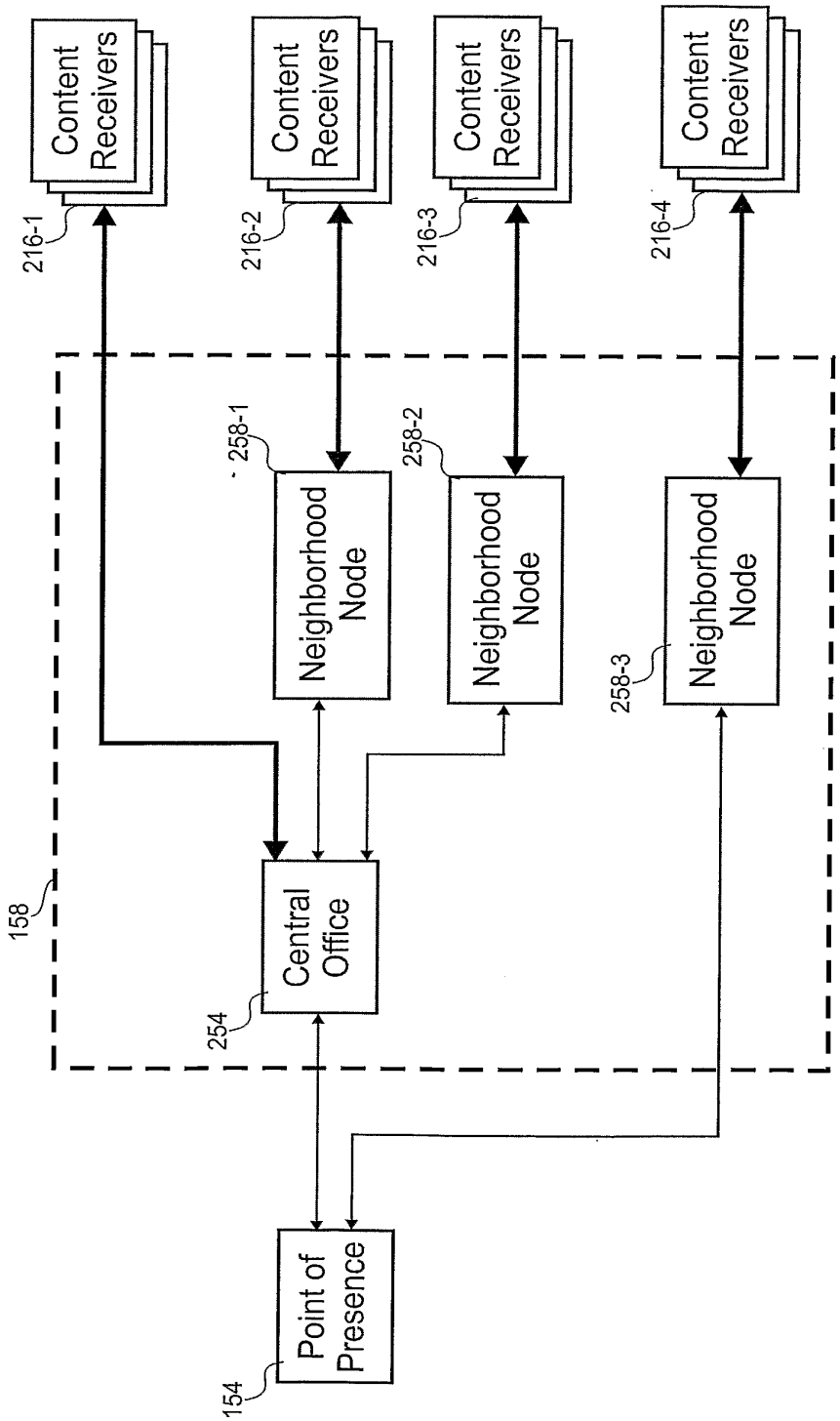

Content Receivers
216-1
Content Receivers
216-2
Content Receivers
216-3
Content Receivers
216-4
258-1
Neighborhood Node
258-2
Neighborhood Node
258-3
Neighborhood Node
158
Central Office
254
Point of Presence
154

Fig. 2B

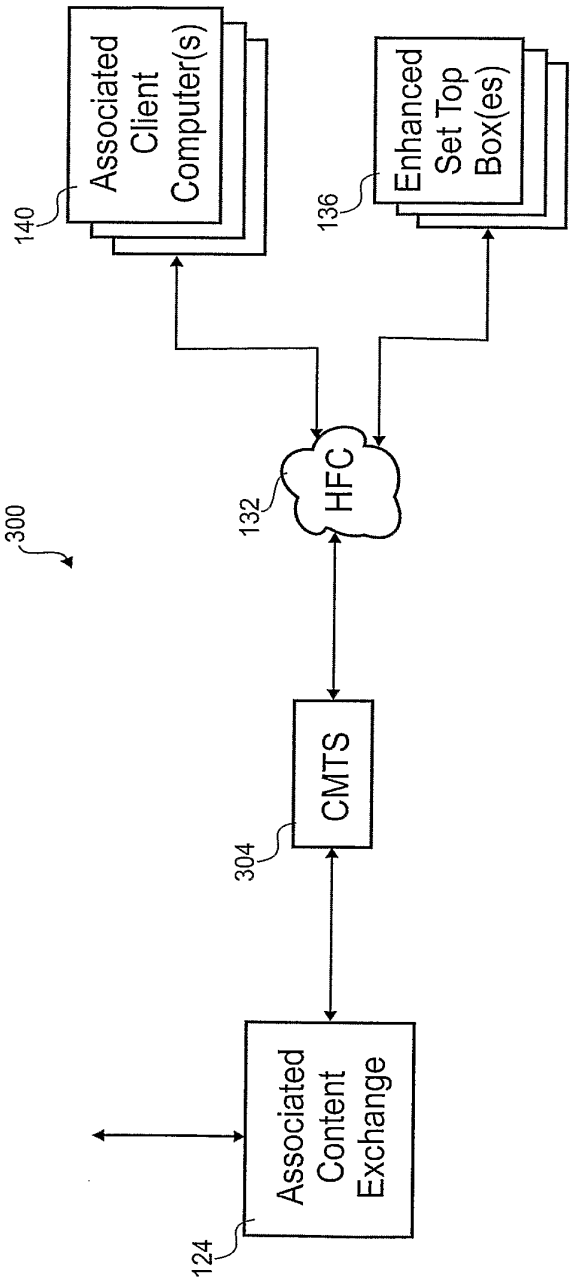

Associated Client Computer(s)
140
Enhanced Set Top Box(es)
136
HFC
132
300
CMTS
304
Associated Content Exchange
124

Fig. 3A

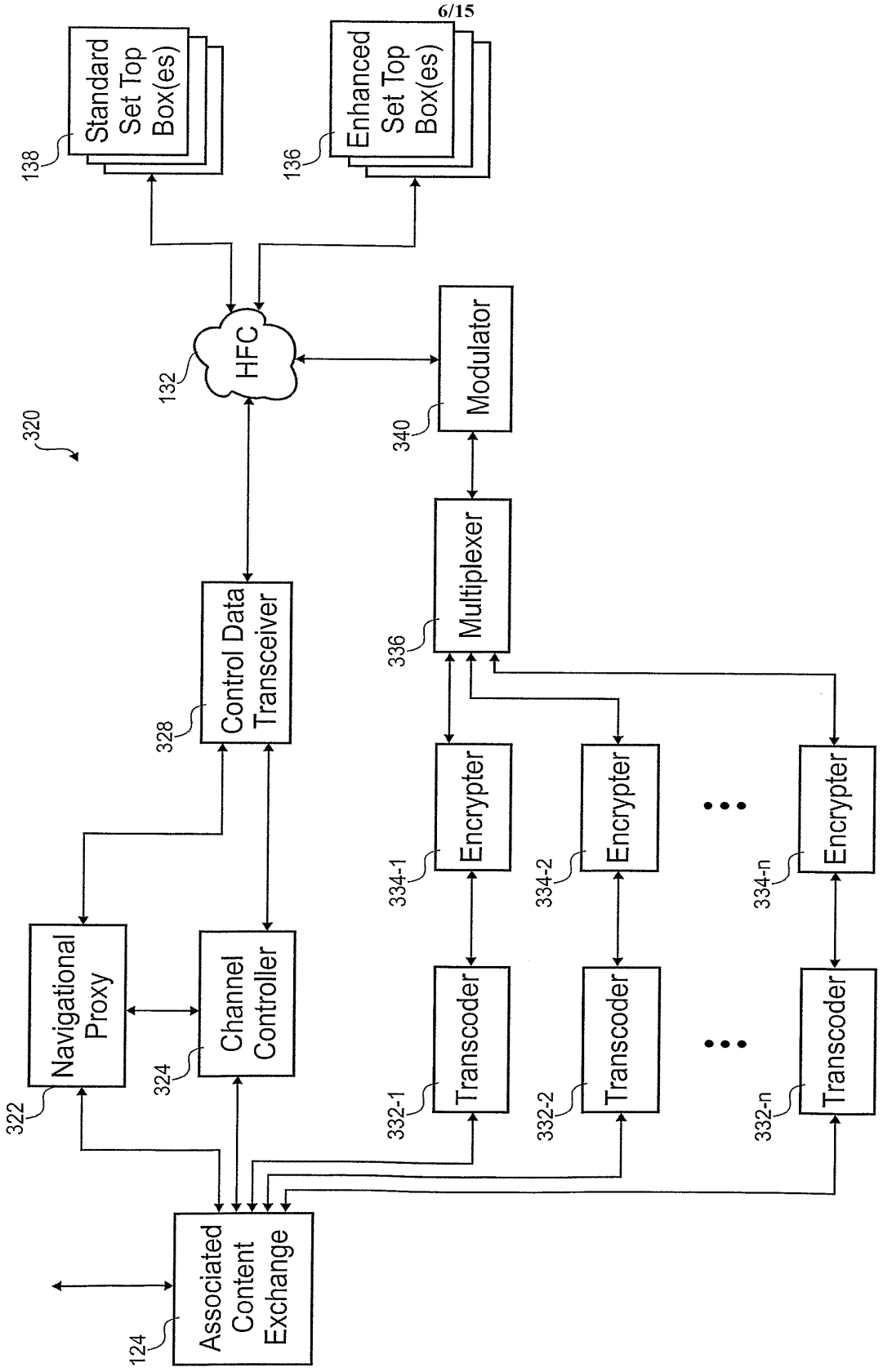

Standard Set Top Box(es)
138
Enhanced Set Top Box(es)
136
HFC
132
320
Modulator
340
Multiplexer
336
Control Data Transceiver
328
Encrypter
334-1
Encrypter
334-2
Encrypter
334-n
Navigational Proxy
322
Channel Controller
324
Transcoder
332-1
Transcoder
332-2
Transcoder
332-n
Associated Content Exchange
124

Fig. 3B

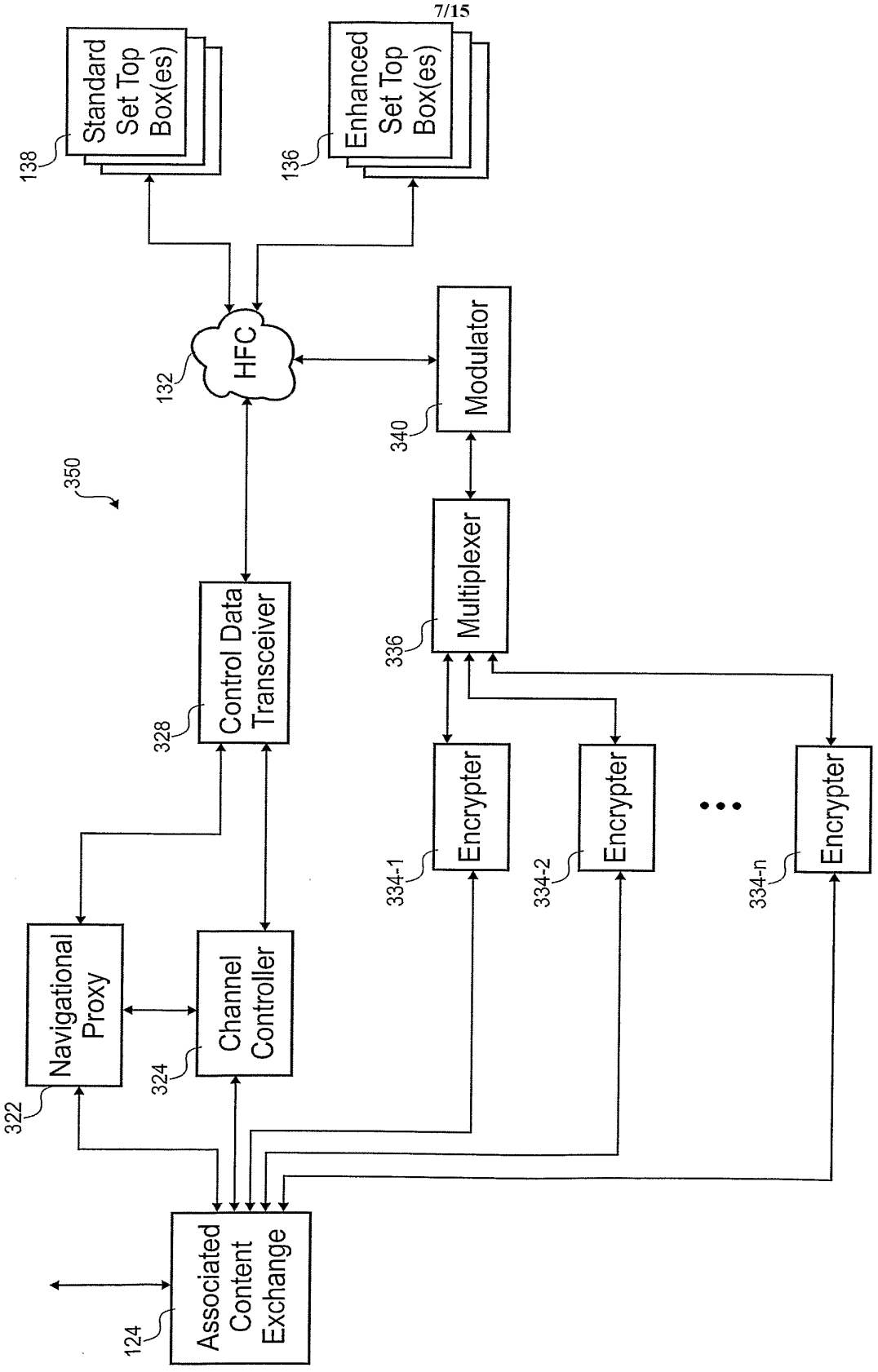

Standard Set Top Box(es)
138
Enhanced Set Top Box(es)
136
HFC
132
Modulator
340
350
Multiplexer
336
Control Data Transceiver
328
Encrypter
334-1
Encrypter
334-2
Encrypter
334-n
Navigational Proxy
322
Channel Controller
324
Associated Content Exchange
124

Fig. 3C

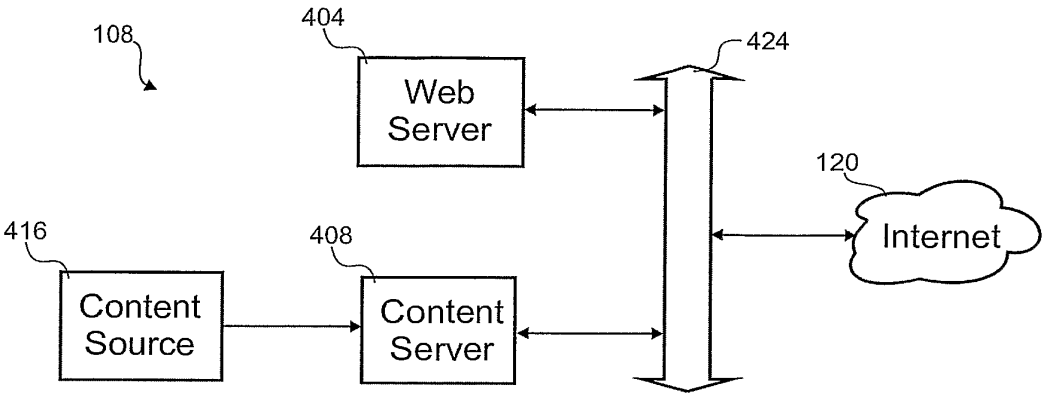


Fig. 4A
(Prior Art)

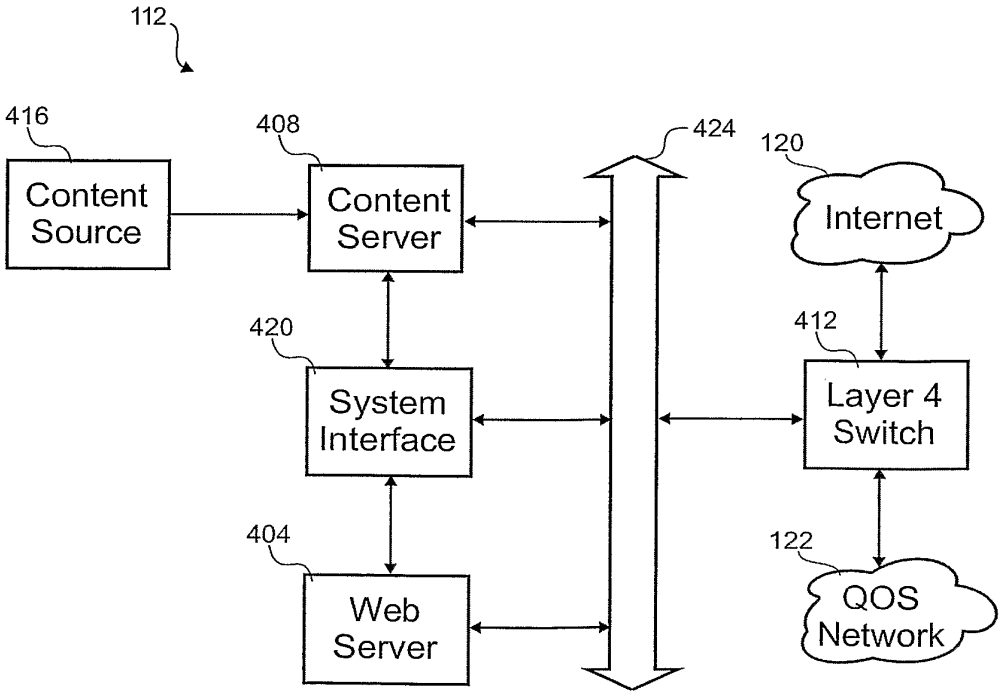


Fig. 4B

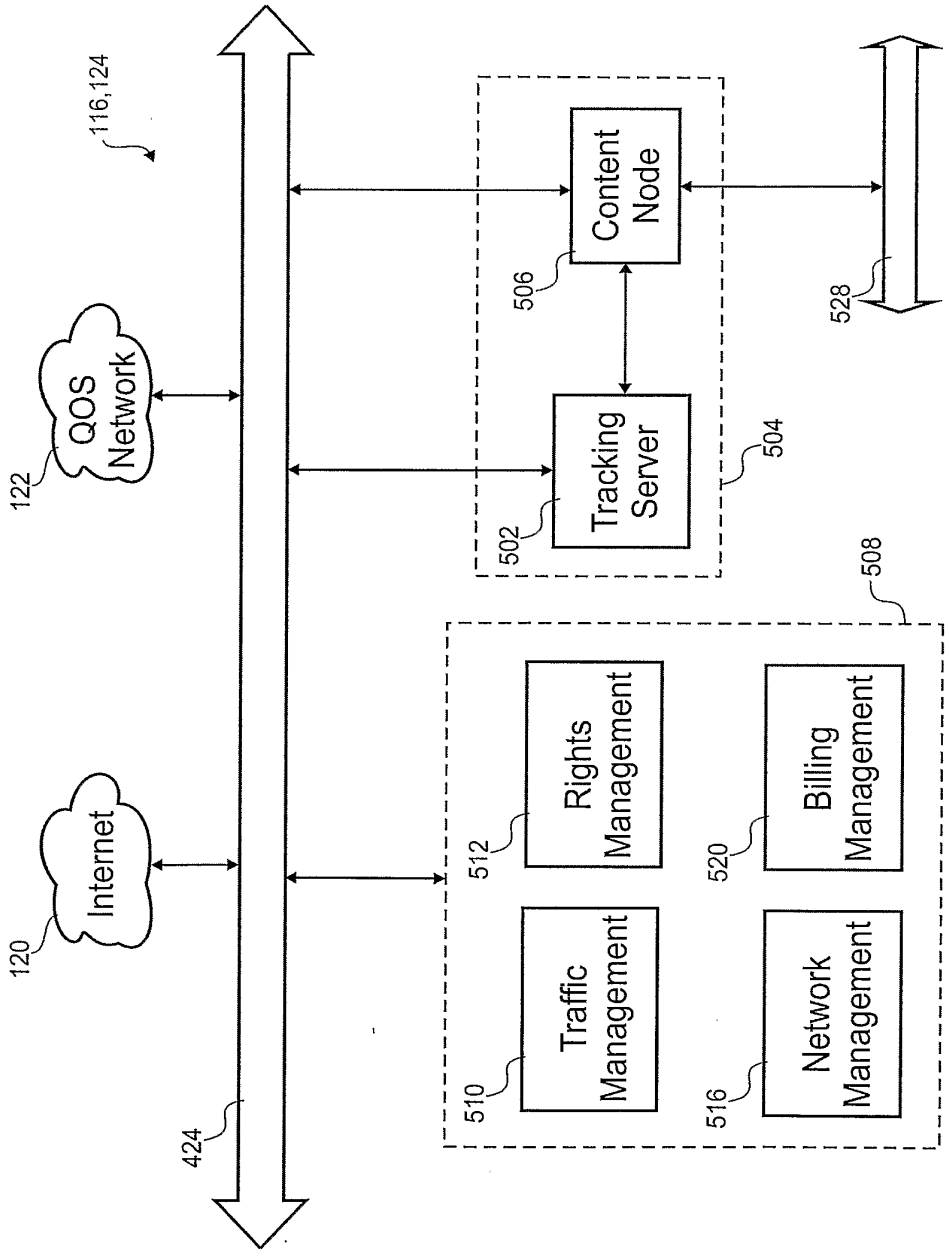

116,124
QOS Network
122
Internet
120
424
Content Node
506
528
Tracking Server
502
504
508
Rights Management
512
Billing Management
520
Traffic Management
510
Network Management
516

Fig. 5A

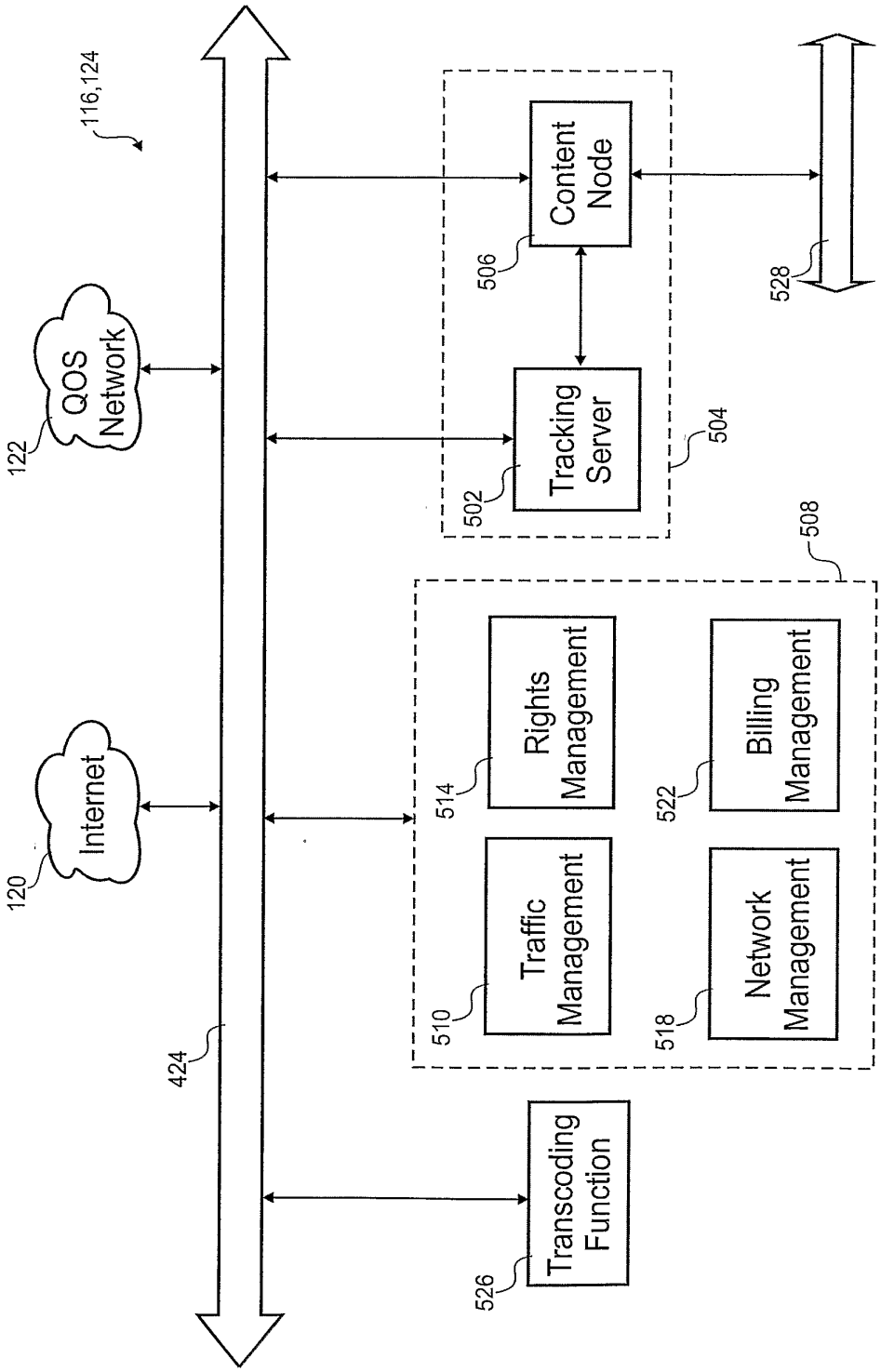

116,124
QOS Network
122
Internet
120
424
Content Node
506
Tracking Server
502
504
528
508
Rights Management
514
Billing Management
522
Traffic Management
510
Network Management
518
Transcoding Function
526

Fig. 5B

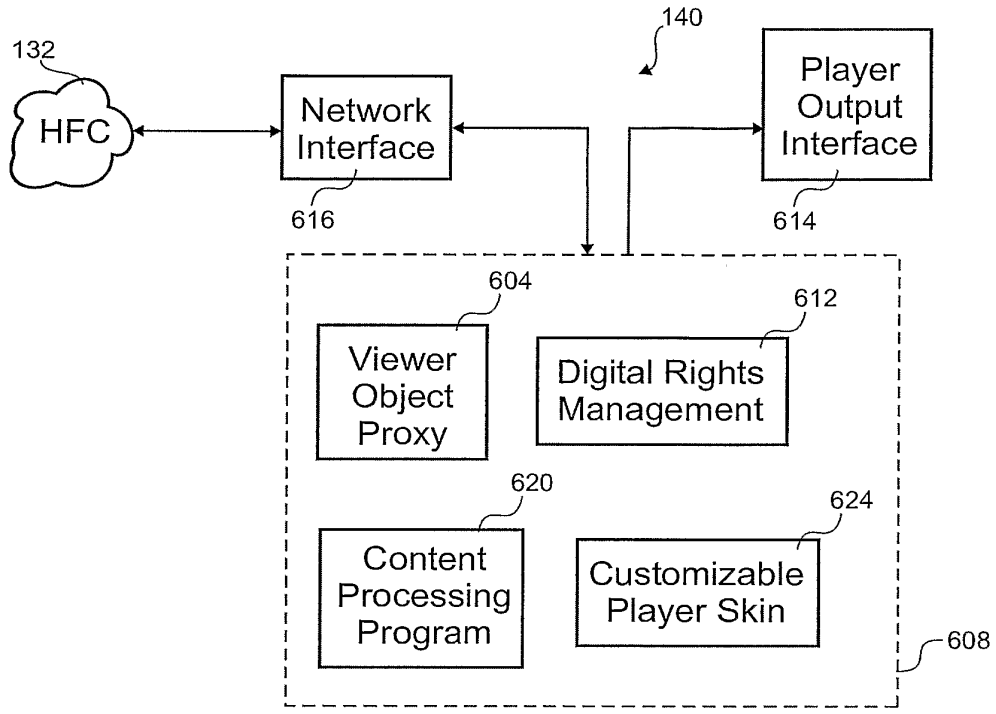

132
HFC
Network Interface
616
140
Player Output Interface
614
604
Viewer Object Proxy
612
Digital Rights Management
620
Content Processing Program
624
Customizable Player Skin
608

Fig. 6A

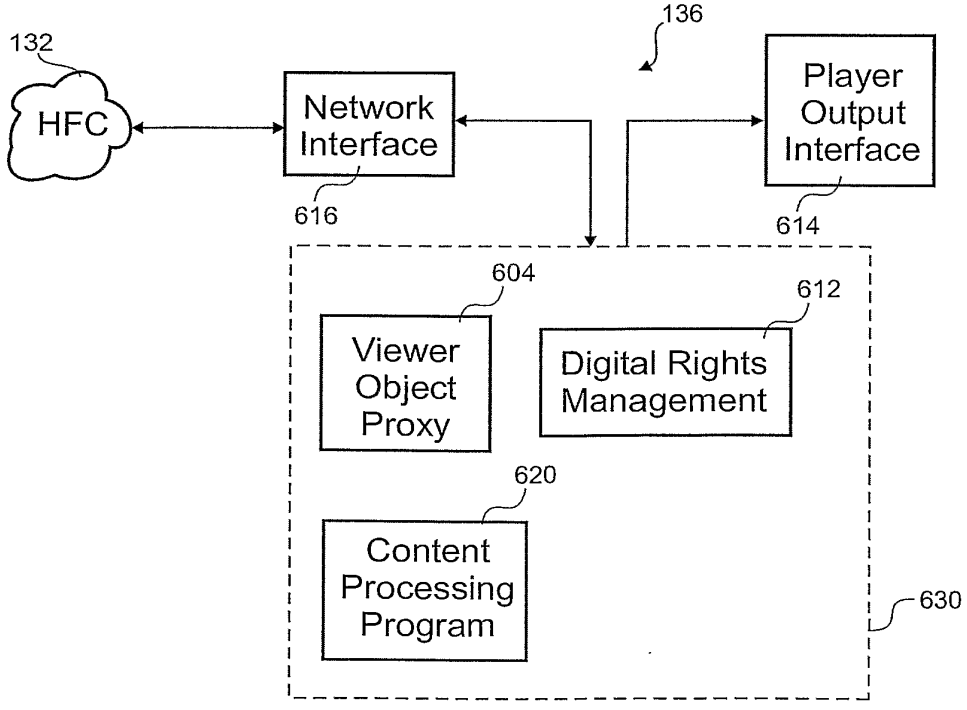

132
HFC
Network Interface
616
136
Player Output Interface
614
604
Viewer Object Proxy
612
Digital Rights Management
620
Content Processing Program
630

Fig. 6B

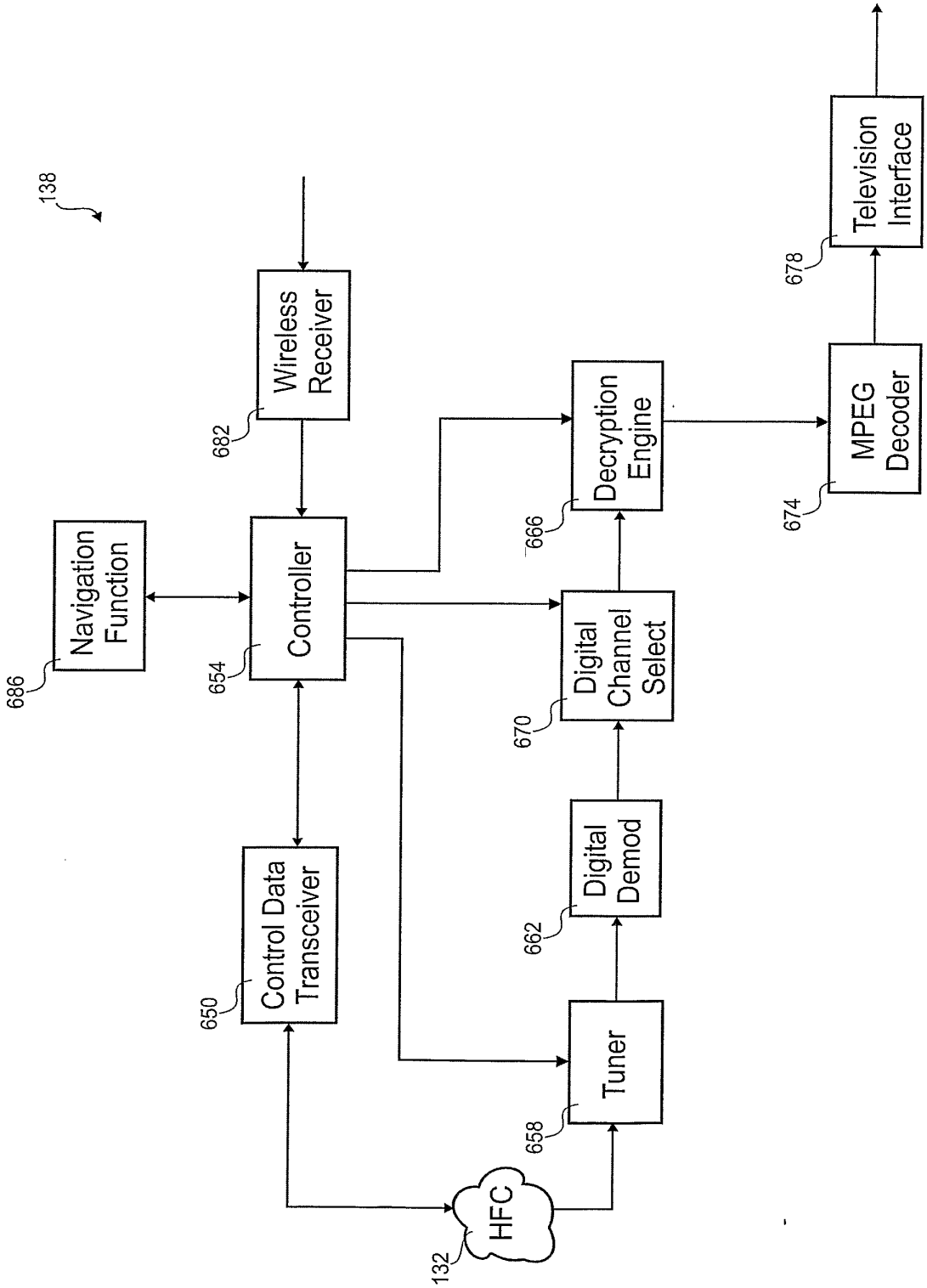

138
Wireless Receiver
682
Navigation Function
686
Controller
654
Decryption Engine
666
MPEG Decoder
674
Television Interface
678
Digital Channel Select
670
Digital Demod
662
Control Data Transceiver
650
Tuner
658
HFC
132

Fig. 6C

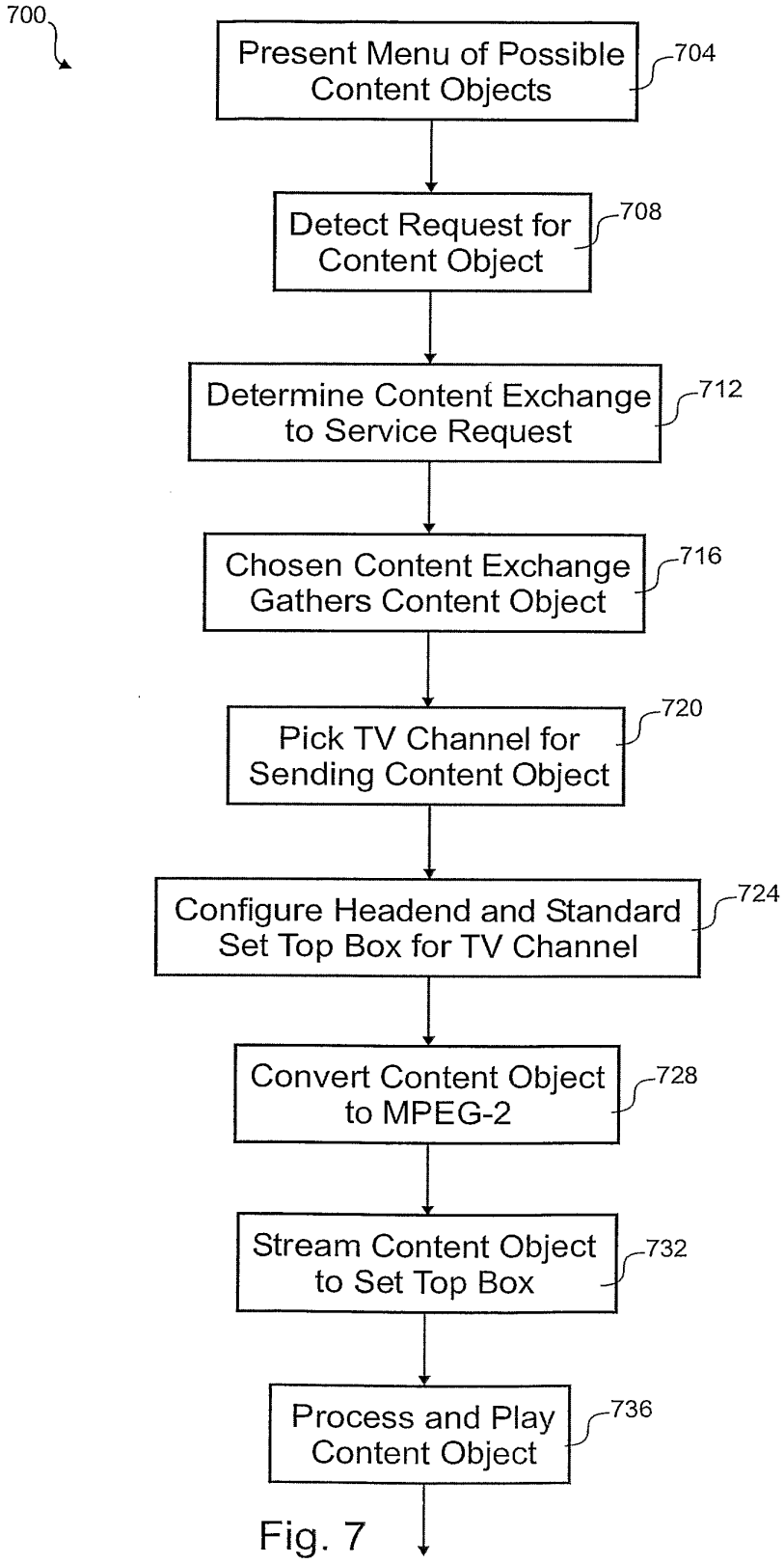

700
Present Menu of Possible Content Objects
704
Detect Request for Content Object
708
Determine Content Exchange to Service Request
712
Chosen Content Exchange Gathers Content Object
716
Pick TV Channel for Sending Content Object
720
Configure Headend and Standard Set Top Box for TV Channel
724
Convert Content Object to MPEG-2
728
Stream Content Object to Set Top Box
732
Process and Play Content Object
736

Fig. 7

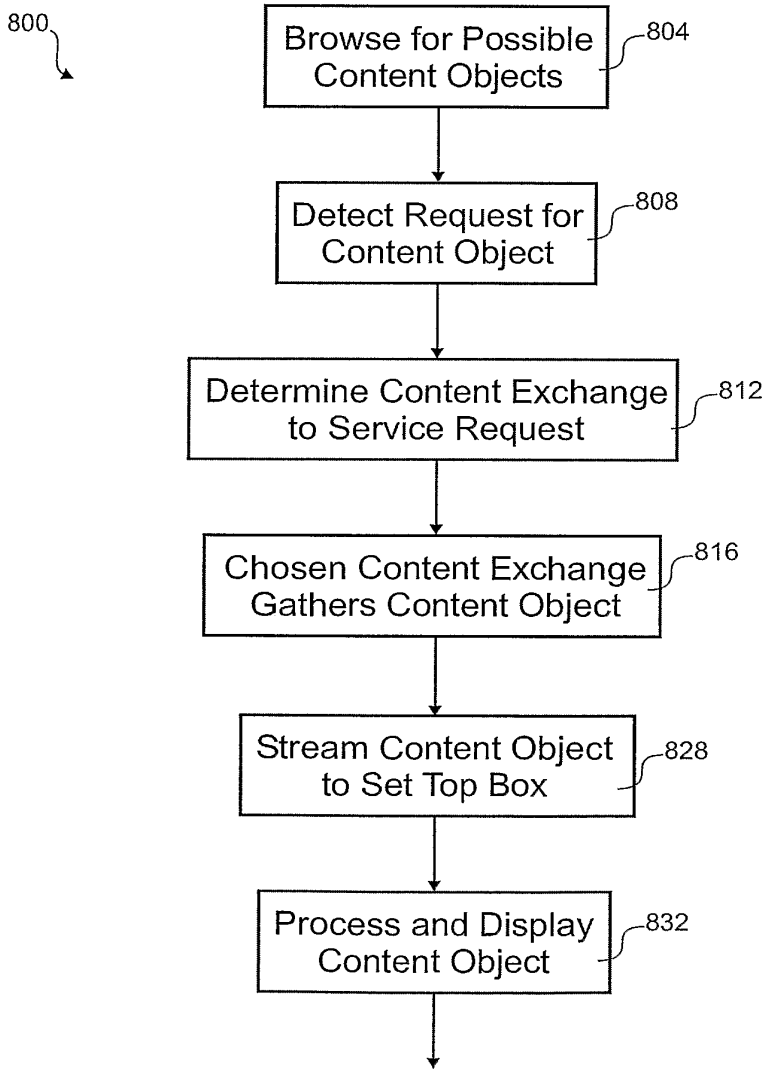

800
Browse for Possible Content Objects
804
Detect Request for Content Object
808
Determine Content Exchange to Service Request
812
Chosen Content Exchange Gathers Content Object
816
Stream Content Object to Set Top Box
828
Process and Display Content Object
832

Fig. 8

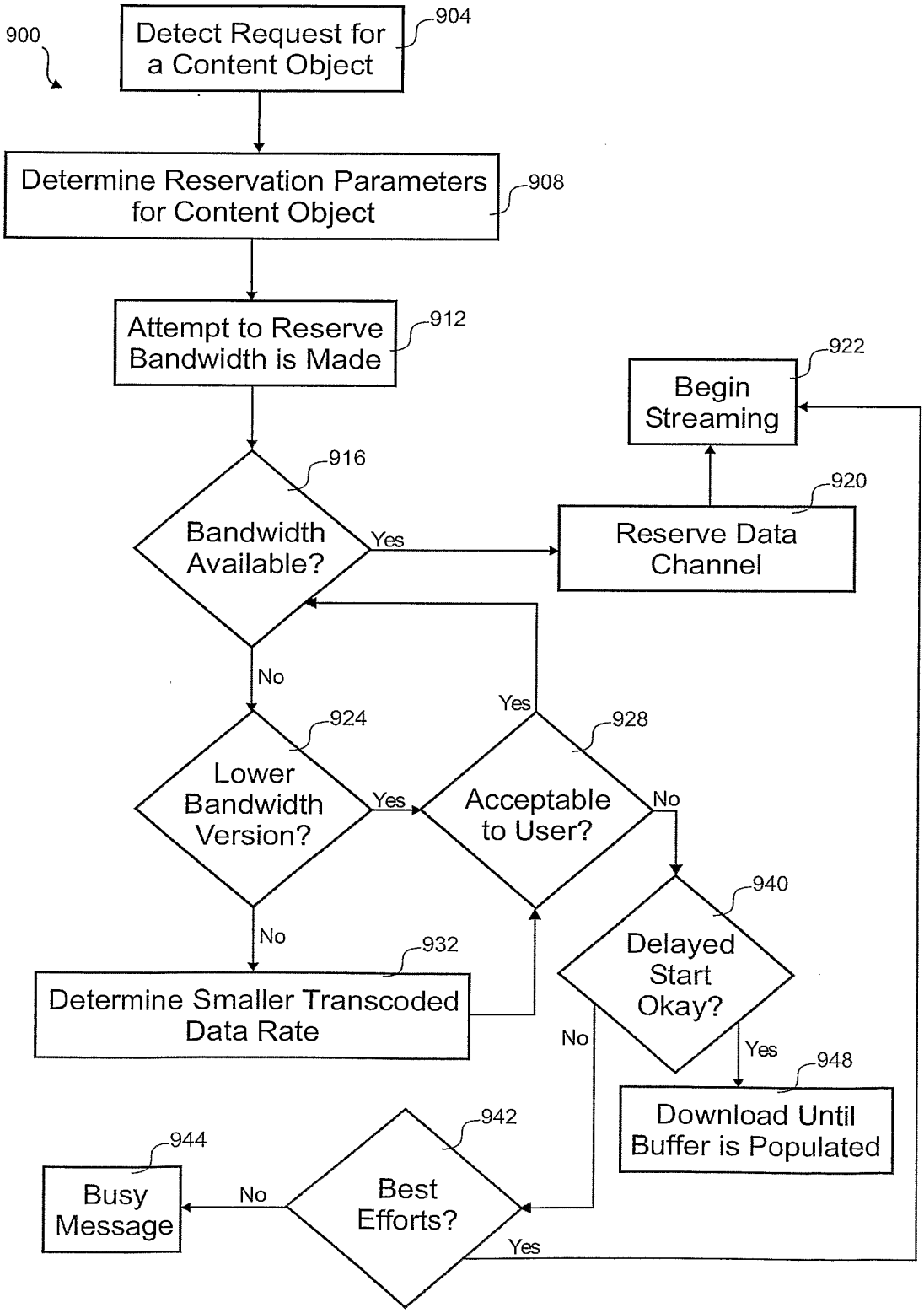

900
Detect Request for a Content Object
904
Determine Reservation Parameters for Content Object
908
Attempt to Reserve Bandwidth is Made
912
Begin Streaming
922
916
Bandwidth Available?
Yes
Reserve Data Channel
920
No
Yes
924
928
Lower Bandwidth Version?
Yes
Acceptable to User?
No
940
No
932
Delayed Start Okay?
Determine Smaller Transcoded Data Rate
No
Yes
948
Download Until Buffer is Populated
942
944
Busy Message
No
Best Efforts?
Yes

Fig. 9

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(71) Applicant *(for all designated States except US)*: **PA CONSULTING SERVICES LIMITED** [GB/GB]; 123 Buckingham Palace Road, London SW1W 9SR (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DURRANT, Simon** [GB/GB]; 43 Withipoll Street, Ipswich, Suffolk IP4 2BZ (GB). **MULROY, Pat** [IE/GB]; 61 Cemetary Road, Ipswich, Suffolk IP4 2JA (GB). **YANG, Dekun** [CN/GB]; 24 Arreton Close, Leicester, Leicestershire LE2 3PP (GB).

(74) Agents: **DRIVER, Virginia, Rozanne** et al.; Page White & Farrer, 54 Doughty Street, London WC1N 2LS (GB).

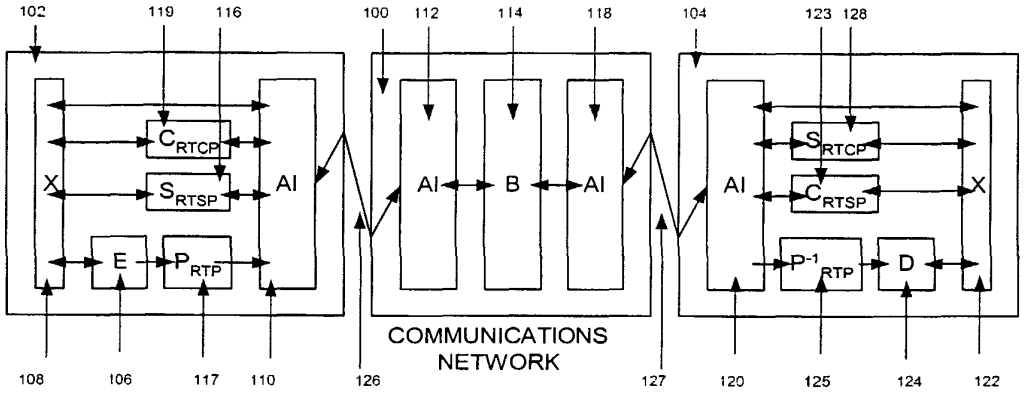
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(54) Title: ERROR CONTROL TO VIDEO ENCODER



(57) Abstract: A method of generating a compressed video data stream (CVDS) from a video stream, for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of: (a) determining values of one or more error rate parameters associated with the wireless channel; (b) determining values of one or more bit rate parameters associated with the wireless channel; (c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters; (d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

WO 03/041413 A1

ERROR CONTROL TO VIDEO ENCODER

FIELD OF THE INVENTION

The present invention relates to video streaming, and, more particularly, to the streaming of video data over a wireless communications network.

The invention has been developed primarily to allow video to be streamed in a UMTS or GPRS mobile telecommunications network using streamable formats such as MPEG-4 and H.263. However it will be appreciated by those skilled in the art that the invention is not limited to use with those particular standards

BACKGROUND TO THE INVENTION

Robust transmission of real time video data over wireless networks promises to be one of important applications of the wireless packet data services. Robustness is one of the key issues because a wireless network is a bandwidth-constrained as well as error-prone environment. Bandwidth constraint forces video data to be compressed into lower bit-rate video streams before it can be transmitted over a wireless mobile network. Channel errors in a wireless mobile network range from random bit errors to burst errors.

Existing video compression standards such as MPEG-4 and H.263 use three kinds of coding techniques: motion compensated prediction to encode temporal redundancy, Discrete Cosine Transform (DCT) with quantisation to encode spatial redundancy, and Variable-Length Code (VLC) for entropy encoding. These compression mechanisms are based on exploiting both the spatial dependency and temporal dependency which make the compressed video stream susceptive to any transmission errors. Both motion-compensation based predictive coding and VLC are sensitive to transmission errors. A single bit error can cause failure in VLC decoding. Use of predictive coding leads to error

propagation. Error resilient encoding is one of important issues in the reliable transmission of video data over noisy channels.

Existing video compression standards provide some error resilience to minimise the amount of data that has to be discarded whenever errors are detected: for example, the use of reversible VLC and the periodic insertion of resynchronisation markers so that the decoder regains synchronisation more quickly when transmission errors occur. Another mechanism is to increase the ratio of intra to inter-coding both at frame and block level to stop any residual error propagation at the expense of reducing the compression gain.

For real-time wireless streaming video applications, one of the key issues is how to achieve best possible encoding robustness under the bandwidth and time constraints of the wireless networks. Each wireless channel is associated with Quality of Service (QoS) parameters indicative of among other things the error rate parameters. During the transmission of video data between a transmitter and a receiver, QoS parameters vary with time randomly and asynchronously for the transmitter and the receiver. It is important for the transmitter to exploit wireless channel conditions and select appropriate error resilient mechanisms for successful end to end real time video transmission over the wireless channel.

It is the object of this invention to provide a method of making best use of error rate parameters associated with wireless channels for generating compressed video data stream with improved quality when transmitted over the wireless channels.

SUMMARY OF INVENTION

The present invention provides a method of generating a Compressed Video Data Stream (CVDS) for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of:

a) determining values of one or more error rate parameters associated with the wireless channel;
b) determining values of one or more bit rate parameters associated with the wireless channel;
c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters;
d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

In accordance with the described embodiment of the present invention, a CVDS transmitter in a mobile handset comprises an encoder controller and a prior art video encoder. Preferably the video encoder has several adjustable encoding parameters for altering the degree of error resilience of the generated CVDS. The encoder controller ascertains the error rate parameters associated with the wireless channel between the transmitter and the receiver, and derives the encoding parameters for generating the CVDS with improved error resilience while meeting the bandwidth constraints of the wireless channel.

The basic idea underlying the present invention is to make best use of error rate parameters associated with the wireless channels for generating CVDS with improved quality when transmitted over said wireless channels. The encoder controller may ascertain the error rate parameters from several sources. In an embodiment of the invention where the transmitter is a mobile transmitter and the receiver is a network receiver, the encoder controller can ascertain the error rate parameters associated with the wireless channel between the transmitter and the network from the air interface. In another embodiment of the invention where the transmitter is a network transmitter and the receiver is a mobile receiver, the encoder controller can ascertain the error rate parameters associated with the wireless channel between the network and the receiver. In yet another embodiment of the invention where a mobile transmitter transmits CVDS to a mobile receiver, the encoder controller can ascertain the error rate parameters from the two sources described above. The end to end feedback from the receiver and the transmitter is used to convey the information related to the error rate parameters.

In a preferred embodiment of the invention, the CVDS is packetised into IP format packet before being sent to the transmitter air interface. The IP packet is constructed by three wrapping operations respectively: (1) wrapping the CVDS in an RTP format packet, (2) wrapping the RTP packet in a UDP format packet, and (3) wrapping the UDP packet in a IP format packet.

The present invention can apply to both unidirectional streaming arrangement and bidirectional conversational arrangement. In the streaming arrangement the end to end feedback of error rate parameters can be performed via an RTCP session or an RTSP session. RTCP packets are wrapped in UDP and further IP format. RTSP packets are wrapped in TCP format and further IP format packets. In the conversational arrangement the end to end feedback of error rate parameters can be performed via a SIP session. SIP packets are wrapped in UDP format and further IP format packets.

Preferably, the wireless networks are UMTS or GPRS mobile telecommunications networks. Each wireless channel is associated with Quality of Service (QoS) parameters indicative of among other things the error rate information. At session initiation and when wireless channel characteristics are to be modified, the network provides each mobile handset with a QoS parameter set that is indicative of the available bit rate, error rate conditions of the wireless channel between the mobile handset and the network. The QoS parameter set is read at the mobile handset by the encoder controller or the decoder controller. The error rate parameters are derived from the QoS parameters associated with the wireless channels.

In a preferred embodiment of the invention, the video data is divided into a sequence of frames, with each frame being further divided into a number of Group of Blocks (GOB) or a number of slices, and with each GOB or slice being further divided into a number of blocks. Preferably, the encoder parameters including frame rate, frame type indicative of either intra-coded frame or inter-coded frame, block type indicative of either intra-coded block or inter-coded block, and quantisation parameter.

According to the preferred embodiment, the error control of video encoding is achieved by a combination of the following operations:

a) setting proper ratio of intra-coded frames and inter-coded frames;
b) allocating GOBs or slices with suitable sizes such that the headers of GOBs or slices can be used as resynchronisation markers for the decoder to regain synchronisation quickly when transmission errors occur;
c) setting proper ratio of intra-coded blocks and inter-coded blocks for each GOB or slices in each inter-coded frame.

In a preferred embodiment of the invention, the rate control of video encoding operates in conjunction with the error control such that the generated CVDS is error resilient as well as within the bit rate budget associated with the channel bandwidth. Preferably, the encoder controller performs the rate control based on the derived parameters of the error control and the current encoding status information (e.g. instantaneous bit rate generated by the encoder and the motion estimation). The rate control is used for:

a) setting proper frame rate;
b) setting proper quantisation parameters;

such that the generated CVDS can match the bit rate constraints of the wireless channels.

In an embodiment of the present invention, the CVDS comprises a plurality of layers including the base layer and enhanced layers in which each layer comprises a sequence of frames which may be of the same type (intra-coded or inter-coded) or a mixture of types. Each layer can be carried via an RTP session. Preferably, more than one wireless channels are available and each wireless channel is used to transmit an RTP session. In this embodiment, in conjunction with the above error control operations, the error control also includes mapping CVDS layers into wireless channels such that the base layer is mapped into the wireless channel with better transmission quality.

BRIEF DESCRIPTION OF DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a simplified schematic diagram of a UMTS communication system showing a network and two mobile handsets, where one handset is the transmitter and the other a receiver, for streaming video;

Figure 2 is a simplified schematic diagram of a UMTS communication system showing a network and two mobile handsets, where each handset is simultaneously a transmitter and a receiver for conversational video;

Figure 3 shows the construction of a UDP/IP packet containing MPEG-4 video payload data;

Figure 4 shows the construction of a UDP/IP packet containing RTCP data;

Figure 5 shows the construction of multiple substreams with a common IP address and different UDP addresses per substream;

Figure 6 shows the construction of a TCP/IP packet containing RTSP and SDP data;

Figure 7 shows the construction of a TCP/IP packet containing SIP and SDP data;

Figure 8, Figure 10 and Figure 12 show single and multiple RTP/RTCP sessions and an RTSP session (also labelled more generically as IP Sessions), mapped onto single and multiple wireless channels for streaming video;

Figure 9, Figure 11 and Figure 13 show single and multiple RTP/RTCP sessions and a SIP session (also labelled more generically as IP Sessions), mapped onto single and multiple wireless channels for conversational video;

Figure 14 shows Quality of Service (QoS) parameters associated with the wireless channels between mobile handsets and networks, and the sending of these and other QoS parameters between the mobile handsets via IP sessions for streaming video;

Figure 15 shows QoS parameters associated with the wireless channels between mobile handsets and networks, and the sending of these and other QoS parameters between the mobile handsets via IP sessions for conversational video;

Figure 16 and Figure 17 shows typical mapping of compressed video data stream frames onto base and enhanced substreams;

Figure 18 is a flowchart showing sequential operations performed by the encoder controller;

Figure 19 is a flowchart showing sequential operations performed by the decoder controller; and

Figure 20 is a flowchart showing sequential operations performed by the encoder.

DETAILED DESCRIPTION OF PREFERRED AND OTHER EMBODIMENTS

The preferred embodiment of the present invention is applied to a network and associated mobile handsets designed to operate under the current GPRS or proposed UMTS standard.

Referring to the drawings, and Figure 1 in particular, there is shown a UMTS network 100 that is used to establish an end to end link between a first mobile handset 102 and a second mobile handset 104. The communication session between the first mobile handset 102 and the second mobile handset 104 is unidirectional. Mobile handset 102 is acting solely as a transmitter of compressed video data, whilst mobile handset 104 is acting solely as a receiver of compressed video data. This is termed the streaming arrangement.

In the embodiment shown in Figure 2, the communication session between the first mobile handset 142 and the second mobile handset 144 is bi-directional. Mobile handset 142 is acting both as a transmitter and a receiver of compressed video data, and mobile handset 144 is also acting as a transmitter and receiver of compressed video data. This is termed the conversational arrangement. In Figure 2 the functions and operations of the second mobile handset 144 are identical to the functions and operations of the first mobile handset 142.

It will be appreciated that the transmitter function and operation of mobile handsets 142 and 144 is identical to that of the transmitter function and operation of mobile handset 102. It will also be appreciated that the receiver function and operation of mobile handsets 142 and 144 is identical to that of the receiver function and operation of mobile handset 104. In the case of mobile handsets 142 and 144, the receiver and transmitter functions and operations are present within

the same mobile handset. In mobile handsets 102 and 104 only the transmitter or the receiver function is present respectively. It will be appreciated that the mobile handsets 142 and 144 can also operate exclusively as transmitters or receivers to produce the streaming arrangement, in addition to their conventional conversational arrangement, if so configured.

In Figure 1 the first mobile handset includes a transmitter controller 108, a Real Time Streaming Protocol (RTSP) server 116, an encoder 106, a Real Time Protocol (RTP) packetiser 117, a Real Time Control Protocol (RTCP) client 119 and a transmitter air interface 110, which are operatively interconnected with each other as shown. The encoder 106 accepts raw video data (RVD) from a video source such as a camera (not shown) associated with the first mobile handset 102 and encodes it into a compressed video data stream (CVDS) format, as discussed in detail below. This is then packetised by the RTP packetiser 117. According to the normal operation of a mobile communications network, the transmitter air interface 110 establishes a wireless channel with a transmit side air interface 112 in the network 100, which in turn is in communication with a network backbone 114.

The network 100 also includes a receive side air interface 118 that establishes a wireless channel with a receiver air interface 120 disposed in the second mobile handset 104. The second mobile handset 104 also includes a receiver controller 122, an RTSP client 123, an RTP depacketiser 125, an RTCP server 128 and a decoder 124. These are operatively interconnected with each other as shown.

In Figure 2 the mobile handsets 142 and 144 includes all the components that are present in both the mobile handset 102 for the transmitter function, with the exception of the RTSP server 116, and the mobile handset 104 for the receiver function, with the exception of the RTSP client 123. The RTSP server 116 is replaced by a SIP User Agent (UA) 146 in mobile handset 142 and the RTSP client 123 is replaced by a SIP UA 148 in mobile handset 144. The components of the transmitter function, the components of the receiver function, the User Agent and the air interface for mobile handsets 142 and 144 are operatively interconnected with each other as shown. It will be appreciated that

the function and operation of the mobile communications network shown in Figure 2 is as above.

In a UMTS network, the mobile handsets 102, 104, 142 and 144 are designated User Equipment (UE), the air interface elements 112 and 118 correspond to the Universal Terrestrial Radio Access Network (UTRAN), the backbone element 114 corresponds to the Core Network (CN).

According to normal mobile communications network operation, an end to end link is established between the first and second mobile handsets 102, and 104 (or 142 and 144), comprising a first wireless channel 126 between the first mobile handset and the network and a second wireless channel 127 between the network and the second mobile handset. Wireless channels are established using different frequencies and/or spreading codes and/or time slots in a manner well known in the mobile communications art. They allow for bi-directional communication, both for data and control information.

As part of the wireless channel control information, the wireless channel 126 between the transmitter air interface 110 and the transmit side air interface 112 carries Quality of Service parameters (QoS), from the network 100 to the first mobile handset 102 (or 142). Similarly, the wireless channel 127 between the air interface 118 and the receiver side air interface 120 carries Quality of Service parameters (QoS), from the network 100 to the second mobile handset 104 (or 144).

The packetised CVDS is transmitted over the end to end link defined between the two mobile handsets 102 and 104 (or 142 and 144), across wireless channels 126 and 127. In the preferred embodiment, the CVDS takes the form of an MPEG-4 stream, but other suitable streaming formats, such as H.263 can also be used. Both of these standards are applicable to variable bitrate and low bitrate video, e.g. bitrates of 10kbps or higher. It is particularly preferred that the transmission be in RTP format, as discussed in detail below in relation to Figure 3, Figure 4, Figure 5.

Turning to Figure 3, the packetisation of the raw MPEG-4 data for transmission is shown. This packetisation takes place in the first mobile handset 102 or 142 under the control of the transmitter controller 108 before sending the

packets to the transmitter air interface 110. Upon emerging from the wireless network of the transmitter the packets travel over a packet switched network to the wireless network of the receiver. Here the packets are sent to the receive side air interface 118 and on to the second mobile handset 104 or 144 via wireless channel 127.

Figure 3 shows the packetisation layers for a single MPEG-4 packet 200 in the form in which it leaves the encoder 106. It will be appreciated that a stream of such packets will be generated from the incoming RVD. The MPEG-4 video data 200 is wrapped in an RTP format packet layer 201. This, in turn, is wrapped in a UDP format packet layer 202, which in turn is packetised into an Internet Protocol (IP) packet 203. It is this IP packet 203 that is presented by the RTP packetiser 117 to the transmitter air interface 110 for transmission over the wireless channel. This layering format, defined by IETF, is known and is included in the developing UMTS standard for video transmission.

Each of the packetisation layers of the packet is directed to a particular part of the overall communication. They will not be described in detail because they are already known in the art and conform to the respective standards. However the principal component of each packet will be described insofar as is necessary to understand the embodiments of the invention that follow.

The MPEG-4 layer 200 contains the coded video data. The RTP layer 201 contains sequence numbers, time stamps, and payload bits that enable a depacketiser and decoder to decode it and replay at the correct time and in the correct sequence in relation to other packets from the same stream. The UDP layer is used for asynchronous communication of the data over the wireless communications channel and is a "best effort" connectionless protocol. The IP packet 203 contains an IP address which identifies the mobile receiver 104 or 144 as the destination. The IP packet header may also contain a Differentiated Services Code Point (DSCP) which could be used by a diffserv-enabled core network to determine how that packet should be forwarded by nodes inside that network.

Figure 4 shows the packetisation layers for a single RTCP packet 205 in the form in which it leaves the RTCP server 128. The RTCP packet is wrapped in a UDP format packet layer 206, and packetised into an IP packet 207.

Turning to Figure 5, the CVDS can be transmitted over the wireless channels in one or multiple substreams, each transported by an RTP session, (and an associated RTCP session) where these are mapped to one or multiple wireless channels that may have different quality parameters. In this case the IP address 208 is common to both substreams. Routing through the transmission chain is achieved by characterising different substreams by different socket numbers 210 and 212 in the UDP address.

It will be understood that some of the receiving handsets, or, indeed, the transmitting handset may not be capable of forming a multi wireless channel connection with the network. This may be because of equipment incompatibilities or network resource issues, for example. In this case, it is still possible for the video layers to be allocated to multiple wireless channels in accordance with the above embodiment, whilst multiplexing the video onto a single wireless channel for those not capable of forming the requisite multi wireless channel connection.

In the streaming arrangement of Figure 1, the IP packet of Figure 3 is transmitted directly from the first mobile handset 102, via the network 100, to the second mobile handset 104.

Once received at the receiver air interface 120, the packets are forwarded to the RTP depacketiser 125, where the MPEG-4 data 200 is re-constructed. The packets must be re-ordered using RTP layer data 201 such as frame timestamps and the data from the plurality of substreams must be re-assembled. The re-constructed MPEG-4 data 200 is then sent from the RTP depacketiser 125 to the decoder 124, where it is decoded for replay on, for example, a visual display (not shown) on the second mobile handset 104.

In the return direction (i.e., from the second mobile handset 104 to the first mobile handset 102 in this example), control information is returned in accordance with the known RTCP and RTSP protocols, with the latter using the known Session Description Protocol (SDP).

Figure 8 and Figure 10 show the IP sessions between a streaming server and client. The RTCP sessions provide feedback on the data transmission quality for each RTP session. RTSP additionally provides an overriding control connection from RTSP client 123 to RTSP server 116, using SDP to provide a description of the connection between client and server. It is known in the art that, when a session changes, an RTSP control packet containing a new SDP packet is sent to the remote entity.

The packetisation of the SDP and RTSP information is shown in Figure 6. The SDP information 306 is wrapped in an RTSP packet 300. An RTSP packet 300 is wrapped in a Transport Control Protocol (TCP) packet 302, which is within an IP packet 304. This packet is built up by the RTSP client 123 and supplied to the receiver air interface 120 for transmission to the receive side air interface 118 of the network 100. The destination address of this RTSP packet is that of the first mobile handset 102.

In the preferred embodiment shown in Figure 1, the RTSP packet passes to the transmit side air interface 112 via the backbone 114 for transmission to the transmitter air interface 110, to the RTSP server 116 and thence to the transmitter controller 108. Also, control information is exchanged between both mobile handsets 102 and 104 in accordance with the known RTCP protocol.

In the conversational arrangement of Figure 2 the IP packet of Figure 3 is transmitted and received between the mobile handsets 142 and 144, via the network 100, in the same way as for the streaming arrangement described above. The encoded video packet is also processed in the same way as for the streaming arrangement described above.

For the control of bi-directional communications sessions the Session Initiation Protocol (SIP) is used instead of RTSP. This is managed by user agents 146 and 148 in mobile handsets 142 and 144 respectively. SIP uses SDP to provide a description of the connection between two peer user agents. It is known in the art that, when a session changes, a SIP control packet containing a new SDP payload is sent to the peer user agent.

Figure 9 and Figure 11 show the IP sessions between two peer user agents 146 and 148. The SIP session provides an overriding connection control

between user agents 146 and 148 using the SDP. Again, control information is also exchanged between both mobile handsets 142 and 144 in accordance with the known RTCP protocol. The RTCP session will provide feedback on the data transmission quality for each RTP session.

The packetisation of the SIP information is shown in Figure 7, where the packet is denoted 308. An SDP payload 307 is encapsulated within the SIP packet 308. A SIP packet 308 is wrapped in a User Datagram Protocol (UDP) packet 310, which is within an IP packet 305. This packet is built up by the user agent 148 and supplied to the air interface 127 for transmission to the receive side air interface 118 of the network 100. The destination address of this SIP packet is that of the other mobile handset 142. It will be understood that user agents 146 and 148 are interchangeable in this scenario.

In the preferred embodiment shown in Figure 2, the SIP packet passes to the transmit side air interface 112 via the backbone 114 for transmission to the transmitter air interface 126 and thence to the transmitter controller 108 via the user agent 146.

In use, a user of, say, the first mobile handset, 102 or 142, places a call to the second mobile handset 104 or 144, by dialling the second handset's mobile number.

The first mobile handset's number is mapped to a first IP address taken from a pool of IP addresses, and the second mobile handset's number is mapped to a second IP address taken from the pool of IP addresses. This mapping persists for as long as the connection is maintained. Once the connection is broken, usually because one or both of the users hang up, the mapping is removed and the IP addresses are returned to the pool for reuse. It will be appreciated that this arrangement means that packets can be routed using the allocated IP addresses instead of the phone numbers.

There follows a description of the basic elements of call set-up at the wireless level to aid understanding of the invention.

When a user requests a call, the requested quality class of the wireless channel is communicated to the network 100. In particular, the first mobile handset 102 or 142 can request a particular QoS from the UMTS network, which

specifies, for example, guaranteed and maximum bitrates. On this basis, and assuming there are sufficient network resources available, a wireless communications channel is established between the first mobile handset 102 or 142 and the network 100, the wireless channel having defined QoS criteria.

Alternatively the first mobile handset 102 or 142 might request the network resources as a number of wireless channels each with associated QoS (see later for multiple wireless channel discussion).

The second mobile handset 104 or 144 must similarly establish a connection with the network 100, establishing a wireless communications channel with an independent QoS criteria to that of the wireless channel established by the first handset 102 or 142.

Once the wireless communications channel or set of channels is established, video data from, say, a camera (not shown) associated with the first mobile handset 102 or 142 is received by the encoder 106, which in turn generates a sequence of CVDS video data. The video data is sent to the RTP packetiser 117, where it is packetised as described above and sent to the second mobile handset as described above. The receiving mobile handset is mobile handset 104 if mobile handset 102 is the transmitter; mobile handset 144 if mobile handset 142 is the transmitter; and mobile handset 142 if mobile handset 144 is the transmitter.

As other users make and break wireless communications channels and the network 100 continuously monitors user resource allocations, it can be the case that available bandwidth for any particular call changes, either increasing or decreasing. If a user has a multiple wireless channel allocation, one or more of the wireless channels may be terminated. It will be understood that these bandwidth changes can take place at a number of points along a given wireless communications channel. For example, it could take place between the first mobile handset 102 (or 142) and the network, or between the network and the second handset 104 (or 144).

Other factors, such as distance of a handset from a base station with which it is communicating, or strong multi-path reflections, can also cause the effective bandwidth or quality of a wireless channel to be reduced.

Any change in effective bandwidth or quality can have two consequences. If the bandwidth increases it could in principle be possible to transmit video data at a higher bitrate. If it decreases, however, the rate at which video data can reliably be transmitted also decreases, possibly below the value that was set at the start of transmission. To accommodate these consequences the QoS parameter set including the available bitrate and bit error rate on the wireless channel between the first mobile handset 102 or 142 and the network 100 is monitored by the controller 108 at the first mobile handset 102 or 142.

In the preferred form, at session initiation and when wireless channel characteristics are to be modified, the UMTS network provides the first mobile handset with a QoS parameter set that is indicative of the available bitrate (i.e. bandwidth) on the wireless communications channel. Such a QoS parameter set is supplied through the protocol stack in known wireless systems from the air interface 112 of the network to the air interface 110 of the transmitting mobile handset 102 or 142. It is normally supplied across a wireless control channel on the downlink of the call.

According to the developing UMTS standard, the QoS parameter set is indicative of various transmission parameters, including the transmissible bitrate over the wireless channel, the signal to noise ratio, the error rate and a priority indicator which is an indication provided from the network to the transmitting mobile handset of the likely priority to be placed on the call. This is therefore an indicator of the bandwidth and likely reliability of the wireless communication channel that has been opened for the particular wireless channel. It will be appreciated in this context that the word "call" is used herein to describe the transmission of video data as well or instead of voice data. The QoS parameter set is read at the mobile handset 102 or 142 by the controller 108 and the transmissible bitrate is extracted from it.

The quality of the wireless communication channel between the network 100 and the second mobile handset 104 or 144 is also monitored. In the preferred form, a QoS parameter set indicative of, amongst other things, the available bandwidth for the RTP session mapped onto this wireless channel is ascertained in the second mobile handset 104 or 144 derived from the wireless control

channel information it receives from the network according to the relevant wireless standard (in this case UMTS).

The QoS parameter set is dealt with at the second mobile handset 104 or 144 in a novel manner. The session control protocol (both bi-directional using SIP and unidirectional using RTSP) and have already been discussed. SDP provides for the exchange and updating of session description information such as codec and bitrate.

For the streaming arrangement (shown in Figure 1), according to the existing RTSP standard, various control parameters are conveyed by the RTSP packets including, for example, video commands such as PLAY and PAUSE. The standard also provides an ANNOUNCE instruction The system described herein uses the ANNOUNCE provision in the RTSP standard to cause elements of the QoS parameter set determined in the wireless environment and/or other derived parameters to be placed into an SDP payload which itself is placed in an RTSP packet for transmission from the second mobile handset 104 to the mobile handset 102. The thus constructed novel packets are transmitted by the RTSP client 123, via the receiver air interface and the received side air interface to the network backbone 114. From here they travel to the RTSP server 116 via the transmission side air interface 112 and the transmitter air interface 110.

For the conversational arrangement (in Figure 2), according to the existing SIP standard, SDP payload are conveyed by the SIP packets to control the bi-directional communication between two mobile handsets. A session is initiated using the INVITE instruction, which itself contains a session description in the SDP format. The standard provides for a session to be modified by either agent by issuing a subsequent INVITE instruction. The system described herein uses the re-INVITE provision in the SIP standard to cause the quality parameter determined in the wireless environment and/or other derived parameters to be placed into an SDP packet which itself is placed in a SIP packet for transmission from the receiving mobile handset 144 to the transmitting mobile handset 142. The thus constructed novel packets are transmitted by the session control agent 148, via the receiver air interface 120 and the received side air interface 118 to

the network backbone 114. From here they travel to the session control agent 146 via the transmission side air interface 112 and the transmitter air interface 120.

It can be understood that user agents 146 and 148 are interchangeable in this scenario. For both streaming and conversational arrangements the RTP sessions carrying the video data each have associated RTCP sessions carrying control information back to the transmitter. The system described herein can, in addition to or instead of using RTSP or SIP, use the RTCP application defined (APP) packet to transfer application data (in this case the wireless and other derived QoS parameters) from the receiver to the transmitter.

In both the streaming (Figure 1) and conversational (Figure 2) arrangements, when a session control packet is received at the transmitting mobile handset, this along with locally derived QoS parameters can be used to modify the encoded bitrate as already discussed above. In this way, the bitrate of the video stream transmitted from the encoder can be adapted to the wireless channel between a transmitting mobile handset and the network and also to the wireless channel between the network and a receiving mobile handset. In the streaming arrangement and now referencing Figure 8 and Figure 10, there are shown two ways of transmitting a CVDS from an encoder 106 to a decoder 124 using RTP between an RTP packetiser 117 and an RTP depacketiser 125. RTCP control messages are sent between RTCP server 128 and RTCP client 119. RTSP control messages are sent between an RTSP server 116 and an RTSP client 123. Figure 8 shows a prior art method of streaming CVDS transported by an RTP session 804 and associated RTCP session 805. RTSP control messages are sent via RTSP session 806. It will be appreciated that at least some part of the end to end communications channel is wireless. In Figure 8 the RTP session containing all the frames of the video stream and the RTCP session containing all RTCP control messages are multiplexed onto a single wireless channel, with the CVDS parameters and frame sequencing being derived according to the QoS parameter of the wireless channel at call set up.

Figure 9 shows the prior art for conversational arrangement. Each mobile handset is depicted with an RTP packetiser (117 or 134), an RTP depacketiser (133 or 125) and a user agent (146 or 148). For a conversational arrangement, a

CVDS is transmitted from RTP packetiser 117 to RTP depacketiser 125 using RTP session 814 and RTCP session 815 simultaneously with a CVDS transmitted from RTP packetiser 134 to RTP depacketiser 133 using RTP session 816 and RTCP session 817. A single SIP session 818 controls all the RTP/RTCP sessions. In Figure 9, as in Figure 8, the RTP sessions containing all the frames of the video stream, the RTCP sessions corresponding to these and the SIP session containing all of the SIP control messages are multiplexed onto a single wireless channel, with the CVDS parameters and frame sequencing being selected according to the QoS parameter of the wireless channel at call set up.

Figure 10 shows a preferred embodiment of the invention for the streaming arrangement, in which there is a plurality of wireless channels. In the example shown there are three wireless channels. RTP/RTCP sessions 824/825 and 826/827 are used for transmitting the two substreams of a CVDS and RTSP control messages are sent via RTSP session 828. The wireless channels are provided at call set up as previously described in a situation where the encoder 106, RTP packetiser 117, RTCP client 119 and RTSP server 116 are in a first mobile handset, and the decoder 124, RTP depacketiser 125, RTCP server 128 and RTSP client 123 are in a second mobile handset in accordance with requested QoS and bandwidth parameters according to the UMTS standard.

As with previous embodiments, the CVDS substreams are transported via RTP between the RTP packetiser 117 and RTP depacketiser 125, RTCP control messages are sent between RTCP server 128 and RTCP client 119 and control messages are transmitted via an RTSP session between the RTSP server 116 and RTSP client 123. As shown in the example Figure 8, one RTSP session covers all the RTP/RTCP sessions between any two entities while each CVDS substream requires an individual RTP session and an associated RTCP session.

Figure 11 shows a preferred embodiment of the invention for the conversational arrangement, in which there is a plurality of wireless channels. In the example shown there are three wireless channels. RTP/RTCP sessions 834/835 and 836/837 are used for transmitting the two substreams of a CVDS generated by the encoder 106. RTP/RTCP sessions 838/839 and 840/841 are used for transmitting the two substreams of a CVDS generated by the encoder

129. The SIP control messages are sent via SIP session 842. Figure 11 shows that the base layers produced by encoders 106 and 129, carried by RTP sessions 834 and 838 and packetised by RTP packetisers 117 and 134, use the up and down links of the same wireless bearer at each mobile handset. Similarly, the enhanced layers from the encoders 106 and 129, carried by RTP sessions 836 and 840 and packetised by RTP packetisers 117 and 134, use the up and down links of the same wireless bearer at each mobile handset. It will be appreciated that there are many other possible mappings between RTP/RTCP sessions to wireless bearer. The wireless channels are provided at call set up as previously described and in accordance with requested QoS and bandwidth parameters according to the UMTS standard. As shown in the example, one SIP session 845 covers all the RTP/RTCP sessions between any two entities while each CVDS substream requires an individual RTP session and an associated RTCP session.

Since wireless channels for the transmit side and receive side are allocated separately there is no guarantee that the number of transmit side and receive side wireless channels will be the same. In the streaming arrangement shown in Figure 12 there is one transmit side wireless channel and three receive side wireless channels. On the receive side RTP/RTCP sessions 844/845 and 846/847 and RTSP session 848 are each mapped to a separate wireless channel. On the transmit side all IP sessions 844-848 are mapped to the same wireless channel.

Figure 13 shows the situation for the conversational arrangement, where for the handset containing user agent 146 there is only one wireless channel, whilst for the handset containing user agent 148 there are three wireless channels. In the handset containing user agent 148 the RTP/RTCP sessions 853/854 and 857/858 are mapped to the same wireless channel. However the RTP/RTCP sessions 851/852 and 855/856 are mapped to another wireless channel and the SIP control 859 is mapped to yet another wireless channel. In the handset containing user agent 146 all IP sessions of all types 851-859 are mapped to the same wireless channel.

Under the proposed UTMS standard (and others), wireless channels can be defined in terms of a number of quality of service parameters, such as priority, maximum and guaranteed bandwidth, residual bit error rate and delay.

In the embodiment of Figure 10, the first RTP session 824 is defined as carrying the base substream, having an example bitrate of 16kbps, whilst the second RTP session 826 has a bitrate of 32kbps. The first wireless channel has the lowest bitrate but highest priority and the base substream is allocated to it. The enhancement substream is allocated to the second wireless channel, since it has the lower priority. This ensures that the most important video data is allocated to the wireless channel with the highest priority. The first RTP session can also be marked with the highest priority DSCP for prioritised transport over the IP component of a diffserv enabled core network.

As discussed above in relation to other embodiments, the allocation of resources within a UMTS network is dynamic, and this can mean that bandwidths allocated to either of the RTP sessions can fluctuate with (amongst other things) network load. In the preferred embodiment shown in Figure 1 and Figure 2, the bandwidth available for each wireless channel is known to the transmitter controller 108 as it monitors the network messages at the transmitter air interface 110. In the event that the available bandwidth on one or more of the wireless channels is commanded by the network 100 to be reduced, an assessment is made as to whether it is desirable to reallocate the frames between substreams. For example, assuming the substream frame structure of Figure 16, if the second RTP session bandwidth fell to, say, 16kbps an assessment would be taken to determine whether to simply reduce the number of P and B frames generated and leave other substreams unchanged, or whether a better overall quality would be achieved by including some of the P and B frames on the base substream at the expense of say, reduced resolution in the I frames.

It is not necessarily the case that reallocation will happen automatically and immediately without any assessment of context. In one form, the preferred embodiment is configured to maintain a history of wireless channel behaviour in relation to the quality parameter. As an example, a sudden drop in bandwidth on a wireless channel to which relatively high priority substream or frame type is

mapped may not be a trigger for the frame mapping to be changed. If there is a history of short-term bursts of bandwidth loss, it is likely that the higher bandwidth will be available shortly, and it may ultimately be more efficient to allow the short-term reduction to be ignored. Typically, an assessment of this type will be made by the transmitter controller 108. It will be understood that quite sophisticated proportional, integral and differential factors can be taken in to account to build a relatively sophisticated model of any wireless channel's behaviour (and likely future behaviour) over time. Such modelling well known to those skilled in the relevant art, and so is not described further here.

Similar history data can be collected for the other types of a quality data collected in earlier embodiments of the invention, and similarly used to make decisions about how and when to alter outputs of, for example, the encoder. In general, if there is a history of short-term bandwidth problems, then it may be more efficient or may provide a visibly better overall video streamed image if the bitrate out of the encoder is not immediately altered when the bandwidth initially drops. Rather, it will in some cases be preferable to wait until the bandwidth has remained low for a predetermined time period or number of frames before changing the output of the encoder.

Wireless channels between mobile handset and network have a certain QoS, which is provided for the mobile user of a network service. In an embodiment of the invention, a set of QoS parameters including Bitrate (BR) and Bit Error Rate (BER) are used for controlling the video encoder. These QoS parameters are conveyed between the encoder controller and the decoder controller via IP sessions. Referring to Figure 14, a wireless channel between transmitter 102 and network has QoS parameters BR and BER. A wireless channel between network and receiver 104 has QoS parameters BR' and BER'. The encoder controller 108 sends BR to decoder controller 122 via an RTSP session 866. Having received BR from the encoder controller 108, the decoder controller 122 sends BER' and the calculated Request Bitrate (RBR) to the encoder controller 108 via an RTSP session 866 or RTCP session 865. The encoder controller and the decoder controller will be discussed in detail below.

The encoder controller 108 is used to control the video encoder 106 with the objective of improving the error resilience of video encoding while meeting the bitrate constraint of wireless channels.

In a preferred embodiment of the invention, the video encoder is an MPEG-4 or H.263 compliant encoder. The input video source is encoded into an MPEG-4 or H.263 compliant bit stream. The video data can be constructed using a plurality of different types of frames, which are referred to as I, P and B frames. I frames are self-contained still frames of video data, whereas P and B frames constitute intermediate frames that are predicatively encoded. The precise composition of the frames varies in accordance with the particular standards and application of the standards and is known *per se*.

MPEG-4 specifies a plurality of layers, including the base layer and enhanced layers, in which each layer is comprised of a sequence of frames which may be of the same type (I, P, B) or a mixture of types. As already described, in a wireless network the mobile may be allocated one wireless channel or a plurality of wireless channels. In the preferred form, each wireless channel is used to transmit a single RTP/RTCP session pair. Each RTP session carries an optimum sequence of I, P and B frames, known as a substream. The term "substream" is used rather than "layer" because the frame sequencing onto wireless channels can be varied dynamically and need not be one of the layer sequences pre-defined in MPEG-4 or other known video encoding standards. Other partitions of coded video data for error resilient purposes (e.g. Data Partitioning Modes of MPEG-4/H.263) are also possible and could be represented by substreams.

Figure 16 and Figure 17 illustrate example compositions of a video data stream in accordance with the MPEG-4 video standard. In the example two temporally scalable substreams are used with I frames on the base substream while P and B frames are carried on the enhanced substream. In the illustrated example in Figure 17, only the base substream is used, comprising interleaved I and P frames. The encoder controller can thus control the bitrate of the video data stream for each wireless channel by manipulation of the number of substreams used for transmission, and the number and type of frames per substream.

Video encoding under MPEG-4 or H.263 standards operates on a frame-by-frame basis. Each frame is divided into either Group of Blocks (GOBs) or slices. A GOB comprises of macroblocks of one or several rows in a video frame. Slices are more flexible and can partition the frame into a variable number of macroblocks. A macroblock in turn comprises of four luminance and two spatially corresponding colour difference blocks of image data. All blocks in an I-frame are intra-coded. Blocks in an inter-coded P or B-frame can be of both intra-coded blocks (I-blocks) and inter-coded blocks (P-blocks or B-blocks).

The increase of I-block/P-block ratio (I_b/P_b) in P-frames or I-block/B-block ratio (I_b/B_b) in B-frames has two consequences: (1) improving the error resilience because more intra-coded blocks result in less error propagation; (2) increasing the bitrate because inter-coded blocks comprise substantially smaller amounts of data than intra-coded blocks. The encoder controller controls the encoder to make the best use of wireless channel utilisation for error resilient video encoding.

The error control can also be achieved by allocating GOBs or slices in a frame wherein the header of each GOB or slice can serve as synchronisation markers for decoder to regain synchronisation.

Figure 18 illustrates the operation of the encoder controller 108. The encoder controller operates by a closed-loop process. In the first step 400, the encoder controller obtains relevant information from various sources including the BR and BER associated with the wireless channel between the encoder and the network from air interface, the RBR and BER' via IP control session from the decoder, latency jitter (ΔL) of RTP packets from the RTCP client 123 and the instantaneous bitrate (IBR) from the encoder. In the second step 410, the encoder controller determines the target BR (BR_{target}) and the frame type (FT) based on the BR, RBR and IBR. In the third step 420, the encoder controller determines the I_b/P_b ratio for P-frames and the I_b/B_b for B-frames and the synchronisation marker rate R_{sync} for all frames. In the fourth step 430, the encoder controller determines the QP and the frame rate (FR) for the frame based on the I_b/P_b or I_b/B_b, and BR_{target}. In the fifth step 440, the encoder controller sends the encoding parameters FT, FR, R_{sync}, I_b/P_b or I_b/B_b, and QP to the encoder. In the sixth step 445, the encoder controller sends BR via IP control

session to the decoder. Then the encoder controller goes back to the first step 400.

Figure 19 illustrates the operation of the decoder controller 122. The decoder controller operates by a closed-loop process. In the first step 450, the decoder controller obtains relevant information from various sources including the BR' and BER' associated with the wireless channel between the decoder and the network from air interface, the BR associated with the wireless channel between the encoder and the network via IP session from the encoder. In the second step 460, the decoder controller determines ΔL of RTP packets received. In the third step 470, the decoder controller calculates RBR based on ΔL, BR and BR'. In the fourth step 480, the decoder controller sends the RBR and BER' via IP control session to the encoder controller. Then the decoder controller goes back to the first step 450 .Figure 20 illustrates the operation of the encoder 106. The encoder operates on a frame-by-frame basis. In the first step 490, the encoder obtains the encoding parameters including FT, FR, R_{sync}, I_b/P_b or I_b/B_b, and QP from the encoder controller. In the second step 492, the encoder allocates GOBs or slices for inter-coded frames based on R_{sync}. In the third step 494, the encoder further allocates the I-block distribution within P or B-frames based on I_b/P_b or I_b/B_b. In the fourth step 496, the encoder encodes the frame using the above encoding parameters and adds it to the CVDS. In the fifth step 498, the encoder calculates the IBR and sends it to the encoder controller. Then the encoder goes back to the first step, to process the next frame.

Although various aspects of the invention have been described with reference to specific embodiments, it will be appreciated by those skilled in the art that the invention can be embodied in many other forms.

DEFINITIONS

Unless the contrary intention clearly appears from the context in which certain words are used, the following definitions apply to words used in this specification:

WIRELESS CHANNEL; a physical radio channel with associated QoS parameters, e.g. UMTS Radio Access Bearer.

END TO END LINK; an end to end communications link between transmitter and receiver containing a transmit side wireless channel and / or a receive side wireless channel;

IP SESSION; An IP communications session between two IP hosts carrying either control or application data. Examples are a RTP session, a RTCP session, a RTSP session and a SIP session. One or more IP sessions can be mapped to a wireless channel;

COMPRESSED VIDEO DATA STREAM (CVDS); an overall video stream, where the original stream of image frames is compressed by means of an encoder;

FRAME; a video encoder outputs a number of different frame types. These include full still images and derivative images that have different data transmission requirements, have different sensitivity to errors and may have dependency on other frames. In the MPEG-4 video standard, frames are also known as Video Object Planes (VOPS);

SUBSTREAM; a CVDS may be split into a number of substreams for the purposes of transmission over a channel or plurality of channels. Each substream can be used as a means of transmitting a sequence of video frames that may be of different types. A substream is not necessarily the same as a layer as defined in video standards such as MPEG-4 and H.263. A substream could also be used to transmit any part of the coded frame data that can be successfully partitioned for error resilient purposes (e.g. DCT coefficients and motion vector data in data partitioning modes of MPEG-4/H.263). Each substream is transported by an RTP session and an associated RTCP session.

RTCP SERVER; an entity generating RTCP Receiver Reports based on the reception of RTP packets. These are sent to the transmitter of the RTP packets, where an RTCP client uses them.

RTCP CLIENT; an entity that uses RTCP Receiver Reports. These are sent from the receiver of the RTP packets, where an RTCP server generates them.

CLAIMS

1. A method of generating a compressed video data stream (CVDS) from a video stream, for transmission from a transmitter to a receiver over a wireless channel within a communications network, the method including the steps of:

(a) determining values of one or more error rate parameters associated with the wireless channel;

(b) determining values of one or more bit rate parameters associated with the wireless channel;

(c) calculating values of one or more encoding parameters using the values of the error rate parameters and the bit rate parameters;

(d) controlling encoding of the video stream on the basis of the encoding parameters, thereby to generate the CVDS.

2. A method according to claim 1, wherein step (a) includes ascertaining the error rate parameters associated with the wireless channel between the transmitter and the receiver, and step (d) includes controlling encoding of the video stream to improve an error resilience of the CVDS whilst meeting the bandwidth constraints of the wireless channel.

3. A method according to claim 2, where the transmitter is a mobile transmitter and the receiver is a network receiver, wherein the error rate parameters are derived from data taken from an air interface associated with the transmitter.

4. A method according to claim 2, where the transmitter is a network transmitter and the receiver is a mobile receiver, wherein the error rate parameters are derived from data taken from an air interface associated with the receiver and communicated via end to end feedback between the receiver and the transmitter.

5. A method according to 2, where both receiver and transmitter are mobile, wherein the error rate parameters are derived as in 3 and 4 and are combined in the transmitter.

6. A method according to claims 4 & 5, wherein the end to end feedback is carried out by one or more IP sessions between the receiver and the transmitter, wherein each IP session is one of an RTCP, RTSP or SIP session.

7. A method according to any one of the preceding claims, wherein the communications network is a UMTS or GPRS mobile telecommunications network.

8. A method according to claim 7, wherein the error rate and bit rate parameters are derived from Quality of Service (QoS) parameters associated with the wireless channel

9. A method according to claim 8, further including the step, prior to step (a), of initiating a session in which one or more of the wireless channels is established for transmission of the CVDS, the initiation of the session including receiving in the transmitter the QoS parameters from the network.

10. A method according to claim 9, when the QoS parameters are provided to the transmitter again in the event that they are modified.

11. A method according to any one of the preceding claims, wherein the CVDS is packetised into IP format packet prior to transmission.

12. A method according to claim 11, wherein the transmitter is a mobile handset and the IP packetisation includes the substeps of:

wrapping the CVDS in an RTP format packet;

wrapping the RTP packet in a UDP format packet; and

wrapping the UDP packet in an IP format packet for supply to an air interface associated with the transmitter for transmission to the receiver via the network

13. A method according to claim 12, wherein the receiver is configured to transmit a CVDS to the transmitter in accordance with any one of the preceding claims.

14. A method according to any one of the preceding claims, wherein the encoding parameters include any one or more of the following:

a frame rate;

a frame type, being indicative of either intra-coded frame or inter-coded frame;

a block type, being indicative of either intra-coded block or inter-coded block; and

a quantisation parameter.

15. A method according to claim 14, wherein the video data is divided into a sequence of frames, with each frame being further divided into Groups of Blocks (GOBs) or slices, each GOB or slice being further divided into a number of macroblocks.

16. A method according to claim 15, wherein the encoding parameters include any one or more of the following;

a ratio of intra-coded frames to inter-coded frames;

sizes of GOBs or slices, the sizes being selected such that headers of GOBs or slices can be used as resynchronisation markers for the decoder to regain synchronisation quickly when transmission errors occur;

a ratio of intra-coded blocks and inter-coded blocks for each GOB or slices in each inter-coded frame;

17. A method according to any one of the preceding claims, wherein the CVDS comprises a plurality of layers including a base layer and enhanced layers, each layer comprising a sequence of frames.

18. A method according to claim 17, wherein each layer is carried via an RTP session.

19. A method according to claim 18, wherein more than one transmit side and/or receive side wireless channel is open between the transmitter and the receiver, and each wireless channel is used to transmit an RTP session.

20. A method according to claim 19, wherein layers of the CVDS are mapped onto the wireless channels such that the base layer is mapped into the wireless channel with better transmission quality.

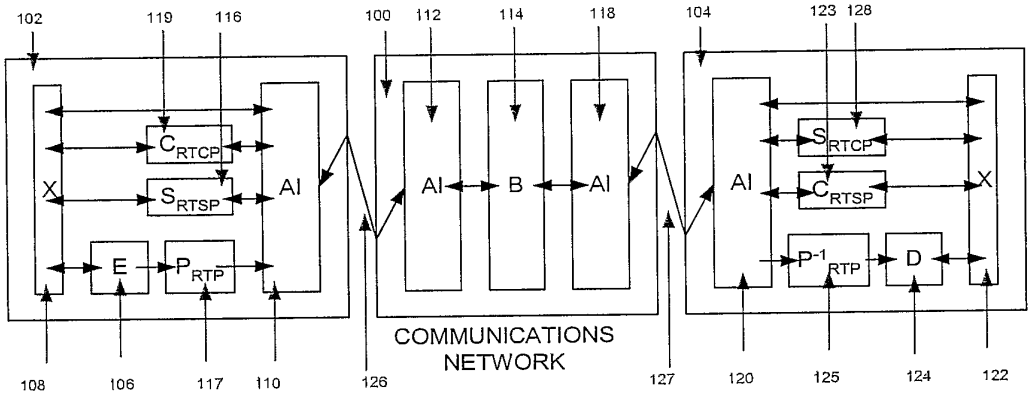


Figure 1

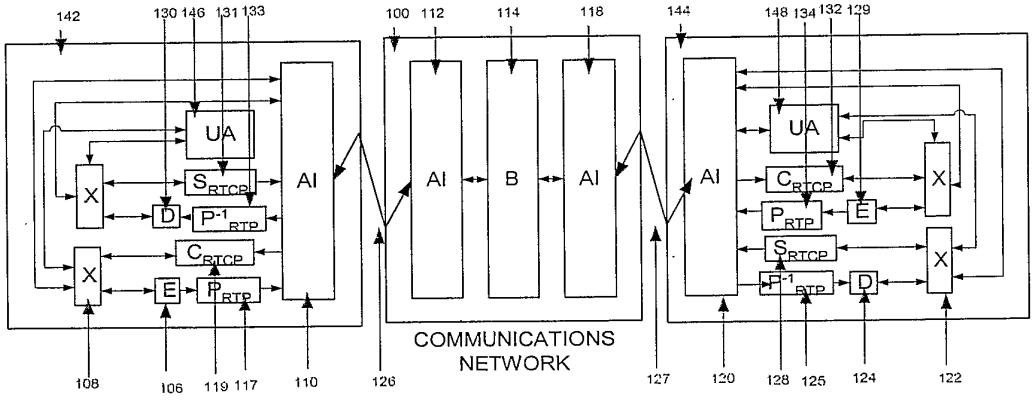


Figure 2

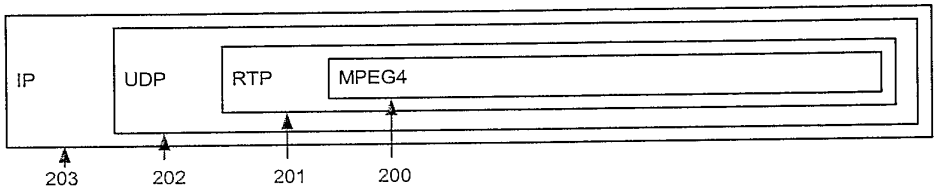


Figure 3

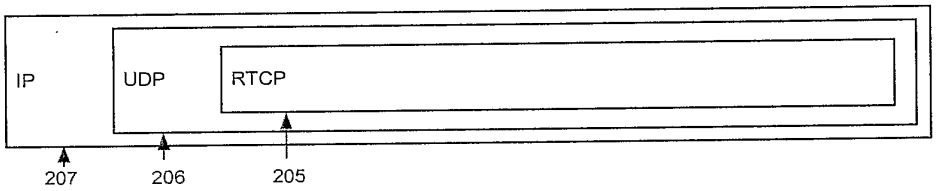


Figure 4

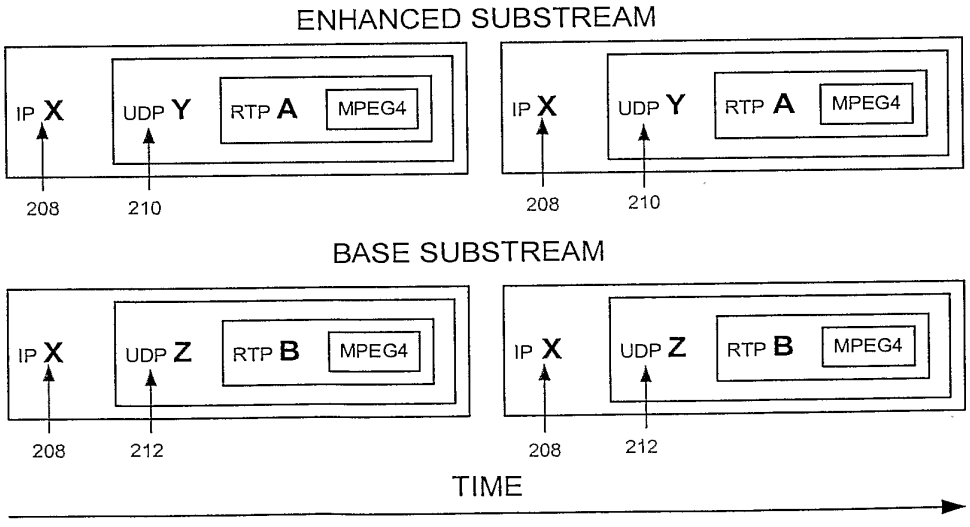


Figure 5

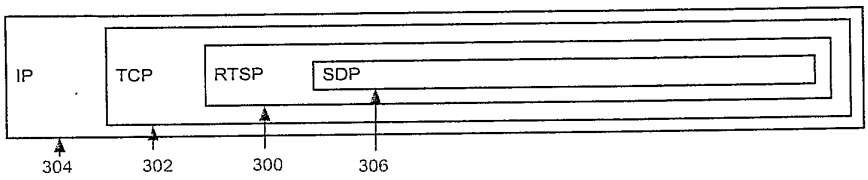


Figure 6

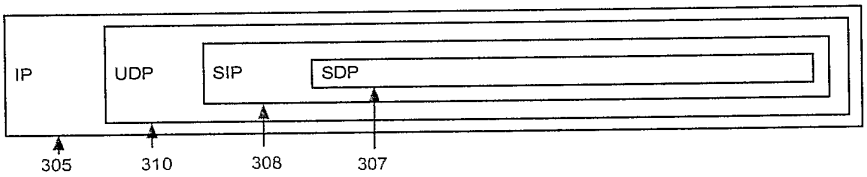


Figure 7

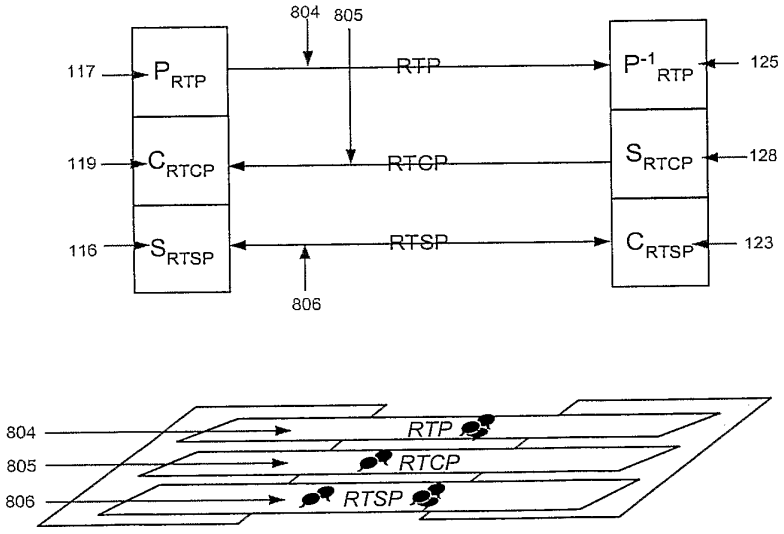


Figure 8

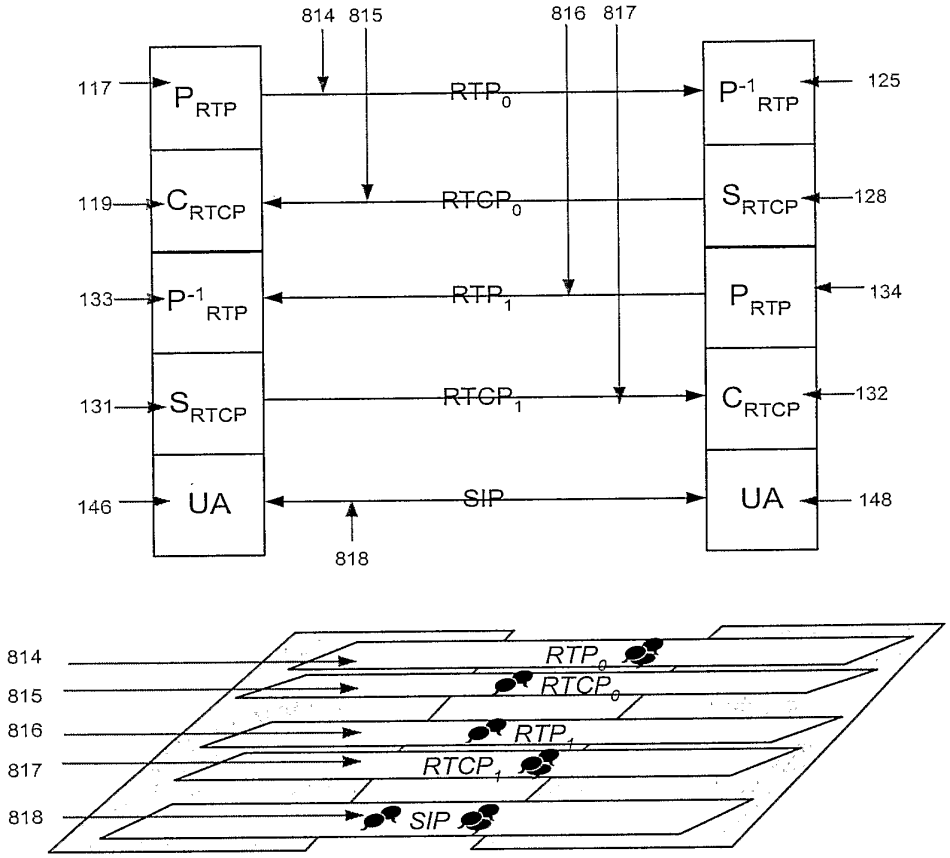

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SIP

Figure 9

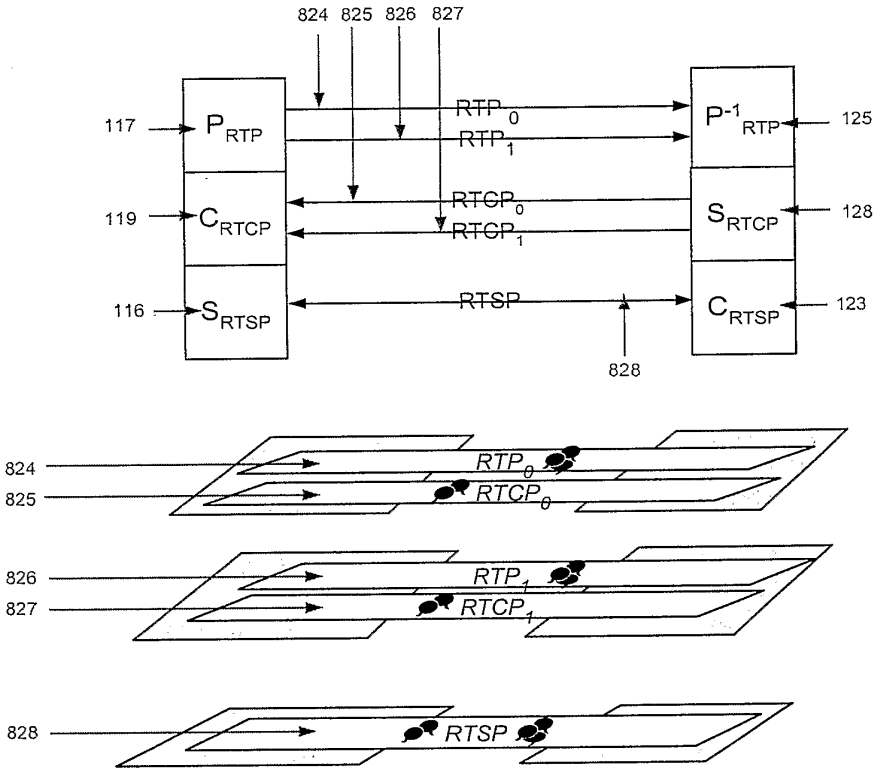

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Figure 10

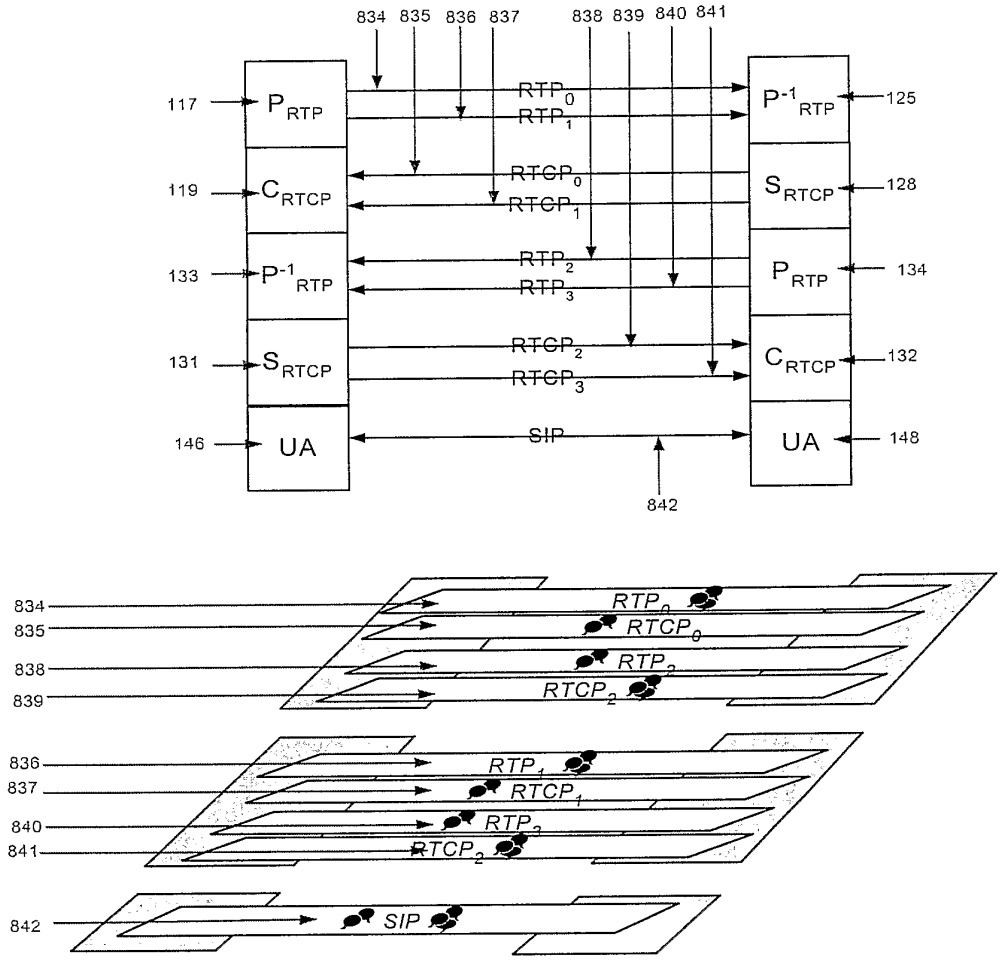

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Figure 11

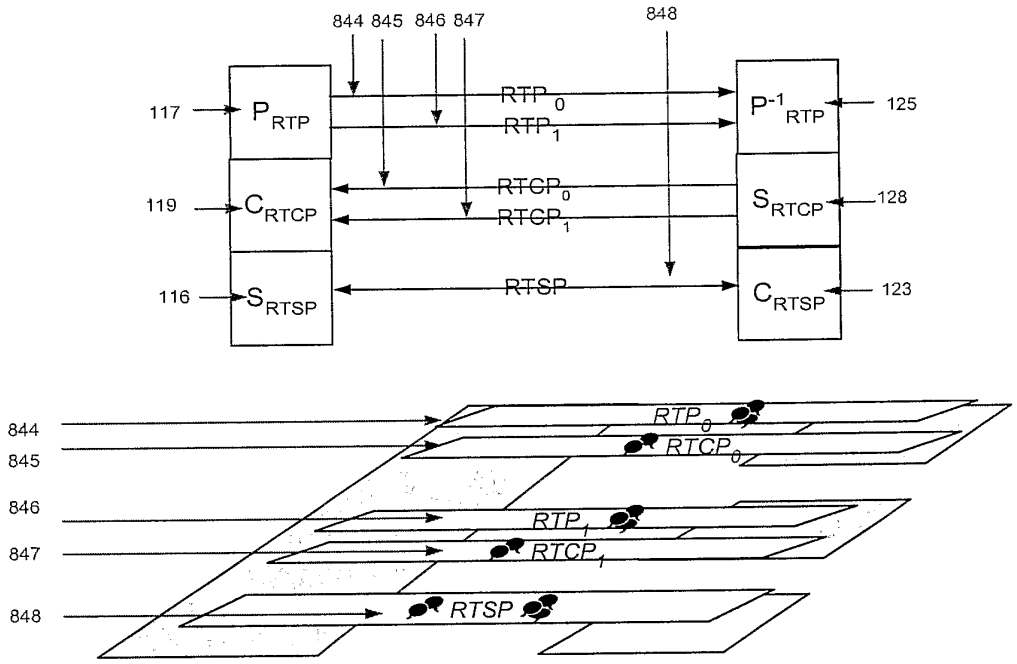

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Figure 12

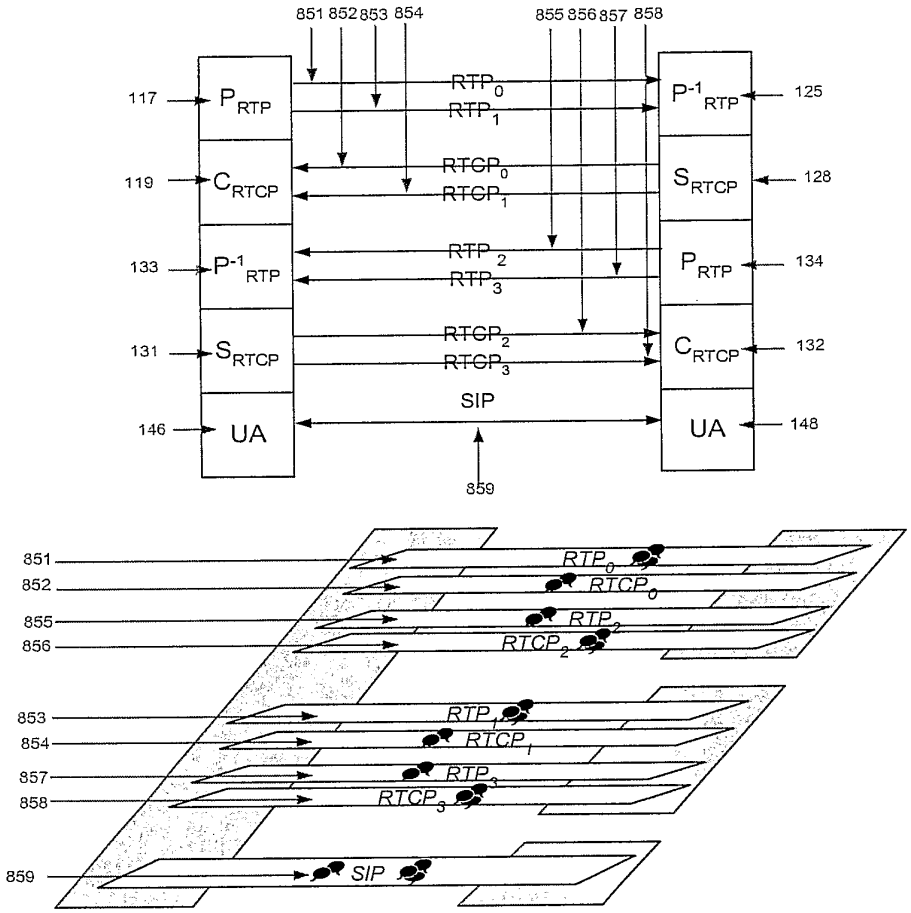

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Figure 13

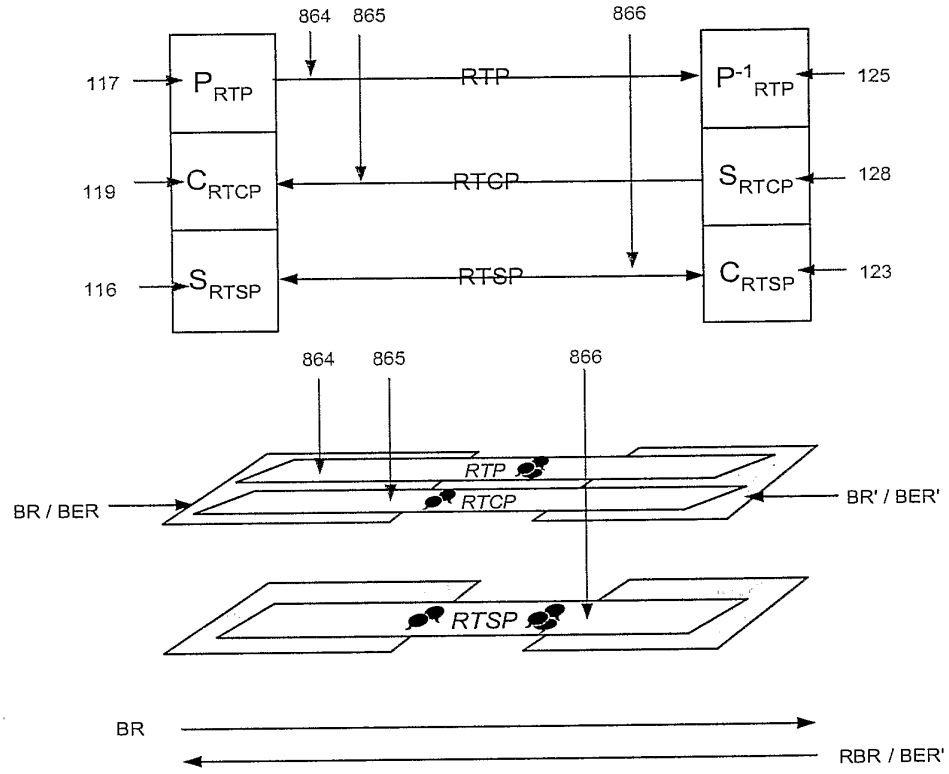

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RTCP
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BR' / BER'
RTSP
BR
RBR / BER'

Figure 14

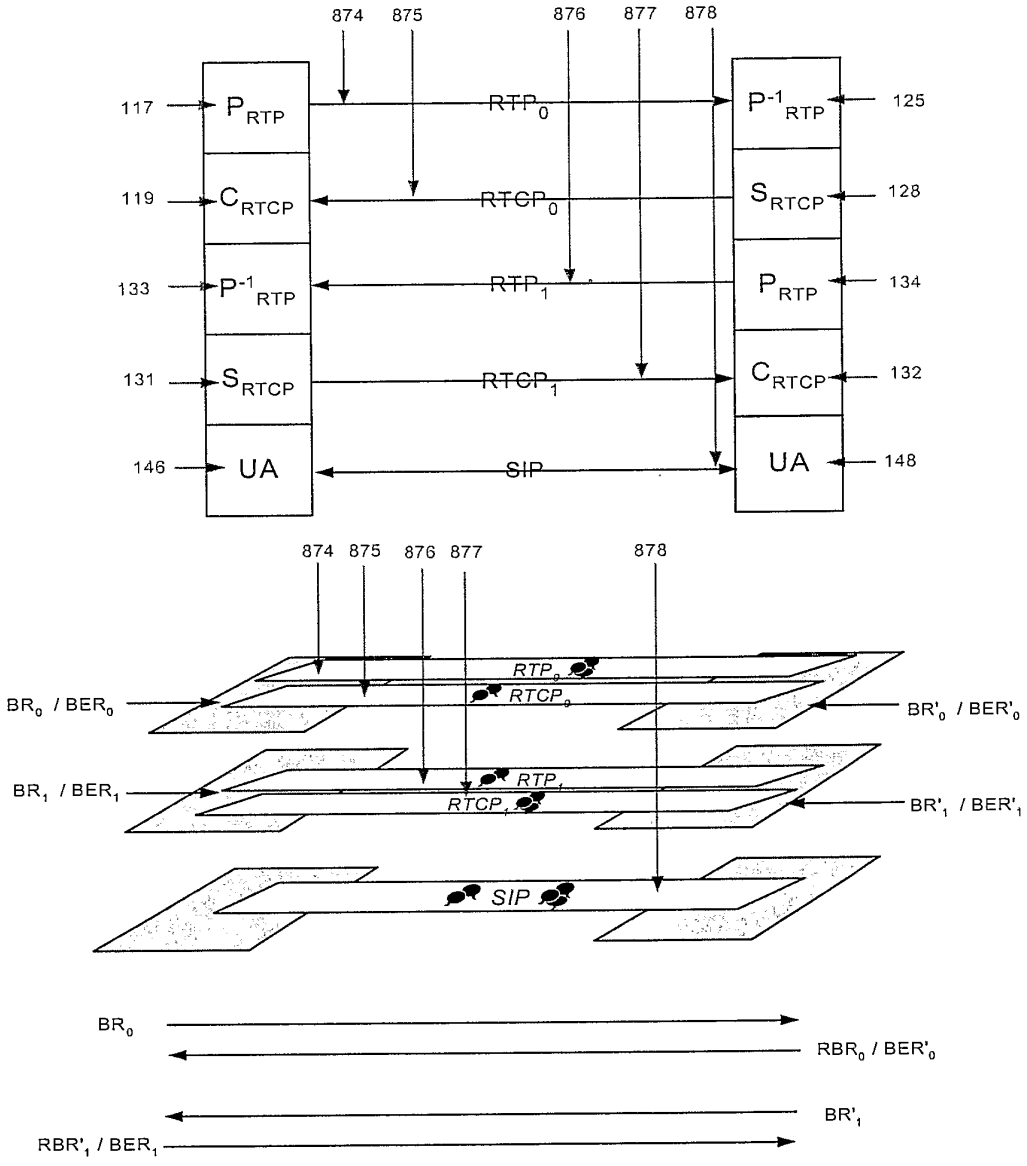

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C_{RTCP}
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UA
SIP
UA
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BR_0 / BER_0
BR'_0 / BER'_0
BR_1 / BER_1
BR'_1 / BER'_1
RTP_0
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BR'_1
RBR'_1 / BER_1

Figure 15

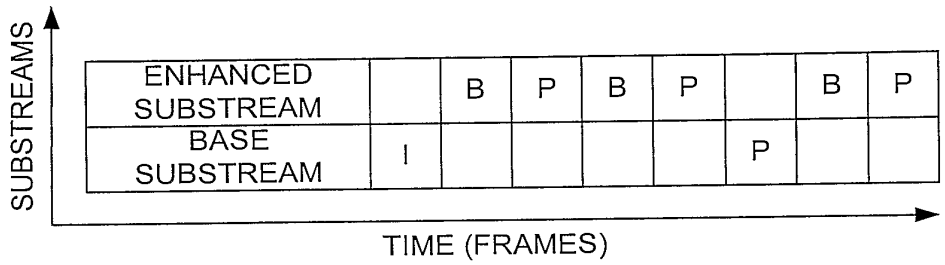


Figure 16

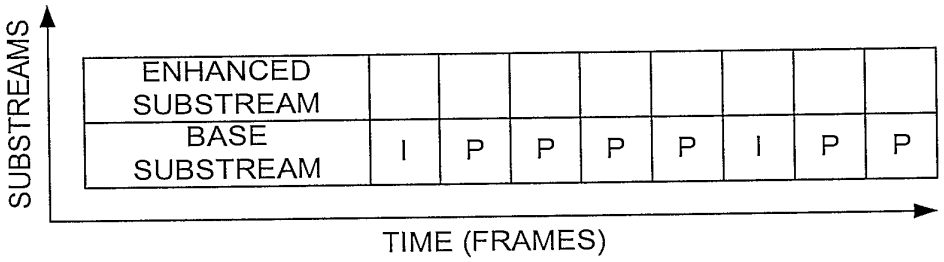


Figure 17

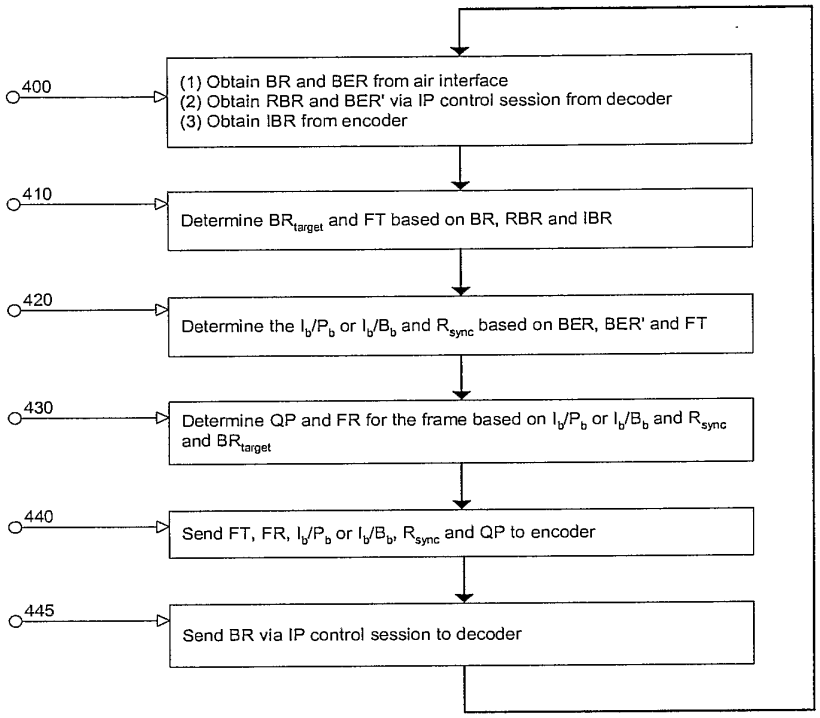


Figure 18

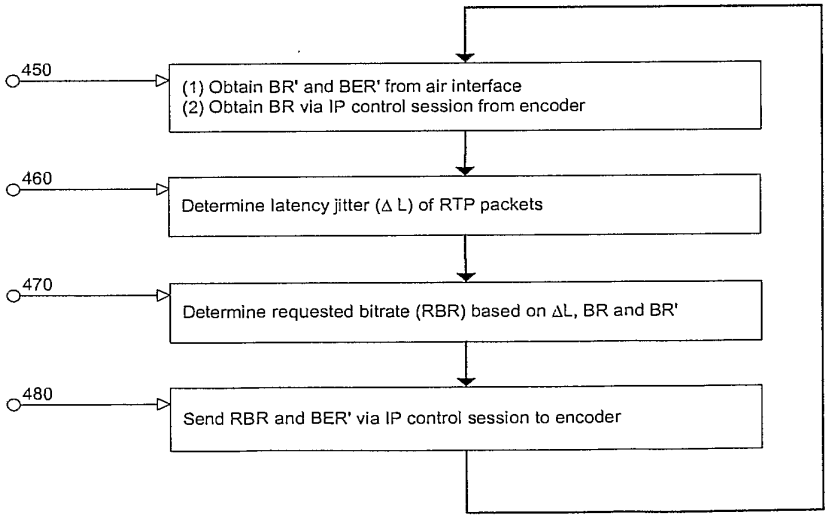


Figure 19

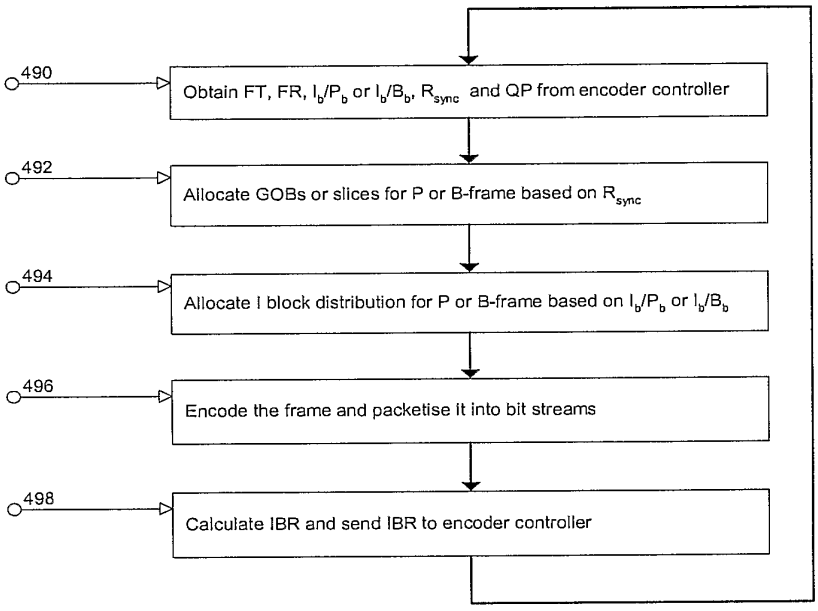

490
Obtain FT, FR, I_b/P_b or I_b/B_b, R_{sync} and QP from encoder controller
492
Allocate GOBs or slices for P or B-frame based on R_{sync}
494
Allocate I block distribution for P or B-frame based on I_b/P_b or I_b/B_b
496
Encode the frame and packetise it into bit streams
498
Calculate IBR and send IBR to encoder controller

Figure 20

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB 01/04924

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 282 240 B1 (NAKAI TOSHIHISA ET AL) 28 August 2001 (2001-08-28) column 5, line 18 - line 49 ---	1-4, 14-16
X	GUERRI J C ET AL: "A feedback packet-level error control for real-time applications in wireless networks" VEHICULAR TECHNOLOGY CONFERENCE, 1999. VTC 1999 - FALL. IEEE VTS 50TH AMSTERDAM, NETHERLANDS 19-22 SEPT. 1999, PISCATAWAY, NJ, USA,IEEE, US, 19 September 1999 (1999-09-19), pages 879-883, XP010353105 ISBN: 0-7803-5435-4	1,2,4, 6-11,14, 15
A	paragraph '0001! paragraph '0003! --- -/--	3,5,12, 16,17

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 July 2002	19/07/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Marie-Julie, J-M

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Webgroup CZ a.s. Ex. 1002, Page 718 of 1406

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 757 490 A (MATSUSHITA ELECTRIC IND CO LTD) 5 February 1997 (1997-02-05) page 13, line 3 -page 16, line 17 page 17, line 21 - line 57	1,2,4
A	HOFFMAN D ET AL: "Hierarchical video distribution over Internet-style networks" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (ICIP) LAUSANNE, SEPT. 16 - 19, 1996, NEW YORK, IEEE, US, vol. 1, 16 September 1996 (1996-09-16), pages 5-8, XP010202065 ISBN: 0-7803-3259-8 paragraph '0001!	1,17,20
A	US 5 825 430 A (ADOLPH DIRK ET AL) 20 October 1998 (1998-10-20) abstract	1,17-20
A	KYUNGRAN KANG ET AL: "Dynamic rate control mechanism for large scale sessions" INFORMATION NETWORKING, 1998. (ICOIN-12). PROCEEDINGS., TWELFTH INTERNATIONAL CONFERENCE ON TOKYO, JAPAN 21-23 JAN. 1998, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 21 January 1998 (1998-01-21), pages 21-24, XP010265270 ISBN: 0-8186-7225-0 the whole document	1,17-20
A	RADHA H ET AL: "Scalable Internet video using MPEG-4" SIGNAL PROCESSING. IMAGE COMMUNICATION, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 15, no. 1-2, September 1999 (1999-09), pages 95-126, XP004180640 ISSN: 0923-5965 the whole document	1,17-20
A	US 6 014 694 A (AHARONI AMIR ET AL) 11 January 2000 (2000-01-11) abstract column 2, line 10 - line 53 column 3, line 61 -column 4, line 7 column 6, line 61 -column 7, line 42	1,17

-/--

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/04924

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	KASSLER A ET AL: "Support for multimedia applications in a wireless ATM system" 1998 1ST. IEEE INTERNATIONAL CONFERENCE ON ATM. ICATM'98. CONFERENCE PROCEEDINGS. COLMAR, FRANCE, JUNE 22 - 24, 1998, IEEE INTERNATIONAL CONFERENCE ON ATM, NEW YORK, NY: IEEE, US, 22 June 1998 (1998-06-22), pages 31-40, XP010290987 ISBN: 0-7803-4982-2 the whole document	1
A	RAMANUJAN R S ET AL: "Adaptive streaming of MPEG video over IP networks" LOCAL COMPUTER NETWORKS, 1997. PROCEEDINGS., 22ND ANNUAL CONFERENCE ON MINNEAPOLIS, MN, USA 2-5 NOV. 1997, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 2 November 1997 (1997-11-02), pages 398-409, XP010252445 ISBN: 0-8186-8141-1 the whole document	1

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Webgroup CZ a.s. Ex. 1002, Page 720 of 1406

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 01/04924

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 6282240	B1	28-08-2001	NONE		
EP 0757490	A	05-02-1997	CN	1152242 A	18-06-1997
			EP	0757490 A2	05-02-1997
			JP	10028269 A	27-01-1998
			KR	255229 B1	01-05-2000
			SG	74565 A1	22-08-2000
			US	6356309 B1	12-03-2002
US 5825430	A	20-10-1998	DE	19547707 A1	03-07-1997
			CN	1160321 A	24-09-1997
			EP	0781051 A2	25-06-1997
			JP	9186998 A	15-07-1997
US 6014694	A	11-01-2000	AU	7928998 A	19-01-1999
			EP	0992160 A1	12-04-2000
			WO	9900984 A1	07-01-1999
			JP	2002511216 T	09-04-2002

Form PCT/ISA/210 (patent family annex) (July 1992)

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/876,579	Filing Date 05/18/2020	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	08/05/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 30	Minus	** 30	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 4	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/DORIS M KING/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	16876579	Filing Date	2020-05-18	Docket Number (if applicable)	066.0141x1c9	Art Unit	2454
First Named Inventor	David F. Brueck			Examiner Name	Chirag R. Patel		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-08-05
Name	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial. No.:	16/876,579	Confirmation No.:	3720
Examiner:	Chirag R. Patel	Art Unit:	2454
Filed:	05/18/2020	Customer No.:	70560

Title: **APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING**

Attorney Docket No.: 066.0141x1C9

REQUEST FOR CONTINUED EXAMINATION
FILED UNDER 37 C.F.R. § 1.114

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

****FILED ELECTRONICALLY USING THE PTO-EFS SYSTEM***

Commissioner:

In further response to the Office Action mailed on February 5, 2021 (for which the period for response has been extended until August 5, 2021), please consider the remarks below under 37 C.F.R. § 1.114, or any other appropriate rule.

Amendments to the Claims begin on the following page (page 2).

Remarks begin on page 10.

Amendments to the Claims

Please amend the claims without prejudice or disclaimer to read as follows:

1. (Currently Amended) A system for adaptive-rate content streaming of a video that is playable on one or more end user stations over the ~~Internet~~internet, the system comprising:

at least one storage device storing the video, wherein the video is digitally encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets, wherein each streamlet corresponds to a portion of the video, and wherein each streamlet in each group of streamlets is encoded at a respective one of the plurality of different bitrates, and wherein each group of streamlets ~~comprising~~ comprises at least first and second streamlets~~, each of the streamlets corresponding to a portion of the video~~;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a ~~different~~ lower bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream.

2. (Original) The system of claim 1, wherein the video is a live event video.

3. (Original) The system of claim 1, wherein the video includes archived content.

4. (Original) The system of claim 1, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the

same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

5. (Original) The system of claim 4, wherein the first and second durations are different.

6. (Currently Amended) The system of claim 1, further comprising: a plurality of web servers located at different locations across the internet, each web server configured to: receive at least one streamlet request over one or more internet connections from a respective one of the one or more end user stations to retrieve the first streamlet ~~storing a portion of the video~~, wherein the at least one streamlet request from the respective one of the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the respective one of the one or more end user stations to select a higher or lower bitrate version of a respective one of the plurality of streams; retrieve from the at least one storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet ~~from the currently selected one of the different copies~~ to the ~~requesting~~ respective one of the one or more end user stations over the one or more ~~network~~ internet connections.

7. (Original) The system of claim 1, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.

8. (Original) The system of claim 1, further comprising:

a first web server configured to: receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality

stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video; retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.

9. (Original) The system of claim 8, wherein the first web server is further configured to: receive at least one virtual timeline request over the one or more internet connections from the one or more end user stations to retrieve a virtual timeline; and send the virtual timeline to the requesting one of the end user stations over the one or more network connections.

10. (Original) The system of claim 9, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.

11. (Original) The system of claim 10, wherein the virtual timeline defines a playlist for a user to view.

12. (Original) The system of claim 11, wherein the virtual timeline comprises a file that is configured to define a playlist for a user to view.

13. (Original) The system of claim 12, wherein the virtual timeline comprises at least one quantum media extension (QMX).

14. (Currently Amended) An end user station to stream a video over a network from a server for playback of the video, the ~~content player device~~end user station comprising:

a processor;

a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:

establish ~~one or more network connections~~an internet connection between the end user station and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;

wherein the video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a ~~bit rate~~bitrate of no less than 600 kbps; and wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates;

select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;

place a streamlet request to the server over the ~~one or more network connections~~internet connection for the first streamlet of the selected stream;

receive the requested first streamlet from the server via the ~~one or more network connections~~internet connection; and

provide the received first streamlet for playback of the video.

15. (Original) The end user station of claim 14, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the

medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

16. (Original) The end user station of claim 15, wherein the first and second durations are different.

17. (Currently Amended) The end user station of claim 14, wherein each of the first streamlets has a first duration that is in the range of 0.1 to 5 seconds.

18. (Currently Amended) The end user station of claim 14, wherein the end user station is further configured to: request and receive a virtual timeline; and wherein one or more streamlet requests are based on the ~~at least one~~ received virtual timeline.

19. (Original) The end user station of claim 18, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.

20. (Original) The end user station of claim 18, wherein the virtual timeline defines a playlist for a user to view.

21. (Original) The end user station of claim 14, wherein the video is a live event video.

22. (Original) The end user station of claim 14, wherein the video includes archived content.

23. (Currently Amended) A process executable by one or more servers to stream a video for playback by one or more end user stations, the process comprising:

storing, by the one or more servers, a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group

of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different one of the different bitrates than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

receiving at least one streamlet request over ~~one or more internet connections~~an internet connection from a respective one of the one or more end user stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the respective one of the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the respective one of the one or more end user stations to select a higher or lower bitrate version of the video;

retrieving from the ~~storage device~~one or more servers the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and

sending the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the ~~requesting~~ respective one of the one of the end user stations over the ~~one or more network connections~~internet connection.

24. (Original) The process of claim 23, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality

stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

25. (Original) The process of claim 23, wherein the first and second durations are different.

26. (Original) The process of claim 23, wherein the video is a live event video.

27. (Original) The process of claim 23, wherein the video includes archived content.

28. (Currently Amended) A process executable by a content player device to stream a video over a network from a server for playback of the video by the content player device, the process comprising:

establishing ~~one or more network connections~~an internet connection between the content player device and the server,

wherein the server accesses a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video; wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a

different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

selecting, by the content player device, a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the ~~end user station~~content player device to select a higher or lower bitrate version of the video;

placing a streamlet request over one or more internet connections from the ~~one or more end user stations~~content player device to retrieve the first streamlet storing the first portion of the video; and

receiving the requested streamlet from the server via the ~~one or more network connections~~internet connection; and rendering, by the content player device, the received streamlet for playback of the video.

29. (Original) The process of claim 28, wherein the video includes archived content.

30. (Original) The process of claim 28, wherein the video is a live event video.

REMARKS

We hereby respond under Rule 114 to request continued examination of the above-referenced application. Support for the above amendments can be found in the originally-filed application, and no new matter has been added.

If there are any remaining issues with this application, the undersigned requests a telephone call to 480.385.5069 (office) or 480.241.8219 (mobile).

Allowable Subject Matter

We appreciate that all claims have been indicated as allowable except for the double patenting issues addressed below.

Double Patenting

The Office Action objects to certain claims, which are alleged to be duplicates of certain claims pending in US Patent No. 10,469,554. We previously submitted a terminal disclaimer citing the '554 Patent, and our previous response pointed out that the claims are different at least in that the claims recited "video" that is not necessarily "live action" video.

Without consenting to the rejection, we are amending each of our independent claims for better clarity and to advance prosecution. We expressly reserve the right to revisit the prior claims at a later date (e.g., in a continuing application). At present, however, the rejections are believed to be no longer relevant. We respectfully request reconsideration.

Conclusion

Should any issues remain, we would welcome a telephone call to - (480) 385-5069 or an email to bcarlson@lkglobal.com. *Recognizing that Internet communications are not secure, we hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. We understand that a copy of these communications will be made of record in the application file. (MPEP 502.03).*

Without limiting the foregoing, we further authorize the use of email for informal correspondence, including the exchange of proposed amendments or other draft documents.

No official fee is believed to be due in connection with this Response, other than any fees that may be addressed elsewhere in this submittal. If, however, any additional time extension or other fee is required to consider this response or to otherwise prevent abandonment of this application, please consider this as a request for an extension of time and as authorization to charge Deposit Account No. 50-2091 for any fees that may be due.

Respectfully submitted,

LORENZ & KOPF, LLC

Dated: August 5, 2021

By: /Brett A. Carlson /
Brett A. Carlson
Reg. No. 39,928

bcarlson@lkglobal.com
480-385-5069 (direct)
480-241-8219 (mobile)
480-385-5060 (general)

LKGLOBAL is LORENZ & KOPF, LLC
Customer No. 70560

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson
Attorney Docket Number:	066.0141X1C9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	1253	1	1480	1480
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1360	1360
		Total in USD ($)		**2840**

Electronic Acknowledgement Receipt	
EFS ID:	43439438
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson
Filer Authorized By:	
Attorney Docket Number:	066.0141X1C9
Receipt Date:	05-AUG-2021
Filing Date:	18-MAY-2020
Time Stamp:	16:44:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$2840
RAM confirmation Number	E202185G45163113
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	20210805_RCE_06-0141X1C9.pdf	697604 11cb4aed396aad7af7e1c6b1849d312ecf66868c	no	3
Warnings:					
Information:					
2		20210805_RCEResponse_06-0141X1C9.pdf	130912 fe9132c7c31f3f0f19a9e4bb093c8302a27abb59	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	9
	Applicant Arguments/Remarks Made in an Amendment	10	11

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	40976 4b16fe0c660e14bc964bade1ad0cfa1040ba90e3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	869492		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 02/05/2021

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
02/05/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@lkglobal.com
ipdept@dish.com

Office Action Summary	Application No. 16/876,579	Applicant(s) BRUECK et al.	
	Examiner CHIRAG R PATEL	Art Unit 2454	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 18 November 2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-30 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 11/17/20, 11/17/20, 11/17/20.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Double Patenting

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process... may obtain a patent therefor..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claims 1-2, 4-21, 23-26, 28 and 30 are rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-5, 7, 9-13, 16-19 and 23-28 of U.S. Patent No. 10,469,554. This is a statutory double patenting rejection.

Claims 1 and 2 of the instant application are a verbatim of claim 1 of the patent.

Claim 4 of the instant application is a verbatim of claim 2 of the patent.

Claim 5 of the instant application is a verbatim of claim 3 of the patent.

Claim 6 of the instant application is a verbatim of claim 4 of the patent.

Claim 7 of the instant application is a verbatim of claim 5 of the patent.

Claim 8 of the instant application is a verbatim of claim 7 of the patent.

Claim 11 of the instant application is a verbatim of claim 9 of the patent.

Claim 12 of the instant application is a verbatim of claim 10 of the patent.

Claim 13 of the instant application is a verbatim of claim 11 of the patent.

Claim 14 of the instant application is a verbatim of claim 12 of the patent.

Claim 15 of the instant application is a verbatim of claim 13 of the patent.

Claims 14 and 21 of the instant application are a verbatim of claim 16 of the patent.

Claim 15 of the instant application is a verbatim of claim 17 of the patent.

Claim 16 of the instant application is a verbatim of claim 18 of the patent.

Claim 17 of the instant application is a verbatim of claim 19 of the patent.

Claim 18 of the instant application is a verbatim of claim 23 of the patent.

Claim 19 of the instant application is a verbatim of claim 24 of the patent.

Claim 20 of the instant application is a verbatim of claim 25 of the patent.

Claims 23 and 26 of the instant application are a verbatim of claim 26 of the patent.

Claim 24 of the instant application is a verbatim of claim 27 of the patent.

Claim 25 of the instant application is a verbatim of claim 28 of the patent.

Claim 23 of the instant application is a verbatim of claim 26 of the patent.

Claims 28 and 30 of the instant application are a verbatim of claim 26 of the patent.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter: A thorough review of the prior art fails to disclose or render obvious, "wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream."

Response to Arguments

Applicant's arguments filed November 18, 2020 have been fully considered but they are not persuasive.

Applicants state, "The only issue raised by the Office Action is a double patenting rejection citing the issued parent to this application, US Patent No. 10,469,554. The Office Action states that the rejection can be overcome with a terminal disclaimer, which is being filed under separate cover"

Examiner removes the obvious double patent rejections in response to the terminal disclaimer filed for US Patent No. 10,469,555. However, a terminal disclaimer does not remove a statutory double patent rejection, which applied to U.S. Patent 10,469,554. The statutory double patent rejections were not addressed in applicant's response.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

/Chirag R Patel/
Primary Examiner, Art Unit 2454

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
(H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.
EAST	02/01/2021	C.P.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Webgroup CZ a.s. Ex. 1002, Page 748 of 1406

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant						☐ CPA	☐ T.D.		☐ R.1.47	
CLAIM		**DATE**								
Final	Original	06/12/2020								
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L12	27	streamlet with multiple near2 bitrates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2021/02/01 17:15
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S5	27	encod$3 near2 streamlets with bitrates	US-PGPUB; USPAT; USOCR;	OR	ON	2020/06/12 10:36

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S9	1	("7818444").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:55
S10	7	(("20080162713") or ("20040170392") or ("20040143672") or ("6486803") or ("20030204519") or ("6486803") or ("20030005455") or ("20040054551") or ("20040170392")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 11:02
S11	54	streamlets with bitrates	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 11:33
S12	74	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 12:37
S13	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:03
S14	5	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlets and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:03

S15	33,997	portions with stream and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:28
S16	1,761,238	portions with stream with bitrat$3and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:29
S17	24	portions with stream with bitrat$3 and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:29
S18	2	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and divid$3 with stream same bitrate and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:30
S19	3	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and (divid$3 split$3)with stream same bitrate and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:30
S20	1	("10469554").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:26
S21	1	("10469554").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:44
S22	1	("10469555").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:47

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8521836	B2	2013-08-27	Kewalramani et al.	
	2	7558869	B2	2009-07-07	Leon et al.	
	3	7707303	B2	2010-04-27	Albers et al.	
	4	7925781	B1	2011-04-12	Chan et al.	
	5	8880721	B2	2014-11-04	Hurst et al.	
	6	9344496	B2	2016-05-17	Hurst et al.	
	7	8683066	B2	2014-03-25	Hurst et al.	
	8	8686066	B2	2014-04-01	Kwampian et al.	

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	9	6708213	B1	2004-03-16	Bommaiah et al.	
	10	6757796	B1	2004-06-29	Hofmann	
	11	9462074	B2	2016-10-04	Guo et al.	

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	1	20050033855	A1	2005-02-10	Moradi et al.	
	2	20030093790	A1	2003-05-15	Logan et al.	
	3	20030195977	A1	2003-10-16	Liu et al.	
	4	20040199655	A1	2004-10-07	Davies et al.	
	5	20040267956	A1	2004-12-30	Leon et al.	
	6	20040220926	A1	2004-11-04	Lamkin et al.	

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	7	20060010003	A1	2006-01-12	Kruse	
	8	20060277564	A1	2006-12-07	Jarman	
	9	20150058496	A1	2015-02-26	Hurst et al.	
	10	20100262711	A1	2010-10-14	Bouazizi	
	11	20050251832	A1	2005-11-10	Chiueh	
	12	20040221088	A1	2004-11-04	Lisitsa et al.	
	13	20040179032	A1	2004-09-16	Huang	
	14	20020161908	A1	2002-10-31	Benitez et al.	
	15	20030021282	A1	2003-01-30	Hospodor	
	16	20080120330	A1	2008-05-22	Reed et al.	
	17	20080120342	A1	2008-05-22	Reed et al.	

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	18	20110307545	A1	2011-12-15	BOUAZIZI	
	19	20050262257	A1	2005-11-24	Major et al.	
	20	20030236904	A1	2003-12-25	Walpole et al.	

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	1	Krasic et al., QUALITY-ADAPTIVE MEDIA STREAMING BY PRIORITY DROP, Oregon Graduate Institute, 2001.	☓
	2	Krasic et al., QoS SCALABILITY FOR STREAMED MEDIA DELIVERY, Oregon Graduate Institute School of Science & Engineering Technical Report CSE 99-011, September 1999.	☒
	3	Huang et al., ADAPTIVE LIVE VIDEO STREAMING BY PRIORITY DROP, Portland State University PDXScholar, July 21, 2003.	☒

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	4	Walpole et al, A PLAYER FOR ADAPCTIVE MPEG VIDEO STREAMING OVER THE INTERNET, Oregon Graduate Institute of Science and Technology, October 25, 2012.	☒
	5	ALBANESE, ANDREW ET AL. "Priority Encoding Transmission", TR-94-039, August 1994, 36 pgs, International Computer Science Institute, Berkeley, CA.	☒
	6	BIRNEY, BILL "Intelligent Streaming", May 2003, Microsoft.	☒
	7	GOYAL, VIVEK K. "Multiple Description Coding: Compression Meets the Network," September 2001, pgs. 74-93, IEEE Signal Processing Magazine.	☒
	8	ON2 TECHNOLOGIES, INC. "TrueMotion VP7 Video Codec" White Paper, Document Version 1.0, January 10, 2005.	☒
	9	PATHAN, AL-MUKADDIM ET AL. "A Taxonomy and Survey of Content Delivery Networks" Australia, February 2007, available at http://www.gridbus.org/reports/CDN-Taxonomy.pdf.	☒
	10	PURI, ROHIT ET AL. "Multiple Description Source Coding Using Forward Error Correction Codes," October 1999, 5 pgs., Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA.	☒
	11	WICKER, STEPHEN B. "Error Control Systems for Digital Communication and Storage," Prentice-Hall, Inc., New Jersey, USA, 1995, parts 1-6.	☒
	12	LIU, JIANGCHUAN ET AL. "Opportunities and Challenged of Peer-to-Peer Internet Video Broadcast," School of Computing Science, Simon Fraser University, British Columbia, Canada.	☒
	13	CLEMENT, B. "Move Networks closes $11.3 Million on First Round VC Funding," Page One PR, Move Networks, Inc. Press Releases, February 7, 2007, http://www.move.tv/press/press20070201.html.	☒
	14	MOVE NETWORKS, INC. "The Next Generation Video Publishing System," April 11, 2007; http://www.movenetworks.com/wp-content/uploads/move-networks-publishing-system.pdf.	☒

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	15	YOSHIMURA, TAKESHI ET AL. "Mobile Streaming Media CDN Enabled by Dynamic SMIL", NTT DoCoMo, Multimedia Laboratories and Hewlett-Packard Laboratories,dated May 7-11, 2002, ACM 1-58113-449-5/02/0005; http://www2002.org/CDROM/refereed/515/.	☒
	16	Nguyen, T. et al., Multiple Sender Distributed Video Streaming, IEEE TRANSACTINOS ON MULTIMEDIA, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 6, no. 2, April 1, 2004, pages 315-326, XP011109142, ISSN: 1520-9210, DOI: 10.1109/TMM.2003.822790.	☒

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	02/01/2021

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CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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	1	7577750	B2	2009-08-18	Shen et al.	
	2	6195680	B1	2001-02-27	Goldszmidt et al.	
	3	6449719	B1	2002-09-10	Baker	
	4	7369610	B2	2008-05-06	Xu et al.	
	5	7408984	B2	2008-08-05	Lu et al.	
	6	7523181	B2	2009-04-21	Swildens et al.	
	7	6976090	B2	2005-12-13	Ben-Shaul et al.	
	8	7240100	B1	2007-07-03	Wein et al.	

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	9	6850965	B2	2005-02-01	Allen	
	10	7334044	B1	2008-02-19	Allen	
	11	7760801	B2	2010-07-20	Ghanbari et al.	
	12	7099954	B2	2006-08-29	Li et al.	
	13	6760772	B2	2004-07-06	Zou et al.	
	14	7054911	B1	2006-05-30	Lango et al.	
	15	7797439	B2	2010-09-14	Cherkasova et al.	
	16	7477688	B1	2009-01-13	Zhang et al.	
	17	7054774	B2	2006-05-30	Batterberry et al.	
	18	5168356		1992-12-01	Acampora et al.	
	19	7818444	B2	2010-10-19	Brueck et al.	

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	20	7599307	B2	2009-10-06	Seckni et al.	
	21	7093001	B2	2006-08-15	Yang et al.	
	22	6874015	B2	2005-03-29	Kaminsky et al.	
	23	6845107	B1	2005-01-18	Kitazawa et al.	
	24	6185736	B1	2001-02-06	Ueno	
	25	57685627		1998-06-16	Zhu et al.	
	26	7274740	B2	2007-09-25	van Beek et al.	
	27	7546355	B2	2009-06-09	Kalnitsky	
	28	7174385	B2	2007-02-06	Li	
	29	7376747	B2	2008-05-20	Hartop	
	30	7719985	B2	2010-05-18	Lee et al.	

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	31	7349358	B2	2008-03-25	Hennessey et al.	
	32	7194549	B1	2007-03-20	Lee et al.	
	33	6374289	B2	2002-04-16	Delaney et al.	
	34	7325073	B2	2008-01-29	Shao et al.	
	35	7609652	B2	2009-10-27	Kellerer et al.	
	36	6795863	B1	2004-09-21	Doty, Jr.	
	37	7817985	B2	2010-10-19	Moon	
	38	7788395	B2	2010-08-31	Bowra et al.	
	39	7536469	B2	2009-05-19	Chou et al.	
	40	7412531	B2	2008-08-12	Lango et al.	
	41	7295520	B2	2007-11-13	Lee et al.	

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	42	7054365	B2	2006-05-30	Kim et al.	
	43	6122660		2000-09-19	Baransky et al.	
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	45	7260640	B1	2007-08-21	Kramer et al.	
	46	7310678	B2	2007-12-18	Gunaseelan et al.	
	47	6618752	B1	2003-09-09	Moore et al.	
	48	6721723	B1	2004-04-13	Gibson et al.	
	49	6859839	B1	2005-02-22	Zahorjan et al.	
	50	7779135	B2	2010-08-17	Hudson et al.	
	51	7593333	B2	2009-09-22	Li et al.	
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	53	6091775		2000-07-18	Hibi et al.	
	54	6091777		2000-07-18	Guetz et al.	
	55	6195680		2001-02-27	Goldszmidt et al.	
	56	6366614		2002-04-02	Pian et al.	
	57	6389473		2002-05-14	Carmel et al.	
	58	6486803	B1	2002-11-26	Luby et al.	
	59	6490627		2002-12-03	Kalra et al.	
	60	6510553		2003-01-21	Hazra	
	61	6574591		2003-06-03	Kleiman et al.	
	62	6604118		2003-08-05	Klleiman et al.	
	63	6731600		2004-05-04	Patel et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	64	5732183		2004-05-04	Graham	
	65	6968387		2005-11-22	Lanphear	
	66	7075986		2006-07-11	Girod et al.	
	67	7096271		2006-08-22	Omoigui et al.	
	68	7349976		2008-03-25	Glaser et al.	
	69	7408984	B2	2008-08-05	Lu et al.	
	70	4535355		1985-08-13	Arn et al.	
	71	8036265	B1	2011-10-11	Reynolds et al.	
	72	5687095		1997-11-11	Haskell et al.	
	73	7116894	B1	2006-10-03	Chatterton	
	74	7328243	B2	2008-02-05	Yaeger et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	75	7330908	B2	2008-02-12	Jungek	
	76	7653735	B2	2010-01-26	Mandato et al.	
	77	8612624	B2	2013-12-17	Brueck et al.	
	78	8868772	B2	2014-10-21	Major et al.	
	79	8402156	B2	2013-03-19	Brueck et al.	
	80	8370514	B2	2013-02-05	Hurst et al.	
	81	8880721	B2	2014-11-04	Hurst et al.	

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	1	20020161898	A1	2002-10-31	Hartop et al.	
	2	20050055425		2005-03-00	Lango et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	3	20050015509		2005-01-00	Sitaraman	
	4	20020131496		2002-09-00	Vasudevan et al.	
	5	20040083283	A1	2004-04-29	Sundaram et al.	
	6	20080219151	A1	2008-09-11	Ma et al.	
	7	20020152318	A1	2002-10-17	Menon et al.	
	8	20060080718	A1	2006-04-13	Gray et al.	
	9	20050120107	A1	2005-06-02	Kagan et al.	
	10	20040103444	A1	2004-05-27	Weinberg et al.	
	11	20050188051	A1	2005-08-25	Sneh	
	12	20030154239	A1	2003-08-14	Davis et al.	
	13	20040030547	A1	2004-02-12	Leaning et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	14	20040117427	A1	2004-06-17	Allen et al.	
	15	20030014684	A1	2003-01-16	Kashyap	
	16	20060206246	A1	2006-09-14	Walker	
	17	20050076136	A1	2005-04-07	Cho et al.	
	18	20030018966	A1	2003-01-23	Cook et al.	
	19	20040030599	A1	2004-02-12	Sie et al.	
	20	20050262257	A1	2005-11-24	Major et al.	
	21	20050033855	A1	2005-02-10	Moradi et al.	
	22	20010047423	A1	2001-11-29	Shao et al.	
	23	20030140159	A1	2003-07-24	Campbell et al.	
	24	20020176418	A1	2002-11-28	Hunt et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	25	20020169926	A1	2002-11-14	Pinckney, III, et al.	
	26	20020178330	A1	2002-11-28	Schlowsky-Fischer et al.	
	27	20050084166	A1	2005-04-21	Bonch et al.	
	28	20020091840	A1	2002-07-11	Pulier et al.	
	29	20080281803	A1	2008-11-13	Gentric	
	30	20061068295	A1	2006-07-27	Batterberry et al.	
	31	20060165166	A1	2006-07-27	Chou et al.	
	32	20020097750	A1	2002-07-25	Gunaseelan et al.	
	33	20020152317	A1	2002-10-17	Wang et al.	
	34	20030021166	A1	2003-01-30	Soloff	
	35	20040168052	A1	2004-08-26	Clisham et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	36	20050066063	A1	2005-03-24	Grigorovitch et al.	
	37	20050204046	A1	2005-09-15	Watanabe	
	38	20060059223	A1	2006-03-16	Klemets et al.	
	39	20060168290	A1	2006-07-27	Doron	
	40	20040260701	A1	2004-12-23	Lehikoinen et al.	
	41	20090055471	A1	2009-02-26	Kozat et al.	
	42	20080222235	A1	2008-09-11	Hurst et al.	
	43	20050185578	A1	2005-08-25	Padmanabham et al.	
	44	20070280255	A1	2007-12-06	Tsang et al.	
	45	20080037527	A1	2008-02-14	Chan et al.	
	46	20080205291	A1	2008-08-28	Li et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	47	20070094405	A1	2007-04-26	Zhang	
	48	20080184688	A1	2006-08-17	Ganguly et al.	
	49	20080263180	A1	2008-10-23	Hurst et al.	
	50	20080133766	A1	2008-06-05	Luo	
	51	20070079325	A1	2007-04-05	de Heer	
	52	20070067480	A1	2007-03-22	Beek et al.	
	53	20070030833	A1	2007-02-08	Pirzada et al.	
	54	20090055547	A1	2009-02-26	Hudson et al.	
	55	20090210549	A1	2009-08-20	Hudson et al.	
	56	20100098103	A1	2010-04-22	Xiong et al.	
	57	20090043906	A1	2009-02-12	Hurst et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	58	20020161911	A1	2002-10-31	Pinckney, III et al.	
	59	20060236219	A1	2006-10-19	Grigorovitch et al.	
	60	20080046939	A1	2008-02-21	Lu et al.	
	61	20060130118	A1	2006-06-15	Damm	
	62	20070204310	A1	2007-08-30	Hua et al.	
	63	20030065803	A1	2003-04-03	Heuvelman	
	64	20040049780	A1	2004-03-11	Gee	
	65	20060133809	A1	2006-06-22	Chow et al.	
	66	20020144276	A1	2002-10-03	Radford et al.	
	67	20020073167	A1	2002-06-13	Powell et al.	
	68	20020174434	A1	2002-11-21	Lee et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	69	20020188745		2002-12-12	Hughes et al.	
	70	20030005455	A1	2003-01-02	Bowers	
	71	20030067872	A1	2003-04-10	Harrell et al.	
	72	20030081582		2003-05-01	Jain et al.	
	73	20030107994		2003-06-12	Jacobs et al.	
	74	20030135631		2003-07-17	Li et al.	
	75	20030151753		2003-08-14	Li et al.	
	76	20030152036		2003-08-14	Quigg Brown et al.	
	77	20030204519	A1	2003-10-30	Sirivara et al.	
	78	20040003101	A1	2004-01-01	Roth et al.	
	79	20040030797	A1	2004-02-12	Akinlar et al.	

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	80	20040031054	A1	2004-02-12	Dankworth et al.	
	81	20040054551	A1	2004-03-18	Ausubel et al.	
	82	20040071209		2004-04-15	Burg et al.	
	83	20040093420		2004-05-13	Gamble	
	84	20040143672	A1	2004-07-22	Padmanabham et al.	
	85	20040170392		2004-09-02	Lu et al.	
	86	20050108414		2005-05-19	Taylor et al.	
	87	20050123058		2005-06-09	Greenbaum et al.	
	88	20070024705		2007-02-01	Richter et al.	
	89	20080028428		2008-01-31	Jeong et al.	
	90	20080056373		2008-03-06	Newlin et al.	

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	91	20080162713		2008-07-03	Bowra et al.	
	92	20080195744		2008-08-14	Bowra et al.	
	93	20020029274	A1	2002-03-07	Allen	
	94	20060075446	A1	2006-04-06	Klemets et al.	
	95	20080104647	A1	2008-05-01	Hannuksela	
	96	20040220926	A1	2004-11-04	Lamkin et al.	
	97	20010013128	A1	2001-08-09	Hagai et al.	
	98	20030204602	A1	2003-10-30	Hudson et al.	
	99	20040010613	A1	2004-01-15	Apostolopoulos et al.	

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	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	1	2011004225	JP	A	2011-01-06	Hodoshima		
	2	2001067264	WO	A1	2001-09-13	Streamcenter, Inc.		
	3	200192752	JP		2001-04-06	Hitachi Information Systems Ltd.		
	4	2006010113	WO	A2	2006-01-26	Network Foundation Technologies, LLC		
	5	2004025405	WO	A2	2004-03-25	Thomson Licensing S.A.		
	6	2466482	CA	A1	2003-05-22	MusicMatch Inc.		
	7	2000-201343	JP		2000-07-18	Toshiba Corp.		
	8	0919952	EP	A1	1999-06-02	Mattavelli et al.		
	9	1670256	EP	A2	2006-06-14	Klements et al.		
	10	1777969	EP		2007-04-25	British Telcom		
	11	1298931	EP	A2	2003-04-02	Oplayo Oy		

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	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	12	1202487	EP	A2	2002-05-02	Toshiba KK		
	13	1395014	EP	A1	2004-03-03	Matsushita Electric Ind. Co. Ltd.		
	14	2367219	GB	A	2002-03-27	Vintage Global		

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	1	FUJISAWA, HIROSHI ET AL. "Implementaton of Efficient Access Mechanism for Multiple Mirror-Servers" IPSJ SIG Technical Report, vol. 2004, no. 9 (2004-DPS-116), January 30, 2004, Information Processing Society of Japan, pp. 37-42.	☒
	2	LIU, JIANGCHUAN ET AL. "Adaptive Video Multicast Over the Internet" IEEE Computer Society, 2003.	☒
	3	"The meaning of performance factor---English-Japanese Weblio Dictionary", [online], February 24, 2012, [searched on February 24, 2012], the Internet <URL:http://ejje.weblio.jp/content/performance+factor>.	☒
	4	TSURU, ET AL. "Recent evolution of the Internet measurement and inference techniques", IEICE Technical Report, Vol. 103, No. 123, pp. 37-42, June 12, 2003.	☒
	5	REJAIE, REZA ET AL. "Architectural Considerations for Playback of Quality Adaptive Video OVer the Internet" University of Southern California, Information Sciences Institute, 1998.	☒
	6	ROY, SUMIT ET AL. "A System Architecture for Managing Mobile Streaming Media Services" Streaming Media Systems Group, Hewlett-Packard Laboratories, 2003.	☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	7	XU, DONGYAN ET AL. "On Peer-to-Peer Media Streaming" Department of Computer Sciences, Purdue University, 2002.	☒
	8	KOZAMERINK, FRANC "Media Streaming Over the Internet - An Over of Delivery Technologies" EBU Technical Review, October 2002.	☒
	9	LIENHART, RAINER ET AL. "Challenges in Distributed Video Management and Delivery" Intel Corporation, EECS Dept., UC Berkeley, 2000-2002.	☒
	10	ZHANG, XINYAN ET AL. "CoolStreaming/DONet: A Data-Driven Overlay Network for Peer-to-Peer Live Media Streaming" IEEE 2005.	☒
	11	GUO, YANG "DirectStream: A Directory-Based Peer-to-Peer Video Streaming Service" LexisNexis, Elsevier B.V. 2007	☒

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5267334	A	1993-11-30	Normille et al.	
	2	5404446	A	1995-04-04	Bowater et al.	
	3	5841432	A	1998-11-24	Carmel et al.	
	4	6389473	B1	2002-05-14	Carmel et al.	
	5	6172672	B1	2001-01-09	Ramasubramanian et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020156912	A1	2002-10-24	Hurst et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

	2	20030055995	A1	2003-03-20	Ala Honkola	
	3	20030233464	A1	2003-12-18	Walpole et al.	
	4	20020131496	A1	2002-09-19	Vasudevan et al.	
	5	20030135863	A1	2003-07-17	VanDer Schaar	

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	0365683	EP	A1	1990-05-02	OTSUKA PHARMA CO LTD		X

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	ROY, S., et al., "Architecture of a Modular Streaming Media Server for Content Delivery Networks," 2002 IEEE. Published in the 2003 International Conference on Multimedia and Expo ICME 2003.	X
	2	BOMMAIAH, E., et al., "Design and Implementation of a Caching System for Streaming Media over the Internet," 2000 IEEE. Published in RTAS '00 Proceedings of the Sixth IEEE Real Time Technology and Applications Symposium (RTAS 2000), page 111.	☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	3	DEFENDANT JADOO TV, INC.'S DISCLOSURE OF INVALIDITY CONTENTIONS, U.S. N. Dist. Ca. Case No. 5:18-cv-05214-EJD dated Sept. 22, 2020.	☒
	4	DEFENDANT JADOO TV, INC.'S DISCLOSURE OF INVALIDITY CONTENTIONS APPENDIX A, U.S. N. Dist. Ca. Case No. 5:18-cv-05214-EJD dated Sept. 22, 2020.	☒
	5	Balk et al., Adaptive Video Streaming: Pre-Encoded MPEG-4 with Bandwidth Scaling, 44 COMPUTER NETWORKS 415 (Mar. 2004)	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/CHIRAG R PATEL/	Date Considered	02/01/2021

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.R.P/

Doc Code: DIST.E.FILE **Document Description: Electronic Terminal Disclaimer - Filed**	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	16876579
Filing Date	18-May-2020
First Named Inventor	DAVID BRUECK
Attorney Docket Number	066.0141X1C9
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
DISH TECHNOLOGIES LLC	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

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as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request. ○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 39928 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/BRETT A. CARLSON/
Name	/BRETT A. CARLSON/

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson/Julie Graf
Attorney Docket Number:	066.0141X1C9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**170**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16876579

Filing Date: 18-May-2020

Applicant/Patent under Reexamination: BRUECK

Electronic Terminal Disclaimer filed on November 19, 2020

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	41166947
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Julie Graf
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	066.0141X1C9
Receipt Date:	19-NOV-2020
Filing Date:	18-MAY-2020
Time Stamp:	11:10:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$170
RAM confirmation Number	E2020AIB10535159
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33611 2490b4dad50041890c6ab95030e5658250eaecf2	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30458 be55c8697533e89844cc242bcc44d4d00ebf6e08	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64069		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial. No.:	16/876,579	Confirmation No.:	3720
Examiner:	Chirag R. Patel	Art Unit:	2454
Filed:	05/18/2020	Customer No.:	70560

Title: **APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING**

Attorney Docket No.: 066.0141x1C9

SUPPLEMENTAL RESPONSE

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

****FILED ELECTRONICALLY USING THE PTO-EFS SYSTEM***

Commissioner:

In further response to the Office Action mailed on June 18, 2020 (for which the period for response has already been extended until November 18, 2020 in our response submitted earlier today), please consider the remarks below under 37 C.F.R. § 1.111, or any other appropriate rule.

REMARKS begin on page 2.

Electronic Acknowledgement Receipt

EFS ID:	41163515
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson
Filer Authorized By:	
Attorney Docket Number:	066.0141X1C9
Receipt Date:	18-NOV-2020
Filing Date:	18-MAY-2020
Time Stamp:	19:46:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		20201118_SupplementalResponse_06-0141X1C9.pdf	136880 2c295b10580c97399fbd862f4473ed8031ba5c9f	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	2	2
	Supplemental Response or Supplemental Amendment	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	136880	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Upon further review of our previously-filed response, it was discovered that we neglected to respond to the double patenting rejection alleging that our claims are verbatim identical to those of the issued parent, US Patent No. 10,469,554. We respectfully disagree: at the very least, the independent claims differ because the "video" referenced in present claim is not necessarily restricted to "live action" video, as in the cited parent. Even to the extent that dependent claims may overlap, this is remediable with a terminal disclaimer.

We are submitting terminal disclaimers citing both US Patent No. 10,489,554 and US Patent No. 10,489,555. Again, if the Examiner has any questions or suggestions to advance prosecution, the undersigned would welcome a telephone call.

Conclusion

Should any issues remain, we would welcome a telephone call to - (480) 385-5069 or an email to bcarlson@lkglobal.com. *Recognizing that Internet communications are not secure, we hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. We understand that a copy of these communications will be made of record in the application file. (MPEP 502.03). Without limiting the foregoing, we further authorize the use of email for informal correspondence, including the exchange of proposed amendments or other draft documents.*

Respectfully submitted,

LORENZ & KOPF, LLC

Dated: November 18, 2020

By: /Brett A. Carlson /
Brett A. Carlson
Reg. No. 39,928

bcarlson@lkglobal.com
480-385-5069 (direct)
480-241-8219 (mobile)
480-385-5060 (general)

LKGLOBAL is LORENZ & KOPF, LLC
Customer No. 70560

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial. No.:	16/876,579	Confirmation No.:	3720
Examiner:	Chirag R. Patel	Art Unit:	2454
Filed:	05/18/2020	Customer No.:	70560

Title: **APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING**

Attorney Docket No.: 066.0141x1C9

RESPONSE AND AMENDMENT
FILED UNDER 37 C.F.R. § 1.111

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

FILED ELECTRONICALLY USING THE PTO-EFS SYSTEM

Commissioner:

In response to the Office Action mailed on June 18, 2020 (for which the period for response has been extended until November 18, 2020), please consider the remarks below under 37 C.F.R. § 1.111.

REMARKS begin on page 2.

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson
Attorney Docket Number:	066.0141X1C9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 2 months with $0 paid	1252	1	640	640
Miscellaneous:				
		Total in USD ($)		**640**

Electronic Acknowledgement Receipt	
EFS ID:	41163337
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson
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Attorney Docket Number:	066.0141X1C9
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REMARKS

This is a response to the above-reference application, which has been granted Track One status. No amendments are made, so no new matter has been added.

Allowable Subject Matter

We appreciate the Examiner's acknowledgement that all claims are allowable but for the double patenting rejection addressed below.

Double Patenting Rejection

The only issue raised by the Office Action is a double patenting rejection citing the issued parent to this application, US Patent No. 10,469,554. The Office Action states that the rejection can be overcome with a terminal disclaimer, which is being filed under separate cover.

After entry of the terminal disclaimer, the rejection is believed to be moot. If there are any issues with the terminal disclaimer or associated fee payment, however, or if any additional disclaimers are needed, the Examiner is invited to contact the undersigned via telephone at 480.241.8219 (mobile) or 480.385.5069 (office).

Information Disclosure Statement

A large information disclosure statement has been submitted under separate cover. Almost all of the references cited are already of record from the parent applications to this matter, but Applicant desires that the art be printed on the front of the issued patent. If there are questions about the IDS or any of the cited art, the undersigned would welcome a telephone call.

Conclusion

Should any issues remain, we would welcome a telephone call to - (480) 385-5069 or an email to bcarlson@lkglobal.com. *Recognizing that Internet communications are not secure, we hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. We understand that a copy of*

these communications will be made of record in the application file. (MPEP 502.03). Without limiting the foregoing, we further authorize the use of email for informal correspondence, including the exchange of proposed amendments or other draft documents.

Respectfully submitted,

LORENZ & KOPF, LLC

Dated: November 18, 2020

By: /Brett A. Carlson /
Brett A. Carlson
Reg. No. 39,928

bcarlson@lkglobal.com
480-385-5069 (direct)
480-241-8219 (mobile)
480-385-5060 (general)

LKGLOBAL is LORENZ & KOPF, LLC
Customer No. 70560

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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	1	5267334	A	1993-11-30	Normille et al.	
	2	5404446	A	1995-04-04	Bowater et al.	
	3	5841432	A	1998-11-24	Carmel et al.	
	4	6389473	B1	2002-05-14	Carmel et al.	
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	1	20020156912	A1	2002-10-24	Hurst et al.	

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	Attorney Docket Number	066.0141X1C9

	2	20030055995	A1	2003-03-20	Ala Honkola	
	3	20030233464	A1	2003-12-18	Walpole et al.	
	4	20020131496	A1	2002-09-19	Vasudevan et al.	
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	1	ROY, S., et al., "Architecture of a Modular Streaming Media Server for Content Delivery Networks," 2002 IEEE. Published in the 2003 International Conference on Multimedia and Expo ICME 2003.	☒
	2	BOMMAIAH, E., et al., "Design and Implementation of a Caching System for Streaming Media over the Internet," 2000 IEEE. Published in RTAS '00 Proceedings of the Sixth IEEE Real Time Technology and Applications Symposium (RTAS 2000), page 111.	☒

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	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	3	DEFENDANT JADOO TV, INC.'S DISCLOSURE OF INVALIDITY CONTENTIONS, U.S. N. Dist. Ca. Case No. 5:18-cv-05214-EJD dated Sept. 22, 2020.	☒
	4	DEFENDANT JADOO TV, INC.'S DISCLOSURE OF INVALIDITY CONTENTIONS APPENDIX A, U.S. N. Dist. Ca. Case No. 5:18-cv-05214-EJD dated Sept. 22, 2020.	☒
	5	Balk et al., Adaptive Video Streaming: Pre-Encoded MPEG-4 with Bandwidth Scaling, 44 COMPUTER NETWORKS 415 (Mar. 2004)	☐

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☒ See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
Name/Print	Brett A. Carlson	Registration Number	39928

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(71) Applicant: OTSUKA PHARMACEUTICAL CO., LTD.
9, Kandatsukasacho 2-chome
Chiyoda-ku Tokyo 101(JP)

(72) Inventor: FUJII, Setsuro
323, Ebiya-cho Sanjyo-sagaru
Gokomachi-dori
Nakagyo-ku, Kyoto-shi Kyoto 604(JP)
Inventor: SHIRASAKA, Tetsuhiko
8-8-302, Uchidehama
Otsu-shi Shiga 520(JP)
Inventor: FUKUSHIMA, Masakazu
9-7, Sen-cho 2-chome
Otsu-shi Shiga 520(JP)
Inventor: SHIMAMOTO, Yuji
3-9-11, Ojigaoka
Otsu-shi Shiga 520(JP)

(74) Representative: Hansen, Bernd, Dr.rer.nat. et al
Hoffmann, Eitle & Partner Patentanwälte
Arabellastrasse 4 Postfach 81 04 20
D-8000 München 81(DE)

EP 0 365 683 A1

(54) **COMPOSITION FOR INHIBITING ABSORPTION OF NUCLEIC ACID BASES.**

(57) A composition for inhibiting absorption of nucleic acid bases in a living body, which contains as an active ingredient a lower thio alkanoic acid represented by the general formula: R^1-S-R^2-COOH (wherein R^1 represents a hydrogen atom or a lower alkyl group, and R^2 represents a lower alkylene group optionally substituted by an amino group) or its salt. This composition is effective for prophylaxis and treatment of gout in virtue of its action of inhibiting absorption of nucleic acid bases.

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SPECIFICATION

Composition for inhibiting absorption of nucleic acid base

<Technical field>

This invention relates to a composition for inhibiting absorption of nucleic acid base, more specifically relates to a composition for inhibiting absorption of nucleic acid base which is the cause of a gout.

<Background art>

An intake amount of nucleic acid base (purine form and pyrimidine form) in recent Japanese meal is gradually increased, and approaches to that of Europeans and Americans, (i.e. 600 to 1000 mg/day). As a food including a large amount of nucleic acid base, example is an animal meat, an internal, e.g. a liver or a kidney, typically a fish meat of sardine, cod, carp, flatfish, trout or the like, shellfish, bacon, beef, chicken, sausage, pork, and these soups or extracts; a grain such as oatmeal, a bean such as kidney bean or pea; a vegetable such as asparagus, mushroom, spinach.

A purine form intaked into a living body is metabolized, and a mainmetabolite, xanthine is finaly

oxidized to uric acid by xanthine oxidase (purine metabolism). In this case, when the intake amount of purine form is excessive, or when an endogenous purine-metabolism abnormality is recognized, by promotion of the purine metabolism, the uric acid concentration in a blood is increased to cause a hyperuricemia, and further due to continuation of it, gout is generated by accumulation of uric acid crystal in a joint.

Accordingly, alimentary therapy using a purine restriction meal in which the content of purine is decreases is conventionally adapted to a gout patient, especially a gout patient of acute arthritis attack term or renal insufficiency complication [for example, "Rinsho eiyo"("a clinical nutrition" in Japanese), 49, 319 (1976); "Kyoto igakukai zasshi" ("Magazine of Kyoto medical associate" in Japanese), 22, 37 (1973); "Saishin Igagu" ("Recent medicine" in Japanese), 29, 486 (1974); "JAMA", 15, 7, 1096 (1955) and the like].

However, even if employing such an alimentary therapy, the decreased amount of uric acid in blood is merely about 0.5 to 1.0 mg/dl. Also, the purine restricting meal is complicated, and due to an unbalanced nutrition and a mental anguish of the patient, this therapy is far from satisfactory.

Accordingly, under the present conditions, the intake

Webgroup CZ a.s. Ex. 1002, Page 820 of 1406

of foods containing a special large amount of nucleic acid base such as purine is merely restricted.

The main object of this invention is to provide a composition for inhibiting absorption of nucleic acid base by which an excess intake or accumulation of nucleic acid base in the living body can be restricted, during the free intake of nucleic acid base, in place of the alimentary therapy mentioned above.

<Disclosure of the invention>

As a result of research which is conducted by inventors to achieve the above object, a new fact that a composition containing, as an effective ingredient, at least one selected from thio-lower alkanoic acid or salt thereof, represented by the general formula:

$$R^1 - S - R^2 - COOH \quad (1)$$

wherein R^1 is a hydrogen atom or a lower alkyl group, R^2 is a lower alkylene group which may have an amino group, has an excellent effect that absorption of nucleic acid base is inhibited, is found.

In the above general formula (1), example of lower alkyl group represented by R^1 is a linear or branched linear alkyl group having 1 to 6 of carbon atoms, such as methyl, ethyl, propyl, isopropyl, butyl, sec-butyl, tert-butyl, pentyl, hexyl or the like. Also, example of lower alkylene group which may have an amino group, represented by R^2, is a

linear or branched linear alkylene group having 1 to 6 of carbon atoms, which may have amino group as a substituent, such as methylene, ethylene, propylene, trimethylene, tetramethylene, pentamethylene, hexamethylene, 2-methyltetramethylene, aminomethylene, 1-aminoethylene, 2-aminotrimethylene, 1-aminotetramethylene, 2-aminopentamethylene, 1-amino-2-methyltetramethylene, 3-aminohexamethylene or the like.

As a preferred compound in the compounds shown by the general formula (1) having the above groups, for example, L-cysteine, L-methionine or the like can be employed, and in particular, L-cysteine is suitable.

The nucleic acid base in this specification includes adenine, guanine, xanthine, hypoxanthine, thymine, uracil, cytosine, or the like.

Although all compounds represented by the general formula (1) are well-known, it is not known at all that these compounds have an inhibiting action of absorption of nucleic acid base. It is also recognized that the pharmaceutically acceptable salt of the above compound (1) has the same inhibiting effect of absorption of nucleic acid base as the compound (1). As an example of such a salt, acid-addition salt obtained by adding a pharmaceutically acceptable acid to thio-lower alkanoic acid of the general formula (1) can be employed. Example of such an acid is an

Webgroup CZ a.s. Ex. 1002, Page 822 of 1406

inorganic acid such as hydrochloric acid, sulfuric acid, phosphoric acid, hydrogen bromide; or an organic acid such as oxalic acid, maleic acid, fumaric acid, malic acid, tartaric acid, citric acid, benzoic acid, acetic acid, p-toluenesulfonic acid, ethanesulfonic acid.

In the case that thio-lower alkanoic acid of formula (1) has an acid group, a salt obtained by reacting a pharmaceutically acceptable basic compound also shows the same inhibiting action of absorption of nucleic acid base. Example of the basic compound is a metal hydroxide such as sodium hydroxide, potassium hydroxide, calcium hydroxide; an alkali metal carbonate or bicarbonate such as sodium carbonate, potassium hydrogencarbonate, sodium hydrogencarbonate; or the like.

In order to effectively inhibiting the absorption of nucleic acid base in the living body, the oral intake of the composition of this invention is desirable, since nucleic acid base is mainly absorbed in the intestinal tract.

Form for oral intake is not limited at all, and therefore may be various pharmaceutical forms as employed in the conventional medicine or general food forms. These forms can be prepared by the conventional methods, and other ingredients used together with the above ingredient can be optionally selected.

That is, the composition of this invention is

prepared to the pharmaceutical form by using the effective amount of the above effective ingredient together with a pharmaceutical carrier used conventionally, e.g. a dilution agent or a vehicle such as filler, bonding agent, humidity-keeping agent, disintegrator, surface active agent, a lubricant. Typical example of the pharmaceutical form is tablet, pil, powder, liquid, suspension, emulsion, granule, capsule or the like. When forming the tablet, an example of the carrier used for manufacturing a pharmaceutical preparation is a vehicle such as lactose, sucrose, sodium chloride, glucose, urea, starch, calcium carbonate, kaolin, crystalized cellulose, silicic acid; a bonding agent such as water, ethanol, propanol, simple syrup, glucose liquid, starch liquid, gelatin solution, carboxymethyl cellulose, shellac, methyl cellulose, calcium phosphate or polyvinyl pyrrolidone; a disintegrator such as dried starch, sodium alginate, agar powder, laminaran powder, sodium hydrocarbonate, calcium carbonate, polyoxyethylene sorbitan fatty acid ester, sodium laurilsulfate, stearyl monoglyceride, starch or lactose; a desintegration inhibiting agent such as sucrose, stearin, cacao butter or hydrogenation oil; an absorption promoting agent such as quaternary ammonium base or sodium laurilsulfate; a humidity keeping agent such as glycerin or starch; an absorbent such as starch, lactose, kaolin, bentonite or

Webgroup CZ a.s. Ex. 1002, Page 824 of 1406

colloidal silica; a lubricant such as purified talc, stearate, boric acid powder or polyethylene glycol; or the like. Furthermore, the tablet may be used in the form having a conventional coating in compliance with the necessity. Example of the coated tablet is sugar coated tablet, gelatin coated tablet, enteric coated tablet, film coated tablet, and further the tablet may be in the form of doublelayer tablet or multilayer tablet.

When forming the pil, an example of a carrier is a vehicle such as glucose, lactose, starch, cacao butter, hydrogenated vegetable oil, kaolin or talc; a bonding agent such as powdered gum arabi, powdered tragacanth, gelatin or ethanol; and a disintegrator such as laminaran or agar; or the like. Capsule is prepared by mixing the effective ingredient with the various carriers mentioned above and then filling the mixture into hard gelatin capsule, soft gelatin capsule or the like in virtue of the conventional method.

In liquid preparation such as solution, emulsion or suspension, a diluent such as water, lactic acid aqueous solution, ethyl alcohol, propylene glycol, etoxyed isostearyl alcohol, polyoxy isostearyl alcohol, polyoxyethylene sorbitane fatty acid ester or the like is used, and liquid preparation is sterilized in virtue of the conventional method. Sodium chloride, glucose, glycerin or

the like can be added to the liquid preparation, and further a dissolution accelating agent, a buffer agent or the like used conventionally can be also added.

Furthermore, to various medicinal preparations mentioned above, antioxidant (e.g. butylated hydroxytoluene, propylgalate, quinone, α-tocopherol or the like), coloring agent, preservative, perfume, flavor agent, sweetening agent or other medicine may be contained.

In the above medicinal preparations, the compound or its salt represented by general formula (1) as an effective ingredient may be contained without a special limitation, and the content of the compound or its salt is at least about 0.01% by weight, preferably about 1% to 70% by weight. In the case of tablet, it is suitable that the content of the compound or its salt is in the range of 0.01g to 1g per 1 tablet.

The effective dose of the medicinal preparation to be orally administered is decided in compliance with the medicine form, conditions such as age, sex or the like and the degree of disease of the patient to be administered. Its dose may be optionally selected without special limitation, ordinally the standard of the amount of effective ingredient is about 30mg to 150mg per 1kg of weight of patient at one day, and may be varied optionally. The administration of the preparation can be divided into

Webgroup CZ a.s. Ex. 1002, Page 826 of 1406

1 to 4 times per one day.

The composition of this invention can be also prepared in the food forms. Food forms are not specially limited except for orally taking, and therefore may be various eatables and drinkables ordinally well-known, such as seasoning, confectionery (Japanese confectionery, Western confectionary, ice cream, etc.), sirup, fruit processed good, vegetable processed good, animal meat processed good, fish meat processed good, delicacy, canned, bottling, refreshing drink, light quickly cooking eatable or drinkable food or the like. Such a food form is prepared by the conventional method, except that the above effective ingredient is blended in the optional step by the suitable means such as kneading, mingling, mixing, dissolving, soaking, permeating, scattering, appling, spraying, pouring or the like. The blending amount of the effective ingredient is not especially limited, and ordinally is decided so that an intake amount per one time is in the range of about 500mg to 2000mg.

In taking or administering the composition of this invention having various forms to the patient, the intake or administration time is optionally decided, and preferably is on or before and after meal, since the absorption of nucleic acid base is most active in intake of meal.

The composition of this invention may be used in the

form of suppository, besides orally taking forms.

<Brief Explanation of the Drawings>

Figs. 1 to 6 show the results carried out in Examples, in order to evidence that the effective ingredient of this invention has an inhibiting action of the absorption of nucleic acid base to the living body.

<Industrial Applicability>

By taking the composition of this invention in the form suitable to restrict the absorption of nucleic acid base in the living body, excess intake or accumulation of nucleic acid base in the living body is inhibited, thereby being useful to therapy and prophylaxis of gout, etc.

<Example>

There was investigated how the effective ingredient of this invention is acted to absorption of nucleic acid base to the living body.

For this test, wistar-king rats which weighed 180g to 200g and to which bait and water were freely given were used, and were divided between control group and experimental group.

Test liquid, which was obtained by suspending 5mg/ml of each nucleic acid base (uracil, thymine, cytosine or adenine) into 5% arabic gum solution, so that the concentration of nucleic acid base is 5 mg/ml, followed by ultrasonication for 5 minutes, was orally administered to

Webgroup CZ a.s. Ex. 1002, Page 828 of 1406

the control group. Dose of this test liquid was 1ml per 100g of rat weight, i.e. 50mg/kg. Also, another test liquid, which was obtained by adding and suspending the test compound, i.e. effective ingredient of this invention, to each suspension liquid containing 5 mg/ml of nucleic acid base, so that the concentration of the test compound is 15 mg/ml, followed by ultrasonication in accordance with the same manner as employing above, was orally administered to the experimental group. Dose of this test liquid was 1ml per 100g of rat weight, i.e. 150 mg/kg.

Each group was consisted of two or three rats, and each test liquid was administered by using oral probe.

After 15, 30, 60 and 120 minutes from administration of test liquid, celiotomy of rat of each group was carried out under anethesia with ether, and immediately about 5 ml of blood is taken from inferior vena cava. This blood was kept standing for 1 to 2 hours under the temperature atomosphere of 4 ℃ as it is, and then was centrifuged for 10 minutes under the same temperature atomosphere to separate a serum.

The nucleic acid base concentration in the serum thus obtained was measeured in accordance with the following method, and the mesuring value was estimated as oral absorption amount of nucleic acid base.

Method for measuring nucleic acid base concentration in

serum

The serum obtained by the above procedure was analyzed by high performance liquid chromatography, after pre-treating as mentioned below.

That is, in the case of determination of uracil and thymine, 5 ml of ethyl acetate was added to 1 ml of serum mentioned above, followed by shaking under acidic condition in the presence of hydrochloric acid. Then, ethyl acetate layer was separated, was heated and evaporated to dryness at 40℃, and was dissolved into a small amount of water. 10 μl of a pre-treated sample thus obtained was applied to "ULTRON N-C_{18}-L column " (5 μm, 4.6 ID mm × 150mm) manufactured by SHINWA KAKOU SHA, 5 mM tetrabutyl anmonium solution (pH 5 to 6) containing 2 % methanol was flowed through the coloumn as a mobile phase, and analysis was carried out at 1 ml/minute of flow rate and 260 nm of detection wave length.

Also, cytosine and adenine were determined as mentioned below. 200 to 400 μl of the serum containing these nucleic acid base was mounted onto "Ultrafree C3GC cenrifugal filtration tube" (manufactured by MILLIPORE compony) followed by centrifuging at 10000 rpm for 10 minutes. Then, 20 μl of the obtained filtrate was applied to "CHEMCOSORB 300-C_{18} column"(5 μm, 4.6 ID mm × 150mm) manufactured by CHEMCO compony, 20 mM phosphate buffer

Webgroup CZ a.s. Ex. 1002, Page 830 of 1406

solution (pH 3.8) was flowed through the coloumn as a mobile phase, and analysis was carried out at 1 ml/minute of flow rate and 260 nm of detection wave length.

Respective concentration of nucleic acid base was caluculated from chromatogram obtained by analyzing samples having a known concentration, which were prepared by adding standard nucleic acid base to normal rat serum, under the same conditions as mentioned above.

Figs 1 to 4 show the test results in the case that L-cysteine was used as test compound, i.e. effective ingredient compound of this invention. In each graph, used nucleic acid base is adenine (Fig. 1), thymine (Fig.2), uracil (Fig. 3) and cytosine (Fig. 4). The axis of ordinate and the axis of abscissa indicate nucleic acid base concentration (μg/ml) in blood and time (min.) after orally administering test liquid, respectively.

Furthermore, by using hypoxanthine as nucleic acid base, absorption inhibiting effect of hypoxanthine in virtue of the effective ingredient compound of this invention was examined in accordance with the following method.

[8 - ^{14}C]hypoxanthine (49.0 mCi/m mol, 250 μCi/ml) was added and blended to both of test liquid for control group, containing 5 mg/ml of hypoxanthine and another test liquid for experimental group, which was prepared by adding

15 mg/ml of L-cysteine to the test liquid of the control group, so that concentration of hypoxanthine is 10 μCi/ml. Each test liquid was orally administered to rats at dose of 1ml per 100 g of rat weight by oral probe. Afer 15, 30 and 60 minutes from administration, blood was taken out from caudal vein of rat of each group, and blood plasma was separated by centrifugation.

For the purpose of deproteination, 1 ml of ice-cooled methanol was added to 0.1 ml of the plasma thus obtained, followed by centrifuging at 3000 rpm for 10 minutes. 0.5 ml of supernatant was contained into a vial, and 10 ml of liquid scintillator (AQUASOL - II) was added to measure the radioactivity with liquid scintillation counter.

From the radioactivity obtaind, the amount of absorbed hypoxanthine was estimated as the corresponding amount of[8 - ^{14}C]hypoxanthine included in 1 ml of blood. Test result is shown in graph of Fig. 5. In this Fig. 5, the axis of ordinate indicates the corresponding amount of ^{14}C - hypoxanthine in blood, and the axis of abscissa indicates time (min.) after oral administration of test liquid. Also, (1) and (2) in graph indicate experimental group (using the test liquid including L-cysteine) and control group (using the test liquid which does not include L-cysteine), respectively. Each value is the mean for three

Webgroup CZ a.s. Ex. 1002, Page 832 of 1406

rats.

Also, by using L-methionine as a test compound and uracil as nucleic acid base, the test was carried out in the same manner as mentioned above. The test result is shown in Fig. 6 by the same manner as the other drawings mentioned above.

In each graph, (1) and (2) in graph indicate experimental group (using the test liquid including the effective ingredient compound) and control group (using the test liquid which does not include the effective ingredient compound), respectively. Each value is the mean for two to three tats.

From Figs. 1 to 6, it is indicated that effective ingredient compound of this invention lowers concentration of nucleic acid base in serum significantly.

What is claimed is:

1. A composition for inhibiting absorption of nucleic acid base, which is taken into a living body to inhibit absorption of nucleic acid base in the living body, containing, as an effective ingredient, thio-lower alkanoic acid or salt thereof represented by the general formula:

$$R^1 - S - R^2 - COOH$$

wherein R^1 is a hydrogen atom or a lower alkyl group, and R^2 is a lower alkylene group which may have an amino group.

2. The composition for inhibiting absorption of nucleic acid base according to claim 1, wherein R^1 is a hydrogen atom and R^2 is a lower alkylene group having an amino group.

3. The composition for inhibiting absorption of nucleic acid base according to claim 1, wherein R^1 is a lower alkyl group and R^2 is a lower alkylene group having an amino group.

4. The composition for inhibiting absorption of nucleic acid base according to claim 1, wherein said thio-lower alkanoic acid is L-cysteine.

5. The composition for inhibiting absorption of nucleic acid base according to claim 1, wherein said thio-lower alkanoic acid is L-methionine.

Webgroup CZ a.s. Ex. 1002, Page 834 of 1406

6. The composition for inhibiting absorption of nucleic acid base according to claim 1, wherein the composition is prepared to the orally taken form.

7. The composition for inhibiting absorption of nucleic acid base according to claim 6, wherein R^1 is a hydrogen atom and R^2 is a lower alkylene group having an amino group.

8. The composition for inhibiting absorption of nucleic acid base according to claim 6, wherein R^1 is a lower alkyl group and R^2 is a lower alkylene group having an amino group.

9. The composition for inhibiting absorption of nucleic acid base according to claim 6, wherein said thio-lower alkanoic acid is L-cysteine.

10. The composition for inhibiting absorption of nucleic acid base according to claim 6, wherein said thio-lower alkanoic acid is L-methionine.

Fig. 1

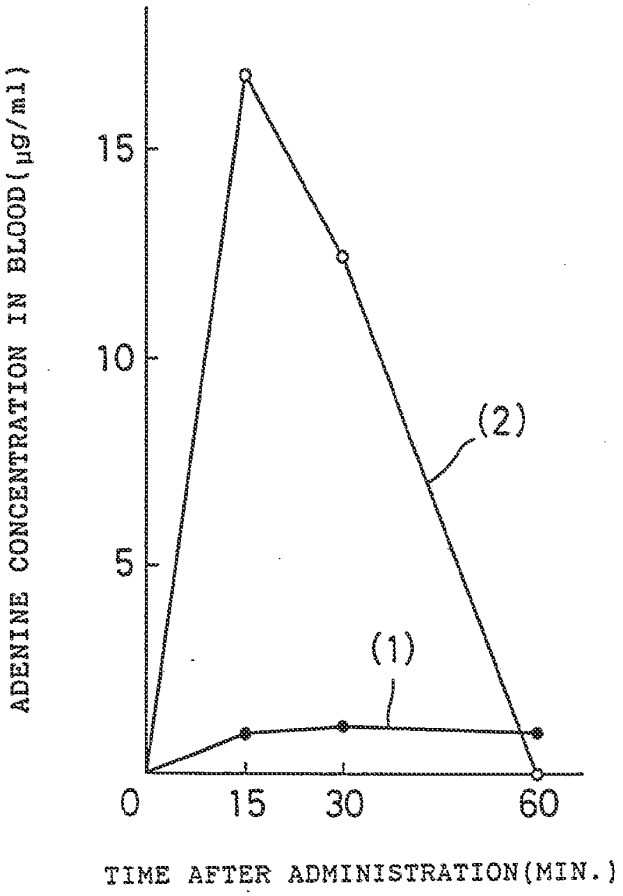

ADENINE CONCENTRATION IN BLOOD(μg/ml)
15
10
5
0
15
30
60
(1)
(2)
TIME AFTER ADMINISTRATION(MIN.)

Fig. 2

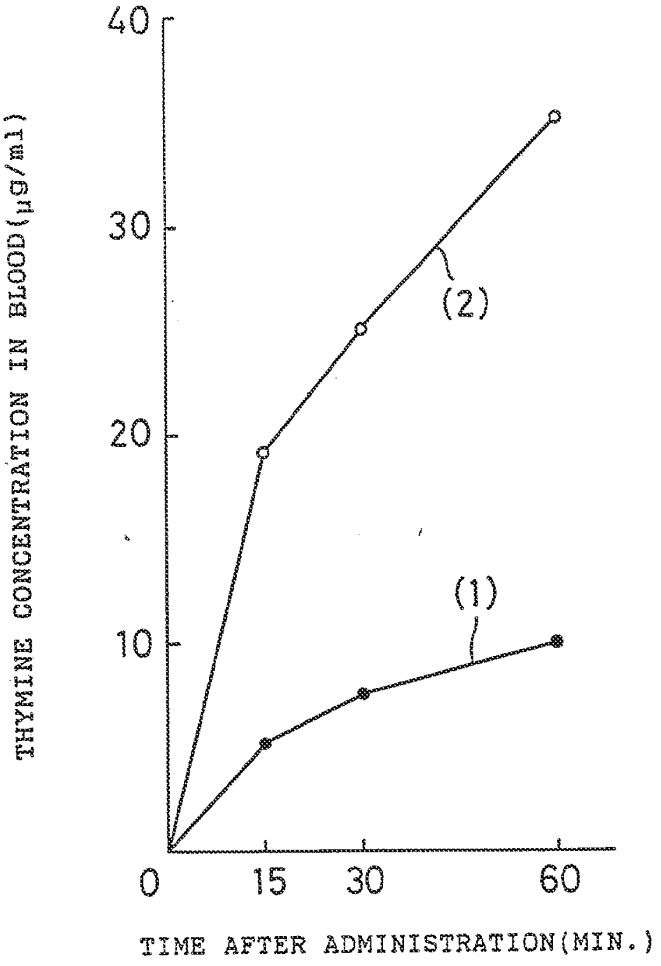

40
30
20
10
0
15
30
60
(1)
(2)
THYMINE CONCENTRATION IN BLOOD(μg/ml)
TIME AFTER ADMINISTRATION(MIN.)

Fig. 3

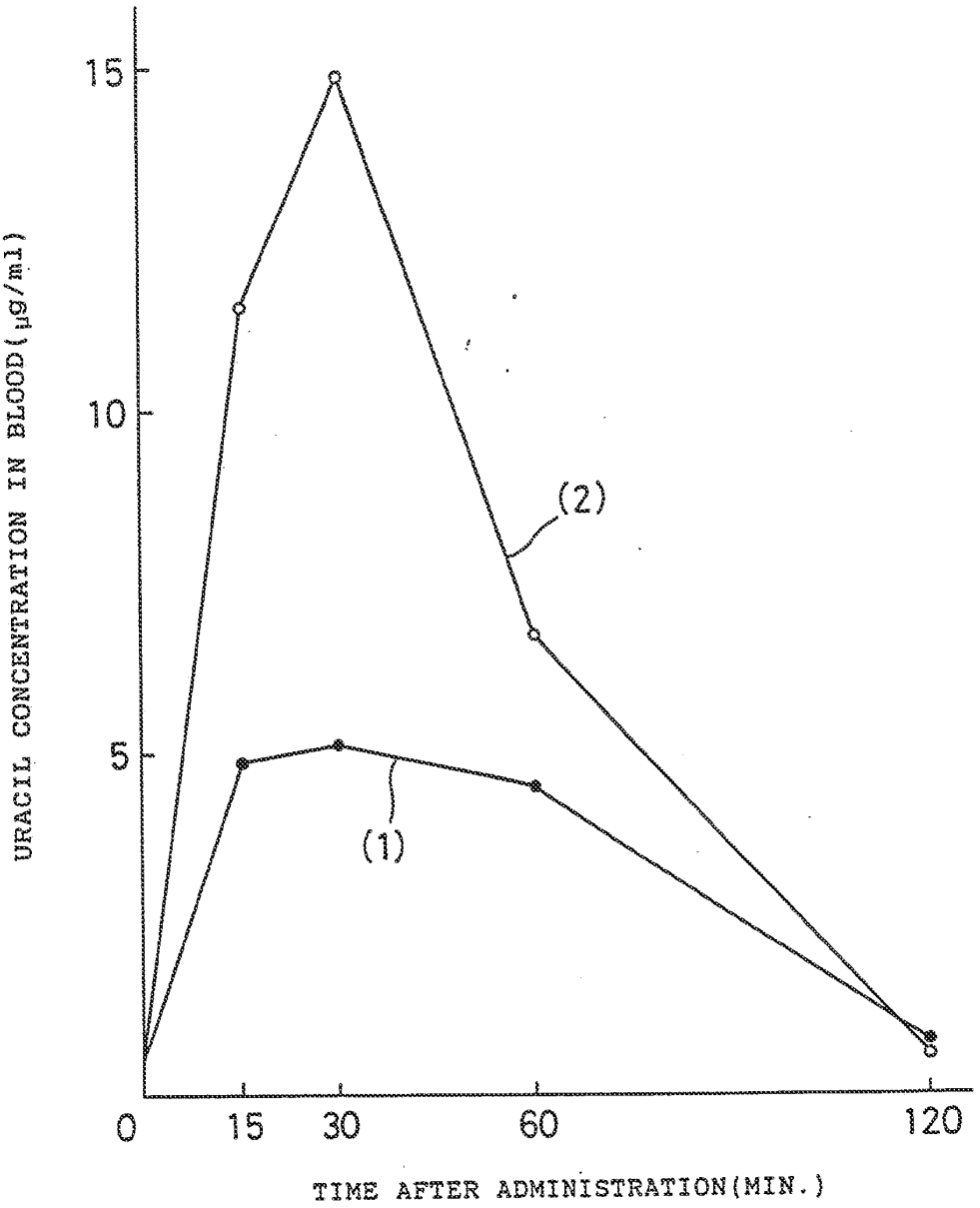

URACIL CONCENTRATION IN BLOOD(μg/ml)
15
10
5
0
15
30
60
120
(1)
(2)
TIME AFTER ADMINISTRATION(MIN.)

Fig. 4

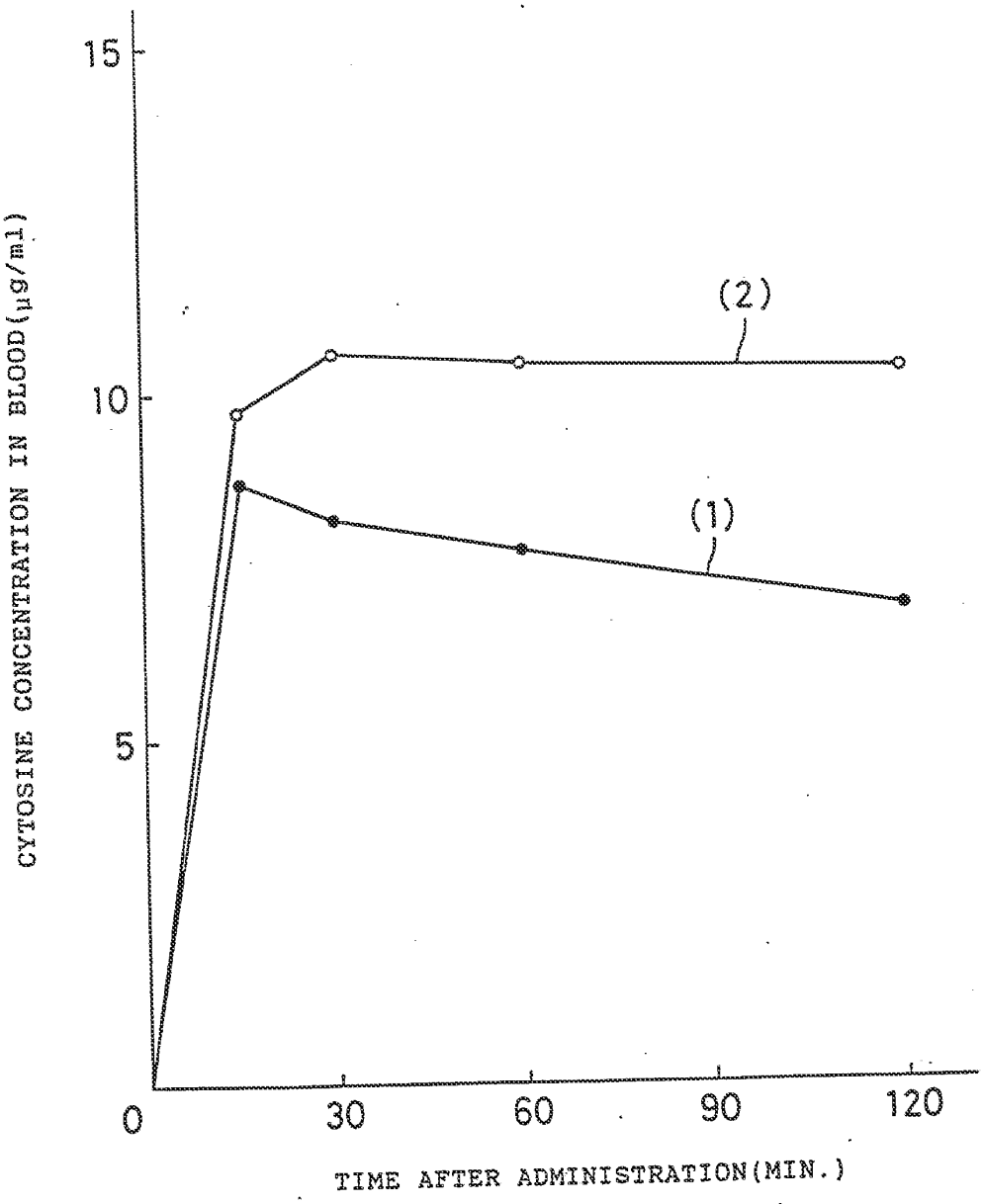

15
10
5
0
30
60
90
120
(2)
(1)
CYTOSINE CONCENTRATION IN BLOOD(μg/ml)
TIME AFTER ADMINISTRATION(MIN.)

Fig. 5

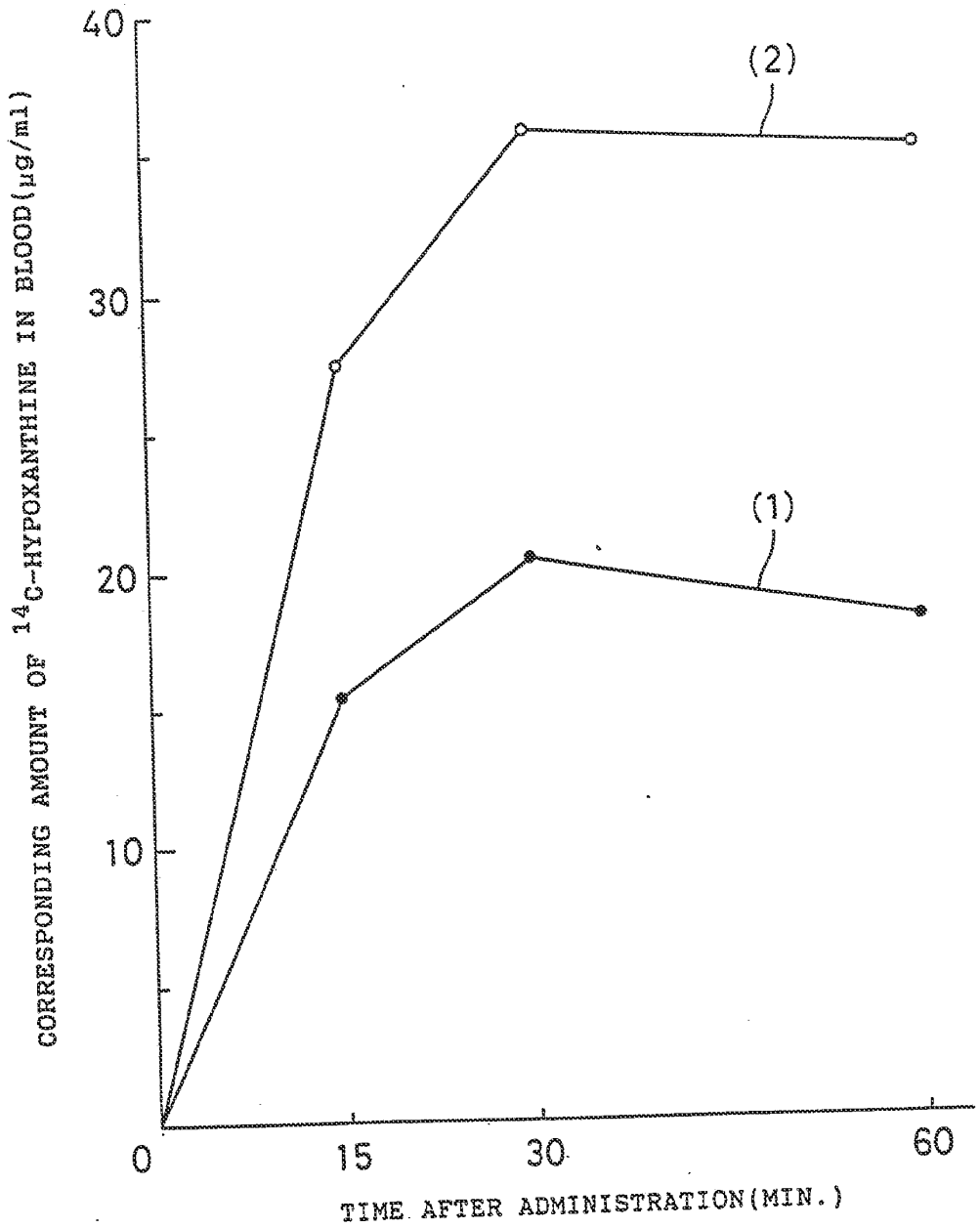
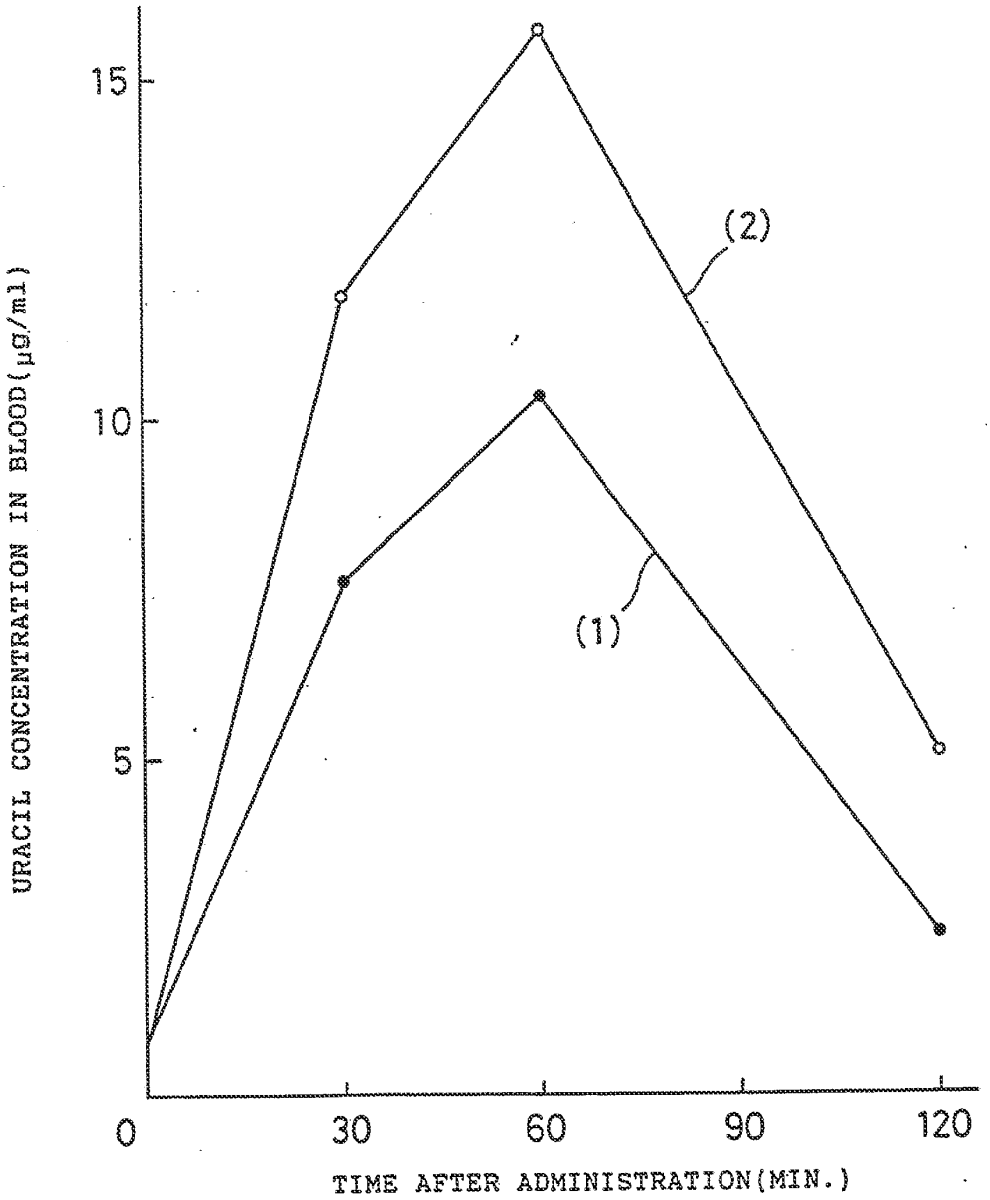

40
30
20
10
0
15
30
60
(2)
(1)
CORRESPONDING AMOUNT OF ^{14}C-HYPOXANTHINE IN BLOOD(μg/ml)
TIME AFTER ADMINISTRATION(MIN.)

Fig. 6


15
10
5
0
30
60
90
120
(1)
(2)
URACIL CONCENTRATION IN BLOOD(μg/ml)
TIME AFTER ADMINISTRATION(MIN.)

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/00313

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[4] A61K31/19// A23L1/03

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System †	Classification Symbols
IPC	A61K31/19, A23L1/03

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	Chemical Abstracts, Vol. 102, No. 7, Abstract No. 102(7):61163b, 1985, (Columbus, Ohio, U.S.A.) Amubode, F.O., et. al., J. Agric. Sci., 103(3), 497-502	1-10
A	Chemical Abstracts, Vol. 95, No. 17, Abstract No. 95(17):148998p, 1981 (Columbus, Ohio, U.S.A.) Ueda, H., et. al., Nutr. Rep. Int., 24(1), 85-94	1-10
A	Chemical Abstracts, Vol. 95, No. 5, Abstract No. 95(5):41169s, 1981, (Columbus, Ohio, U.S.A.) Aguilar, F., et. al., Bol. Soc. Quim. Peru. 45(3),256-65	1-10
A	Chemical Abstracts, Vol. 91, No. 9, Abstract No. 91(9):73452n, 1979, (Columbus, Ohio, U.S.A.) Muramatsu, T., et. al., J. Nutr.,	1-10

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
June 12, 1989 (12. 06. 89)	June 26, 1989 (26. 06. 89)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	

Form PCT ISA 210 (second sheet) (January 1985)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

	109(6), 1057-62	
A	Chemical Abstracts, Vol. 81, No. 23, Abstract No. 81(23):150847t, 1974, (Columbus, Ohio, U.S.A.) Kal'nitskii, B.D., Byull. Vses. Nauchno-Issled. Inst. Fiziol., Biokhim. Pitan. Skh. Zhivotn., 7(2), 20-2	1-10

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ...., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ...., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ...., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Webgroup CZ a.s. Ex. 1002, Page 843 of 1406

Electronic Patent Application Fee Transmittal

Application Number:	16876579
Filing Date:	18-May-2020
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson/Julie Graf
Attorney Docket Number:	066.0141X1C9

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt	
EFS ID:	41130700
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Julie Graf
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	066.0141X1C9
Receipt Date:	17-NOV-2020
Filing Date:	18-MAY-2020
Time Stamp:	15:15:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$260
RAM confirmation Number	E2020AGF17106225
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	20201116_IDSCert_066-0141X1C9.pdf	227440 176ba1014fc671051cf91a994df4b3c9296caea5	no	1
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13	Non Patent Literature	NPL_Fujisawa_Implementation OfEfficientAcdess.pdf	511563 91dff145bd502cbcca14ed40adf4002af21abab7	no	10
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I. **THIS IDS IS BEING FILED UNDER 37 C.F.R. 1.97(b): (check one box)**

☐ Within three months of the filing date of a national application other than a continued prosecution application under 1.53(d).

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VI. **CONCLUSION**

It is respectfully submitted that the claims presently on file patently distinguish the present invention from each of the references cited in this IDS. The references cited in this IDS are being cited only in the interest of candor and without any admission that they constitute statutory prior art or contain matter which anticipates the invention or which would render the same obvious, either singly or in a combination, to a person of ordinary skill in the art. Furthermore the filing of this IDS should not be construed to be an admission that the information cited in this IDS is, or is considered to be, material to patentability as defined in 1.56(b). In addition, the filing of this IDS should not be construed as a representation that a search has been made.

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(71) **MUSICMATCH, INC.,**
270-16935 West Bernardino Drive, SAN DIEGO , XX (US).

(72) **DORON, AMIR (US).**
DUNNING, TED E. (US).
GRUHNE, MATTHIAS (US).

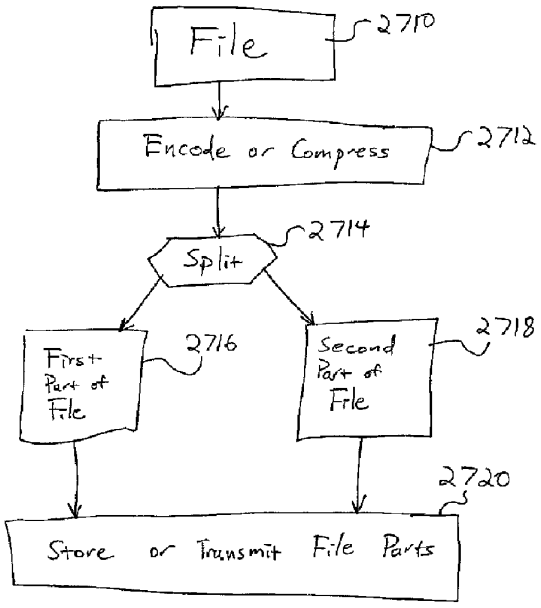
(74) **SIM & MCBURNEY**

(54) DECOUPAGE DE FICHIERS, CODAGE ECHELONNABLE, ET TRANSMISSION ASYNCHRONE DANS UN TRANSFERT CONTINU DE DONNEES

(54) FILE SPLITTING SCALADE CODING AND ASYNCHRONOUS TRANSMISSION IN STREAMED DATA TRANSFER

(57)

Files (2750) are divided into parts (2716, 2718) and at least some of the parts are transmitted to a client using a communication channel. At least some of the transmitted parts are cached locally. This allows subsequent streaming playback of the file while using 'less bandwidth by transmitting the part of the file that hasn't been cached, and combining the cached parts with the tramitted parts. In some embodiments, files may be represented at a low quality level by a first data set (2804), and at higher quality levels with additional data sets (2806). Data sets are cached locally, so that during subsequent streaming playback of the file, the quality level of the playback may be improved by sending additional data sets using bandwidth that would otherwise be dedicated to transmitting the cached data sets.



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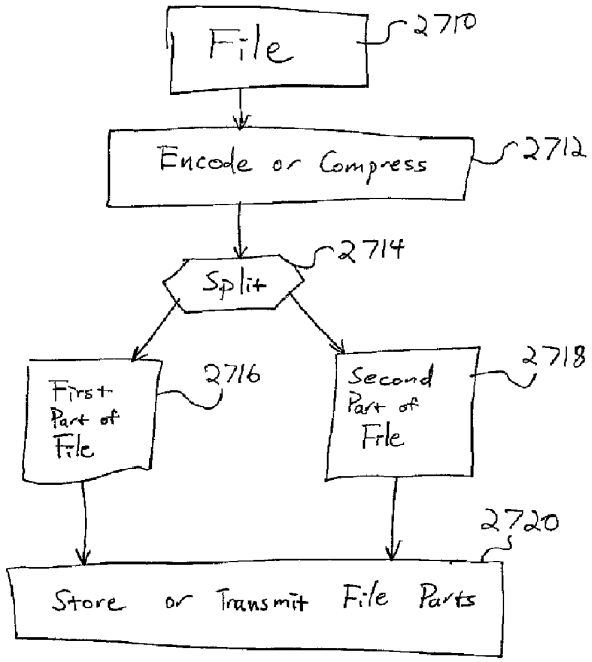
(71) Demandeur/Applicant:
MUSICMATCH, INC., US

(72) Inventeurs/Inventors:
DUNNING, TED E., US;
DORON, AMIR, US;
GRUHNE, MATTHIAS, US

(74) Agent: SIM & MCBURNEY

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(54) Title: FILE SPLITTING SCALADE CODING AND ASYNCHRONOUS TRANSMISSION IN STREAMED DATA TRANSFER



(57) Abrégé/Abstract:
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(57) Abrégé(suite)/Abstract(continued):
tramitted parts. In some embodiments, files may be represented at a low quality level by a first data set (2804), and at higher quality levels with additional data sets (2806). Data sets are cached locally, so that during subsequent streaming playback of the file, the quality level of the playback may be improved by sending additional data sets using bandwidth that would otherwise be dedicated to transmitting the cached data sets.

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(71) Applicant: **MUSICMATCH, INC.** [US/US]; 1635 W. Bernardino Drive, Suite 270, San Diego, CA 92127 (US).

(72) Inventors: **DUNNING, Ted, E.**; 11797 River Rim Road, San Diego, CA 92126 (US). **DORON, Amir**; 8455 Lake Ben Avenue, San Diego, CA 92119 (US). **GRUHNE, Matthias**; Schulstrasse 2a, 99718 Westgreussen (US).

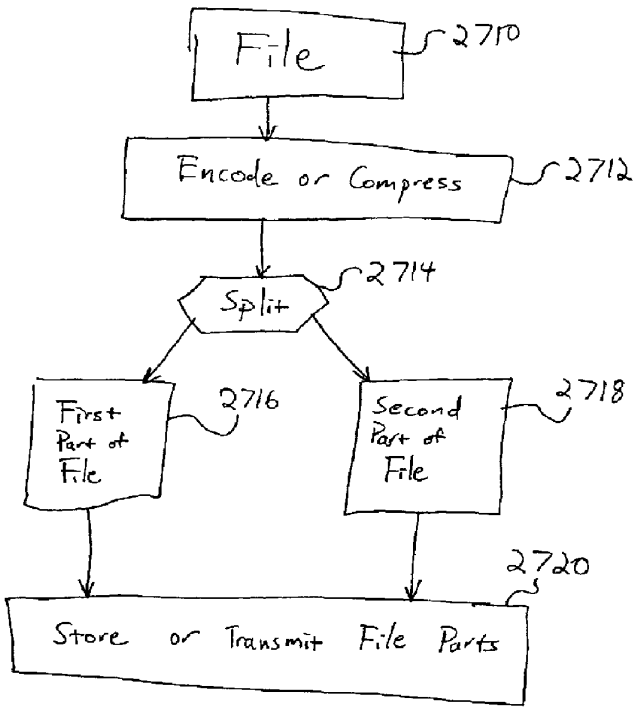
(74) Agents: **PLIMIER, Michael, D.** et al.; Fenwick & West LLP, Two Palo Alto Square, Palo alto, CA 94306 (US).

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(54) Title: FILE SPLITTING SCALADE CODING AND ASYNCHRONOUS TRANSMISSION IN STREAMED DATA TRANSFER



(57) Abstract: Files (2750) are divided into parts (2716, 2718) and at least some of the parts are transmitted to a client using a communication channel. At least some of the transmitted parts are cached locally. This allows subsequent streaming playback of the file while using 'less bandwidth by transmitting the part of the file that hasn't been cached, and combining the cached parts with the tramitted parts. In some embodiments, files may be represented at a low quality level by a first data set (2804), and at higher quality levels with additional data sets (2806). Data sets are cached locally, so that during subsequent streaming playback of the file, the quality level of the playback may be improved by sending additional data sets using bandwidth that would otherwise be dedicated to transmitting the cached data sets.

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FILE SPLITTING, SCALABLE CODING, AND ASYNCHRONOUS TRANSMISSION IN STREAMED DATA TRANSFER

Cross-Reference to Related Application

[0001] This application is a continuation-in-part of U.S. Patent Application Serial Number 09/846,823, filed on April 30, 2001, Patent No. X,XXX,XXX, the disclosure of which is incorporated by reference, and which claimed priority from U.S. Provisional Application Serial Number 60/201,622, filed May 3, 2000, the disclosure of which is incorporated by reference. The present application also claims priority from provisional U.S. Patent Application Serial No. 60/337,939, for "File Splitting, Scalable Coding, and Asynchronous Transmission in Streamed Data Transfer," filed November 9, 2001, the disclosure of which is incorporated by reference.

Background of the Invention

Field of the Invention

[0002] The present invention is related to delivery of streamed programs such as audio and video, and more particularly to systems and methods providing improved control, efficiency, and quality of such streamed transmissions using file splitting, scalable coding, and asynchronous transmission.

Description of the Background Art

[0003] Delivery of audio and video programs over the Internet provides several advantages over conventional broadcast media such as radio and television. Unlike broadcast media, which require users to receive programs at particular times, or to record them for later use, Internet delivery allows users to select and receive programs upon demand, at a time that is convenient to them. For example, a user may browse to a news story, presented in text format, and click on a link that initiates playback of an audio report on the news item. Users may also click on links to hear songs or song samples, as is common in e-commerce sites, such as amazon.com or cdnow.com, in order to permit users to sample songs before purchasing compact discs (CDs). Internet delivery of audio programming may also be used for implementing personalized radio stations, which deliver music tracks selected in response to the tastes of particular users. Similar functionality is available for the delivery of video programs on demand, allowing users to view sports highlights, news reports, music videos, and even films and television shows, over the Internet.

[0004] Software for playing back such audio and video files is known in the art, including for example the Windows Media Player from Microsoft Corporation, and the RealPlayer from Real Networks, Inc. Functionality for audio and video delivery may also be built into browsers such as Netscape Navigator and Microsoft Internet Explorer.

[0005] One disadvantage of Internet delivery of audio and video programs is the relatively limited bandwidth that is available for any particular program. Compared with broadcast media, such as radio, television (over-the-air or cable), and the like, typical Internet connections offer far less bandwidth and thus limit the amount of information that may be transmitted to the end user in a given period of time. Thus, even with the application of aggressive compression algorithms, sound quality and picture quality of streamed programs received over the Internet tend to be substandard. For example, due to the limited number of bits available, existing Internet delivery schemes fail to provide received audio programs at a quality approaching that of CDs.

[0006] As an alternative to streamed programs, and in order to improve quality of the received programs, users may download programs and then, subsequent to downloading them, play the received program via their computers. Since the program is not being viewed or listened to in "real time," more time is available to transmit and receive the program, so that larger files may be provided, and better quality achieved. However, it may take many minutes, or even hours, to download a short program at a reasonable level of quality. Thus, such a scheme does not provide the user with an immediate listening or viewing experience; rather, the user must wait until the program is downloaded before it can be viewed or listened to.

Summary of the Invention

[0007] The present invention provides improved quality, security, and efficiency for streamed programs, by combining received streamed data with previously-stored (cached) data. In one embodiment, a program file containing program data such as audio, video, or the like, is split into two or more sections. In one embodiment, each section is not usable on its own to provide program output (e.g., audio signals where the program file is an audio file), but can only be used when recombined with the remaining sections. In one embodiment, one section of the split data is considerably smaller than the other section(s). This splitting allows the second section to be cached by a client machine without a danger that the client has a persistent usable copy of the original file. This allows the benefits of caching to be realized without providing users with unauthorized persistent copies of files.

[0008] For example, the second section may be transmitted in advance of the actual playback of a program file, thus avoiding bottlenecks that may result when the entire program file is transmitted upon user demand. Until the first section is transmitted, the user will not be able to play the program file. The smaller first section may be streamed to allow playback of the program file. The first section is discarded after playback so that no persistent usable copy of the program file remains on the user's machine. The second section remains cached, allowing future streaming playback to be performed efficiently. The ability to not provide a persistent usable

copy of the program file can be advantageous because copyright holders may not wish to authorize such persistent copies, since the persistent copy could cannibalize revenues from sales of the program file in a tangible medium (such as audio CDs), or paid future downloads, streamed or otherwise, of the program file.

[0009] Alternatively, the program file is split into sections in order to provide scalability in the playback quality level. The first section is playable at a relatively low quality level. Additional sections of data may be added to the first section to increase the quality level. Thus, the program file may be downloaded and played at a quality level determined by the bandwidth of the connection. The sections may be cached so that when it is desired to play the program file again, additional sections may be downloaded and added for higher quality playback.

[0010] In some embodiments, a persistent copy of a playable version of the program file is not stored on the client. The additional sections are not playable without the first level. Thus, the additional sections may be cached, so that the file can be played back by combining a downloaded first section with cached additional sections.

[0011] The file splitting and scalable coding embodiments may also both be used on the same program file. This allows most of the file to be cached while still providing the server control over when the file may be played back. It also allows subsequent playbacks of the file after the first to be progressively higher quality as more of the scalable sections are transmitted with every playback.

Brief Description of the Drawings

[0012] Fig. 1A is a block diagram of a functional architecture.

[0013] Fig. 2 is a block diagram of a conceptual architecture for one embodiment.

[0014] Figs. 3A and 3B illustrate a method for splitting a program file according to one embodiment of the present invention.

[0015] Figs. 3C and 3D illustrate a method of receiving and playing a previously split program file according to one embodiment of the present invention.

[0016] Fig. 4A illustrates an example of a scalably-coded program file.

[0017] Fig. 4B is a block diagram illustrating the use and combination of primary data and secondary data to provide different playback quality levels.

[0018] Figs. 4C and 4D depict examples of scalable coding according to one embodiment of the present invention.

[0019] Figs. 5A and 5B depict techniques for combining file splitting and scalable coding according to one embodiment of the present invention .

Detailed Description of the Preferred Embodiments

[0020] The following description of preferred embodiments of the present invention is presented in the context of an Internet-based jukebox or personalized radio station where it is desirable to stream music files. One skilled in the art will recognize that the present invention may be implemented in many other domains and environments, both within the context of musical files, and in other contexts. Accordingly, the following description, while intended to be illustrative of a particular implementation, is not intended to limit the scope of the present invention or its applicability to other domains and environments. Rather, the scope of the present invention is limited and defined solely by the claims.

Architecture Overview

[0021] Referring now to Fig. 2, there is shown a conceptual architecture of one embodiment of the present invention. In the architecture of Fig. 2, the invention is implemented in connection with a web-based "jukebox" 103, or personalized radio station.

[0022] Stream delivery system 150 interacts with jukebox 103 to specify a sequence of audio files to deliver to jukebox 103. In some embodiments, this jukebox 103 may run on a client such as a personal computer, while the stream deliver server system is part of a remote server, connected to the client via a network. Jukebox 103 transmits requests to stream delivery system 150, and stream delivery system 150 delivers the audio files, as tracks, to jukebox 103. Stream delivery system 150 also communicates with real-time subscription authorization module 157, which includes real-

time server 154 and database 156 that keep track of which user accounts are active and enforces global business rules about which accounts can listen to the radio at a given time. Within stream delivery system 150, there are a number of distinct software entities. Radio sequence generator 1613 receives requests from jukebox 103, receives format definitions 1611 and general constraints 1616, and receives recommendations from recommendation engine 107, to generate track selections to be transmitted to jukebox 103. The track selections generated by radio sequence generator 1613 specify which files to play according to estimated listener preferences as well as predetermined station formats. Authorization and content server 1614 keeps a record of the files that are selected by radio sequence generator 1613; server 1614 is consulted by radio sequence generator 1613 when files are requested. If generator 1613 does not provide the necessary security information, server 1614 flags this anomaly and declines to provide the data.

[0023] Referring now to Fig. 1A, there is shown a block diagram of a functional architecture for one embodiment of the present invention. Content index 110 provides a concise index of content stored in database 102, and is generated by conventional index generation means, to enable more efficient searching and updating of database 102.

Stream Delivery

[0024] In one embodiment, program files, such as audio files, are delivered to users as streamed data. The relationship discovery engine described in U.S. Patent Application Serial Number 09/846,823, filed on April 30, 2001, Patent No. X,XXX,XXX, describes one way to implement a personalized radio station, which may be used in conjunction with the present invention. The radio sequence transmitter 121 may deliver units of data to jukebox 103 in a format wherein each unit encodes a period of music. Since radio stations typically repeat their programming several times, it is beneficial to cache the data units in order to reduce the amount of transmitted data. In addition, if a sufficiently large time scale is used, different channels of the radio station may have considerable overlap among currently playing selections that are being delivered to various users. By identifying these common units, trans-

mitter 121 can take advantage of further economies of transmission, so as to provide more efficient delivery of audio data.

[0025] In one embodiment, the transmitter 121 employs file splitting to improve the streaming performance, and provide streaming performance even in situations where channel capacity would otherwise be insufficient to provide the desired level of quality. In some embodiments, files are split prior to being stored in the content database 102 or with the compressed signal files 1615. In other embodiments, the files 101 are stored in the content database 102 or with the compressed signal files 1615 without first being split; the files are then split prior to being transmitted to a user for playback.

[0026] Fig. 3A is a flow diagram illustrating a method of splitting and storing a program file (such as a bitstream) containing program data such as audio, video, or the like, according to one embodiment. The process begins with the unsplit file 2710. Prior to being split, the file 2710 may be encoded and/or compressed 2712, although such operations are not essential to the present invention. Next the file 2710 is split 2714 into two or more parts, resulting in at least a first part 2716 of the file and a second part 2718 of the file. Particular techniques for splitting 2714 file 2710 are described in more detail in connection with Fig. 3B below. In one embodiment, the second part 2718 is substantially larger than the first part 2716. The file may be split 2714 into more than two parts. The parts 2716 and 2718 of the file 2710 are then stored 2720 in the content database 102 or with the compressed signal files 1615, or in some other location for later transmission. Alternatively, in an embodiment wherein files are split 2714 immediately prior to being transmitted, parts 2716 and 2718 are transmitted 2720 to an end user or remote computer for playback.

[0027] Fig. 3B is a block diagram illustrating an example of a method of splitting 2714 file 2710 into parts 2716, 2718 according to one embodiment. In the illustrated example, the file 2710 has M bits 2722-1 through 2722-M. The system generates first part 2716 of the file 2710 by taking N out of every P bits. The system generates second part 2718 of the file by taking the remaining P-N out of every P bits. In Fig. 3B, N is equal to one, and P is equal to four. Thus, the system assigns first bit 2722-1 to first part 2716, and assigns the next three bits 2722-2 through 2722-4 to sec-

ond part 2718. The system then assigns fifth bit 2722-5 to first part 2716 and the next three bits 2722-6 through 2722-8 to second part 2718. The system repeats this pattern until all the bits of the file 2710 have been assigned to one of first and second parts 2716, 2718. In short, then, the system divides file 2710 into sections, with the first bit (or some other bit) of each section being sent to the first part 2716, and the remaining bits of each section being sent to the second part 2718. In general, the splitting technique of the present invention results in two or more sections 2716, 2718 each of which cannot be played back on its own, but can be played only when recombined with the other section or sections.

[0028] In one embodiment, N is equal to one, and P is equal to twenty, so that the first part 2716 is approximately 5% the size of the original file 2710, and the second part 2718 is approximately 95% the size of the original file 2710.

[0029] One skilled in the art will recognize that the system of the invention is not limited to file-splitting by bits, but may split files according to other units, such as bytes, or simply an arbitrary unit size. Alternatively, other file-splitting techniques may be used. For example, the system can include all headers, compression table selectors and scale factors into the first section 2716, and include all encoded program data (such as audio or video) into the second part 2718. Other methods of splitting the file 2710 into two or more parts may also be used.

[0030] In general, it is desirable in most embodiments that each part of the file 2710 is not decodable or able to be played back on its own, but can only be decoded and/or played back when recombined with the remaining part(s). This allows a part to be handled, transmitted, cached, or otherwise processed, without concerns that a user may permanently store and reuse an unauthorized copy of the program. Since a part cannot be used independently to recreate a recognizable facsimile of the signal in the original file 2710, the part can be cached by a client machine without any danger that the client has been given an unauthorized, useable persistent copy of the program file 2710. The ability to not provide a persistent usable copy of the program file can be advantageous because copyright holders may not wish to authorize such persistent copies, since the persistent copy could cannibalize revenues from sales of

Webgroup CZ a.s. Ex. 1002, Page 869 of 1406

the program file in a tangible medium (such as audio CDs), or paid future downloads, streamed or otherwise, of the program file.

[0031] Fig. 3C is a flow diagram illustrating a method of receiving and playing a previously split program file according to one embodiment of the present invention. When a file is to be transmitted from stream delivery system 150 to the jukebox 103, the jukebox 103 or server 1614 determines 2724 whether the second part 2718 of the file 2710 has previously been stored, or cached, locally and is available for retrieval. If the second part 2718 is not available locally for retrieval, jukebox 103requests transmission of both parts 2716, 2718 of the file 2710. In response, server 1614 retrieves the requested parts 2716, 2718 from the files 1615 or the content database 102 (depending on where the parts 2716, 2718 have been stored), and transmits both the parts 2716, 2718 of the file 2710 to the jukebox 103, which receives 2726 them. Alternatively, if the files 2710 are stored unsplit, server 1614 retrieves the file 2710 to be sent, splits the requested file according to techniques described above, and then transmits the parts 2716, 2718 to the jukebox 103, which receives 2726 them.

[0032] Upon receiving 2726 parts 2716, 2718, in one embodiment the jukebox 103 stores 2732 the second part 2718 locally, so as to avoid the need to retransmit the second part 2718 if it is needed in the future. The jukebox 103 combines 2728 both parts 2716, 2718, and plays back 2730 the recombined program file 2710. This reception 2726, combination 2728, and playback 2730 may all take place concurrently, for example according to a streamed transmission methodology. In one embodiment, as the bits arrive at the jukebox 103, they are combined 2728 and played back 2730; the jukebox 103 need not wait until the entirety of the parts 2716, 2718 are received 2726 before combining 2728 and playing them back 2730. In one embodiment, the recombined file 2710 and the first part 2716 are discarded 2731 after or during playback. Since the cached second part 2718 represents only a portion of the program file 2710 and in one embodiment cannot be decoded or played back on its own, the invention prevents users from retaining an unauthorized playable copy of the program file 2710. Ultimate control over the user's playback of the program file 2710 thus remains with the server 1614, since the stored second part 2718 cannot be used to play back of the file 2710 until the server 1614 retransmits the first part 2716.

[0033] If the second part 2718 has been received and stored locally in a prior session, jukebox 103 requests transmission of only the first part 2716 of the file 2710. In response, server 1614 retrieves the requested first part 2716 from the files 1615 or the content database 102, and transmits the first part 2716 to the jukebox 103, which receives 2734 it. Alternatively, if the files 2710 are stored unsplit, server 1614 retrieves the file 2710 to be sent, splits the requested file according to techniques described above, and then transmits the first part 2716 of the file 2710 to the jukebox 103, which receives 2734 it. The jukebox 103 retrieves 2736 the second part 2718 from local storage and combines 2738 the first and second parts 2716, 2718 to reconstruct the file 2710. The jukebox 103 plays back 2740 the reconstructed program file 2710. In one embodiment, as the bits arrive at the jukebox 103, they are combined 2738 with the stored second part 2718 to form a representation of the program file and played back 2740; the jukebox 103 need not wait until the entirety of the first part 2716 is received 2734 before combining and playing back the program. In other words, playback 2740 may take place while the first part 2716 is being streamed. As described above, in one embodiment, the recombined file 2710 and the first part 2716 are discarded 2731 after or during playback.

[0034] As can be seen from the description above, it is not necessary to transmit the second part 2718 more than once. The second part 2718 can be stored locally after the first transmission, so that, in one embodiment, only the first part 2716 need be transmitted for subsequent streaming playback of the program file 2710. Since in some embodiments the stored second part 2718 is substantially larger than the first part 2716, the present invention greatly reduces bandwidth requirements for streaming playback of the program file 2710. After the second part has been stored locally 2732, even clients with slow connections may effectively stream the program file 2710. Thus, from the user's perspective, the program file 2710 appears to be streamed in a manner equivalent to conventional streaming.

[0035] In addition, the described file splitting may provide advantages in licensing distribution of programs for playback by users. The file splitting benefits the licensor because the user does not receive a persistent usable copy of the program file, and the server retains control of playback of the program file 2710. This is advan-

tageous because in contexts where blanket licensing or compulsory licensing is available for providing streamed data, in audio programming for example, a persistent copy would cannibalize revenues from future licensed streamed data downloads, and lack of control would make collecting licensing revenues difficult. The file splitting benefits users who do not want to wait while a large file is transmitted and received before accessing the program file. By splitting the file and storing part locally, transmission of large and unwieldy amounts of data in real-time is unnecessary. The user has quick access to the program file, even if he or she is using a slow communication channel.

[0036] The present invention thus improves efficiency in the transmission of program files such as audio or video files, and helps avoids bottlenecks associated with conventional streaming techniques, while still providing control and security.

[0037] Fig. 3D is a flow diagram illustrating a method of receiving and playing a previously split program file according to one embodiment of the present invention, so as to provide improved streaming performance from a user's perspective, even if adequate bandwidth to stream the entire file 2710 is not available, through advance downloading of the second section 2718. For example, the second section 2718 may be transmitted in advance of the actual playback of an audio or video program in a first session, thus avoiding potential bottlenecks that may result when the entire program file 2710 is transmitted upon user demand according to streamed techniques. Advance transmission can be performed at off-peak times, thus avoiding bandwidth bottlenecks. This advance transmission can occur when the user is not actually listening to music, so as to facilitate improved usage of an otherwise idle network connection.

[0038] The jukebox 103 determines 2742 which program files are likely to be requested by a user, so that at idle times it can transfer data that is likely to be useful in the future. Such determination may be made, for example, by using the learned artist relationships described in U.S. Patent Application Serial Number 09/846,823, filed on April 30, 2001, Patent No. X,XXX,XXX, in order to "guess" which tracks the user is most likely to request in the future. Alternative methods of determination may also be used. In some embodiments, the files the user will likely want may be

known, such as when the user listens to a personalized radio station, or tends to listen to a particular online radio station. Such radio stations often have a list of the files that will be streamed later. Thus, this list can be used to determine 2742 what files will be required.

[0039] After the jukebox 103 determines 2742 what files will likely be required, the jukebox 103 requests the second parts 2718 of the files at a time when the connection is idle, or when sufficient bandwidth exists to transmit files. The authorization and content server 1614 then transmits 2744 the requested second parts 2718 to the jukebox 103. The jukebox 103 locally stores 2746 the second parts 2718 to the files. At a later time, when a user requests that a program file 2710 be streamed, the jukebox 103 requests the first part 2716 of the program file 2710, as described above. In response, authorization and content server 1614 transmits 2748 the first part 2716. The jukebox 103 combines 2750 the received first part 2716 with the stored second part 2718 to form a representation of the file 2710 and plays back 2752 the representation of the file 2710. Such a technique permits higher-quality playback than would otherwise be available, by pre-transmitting a significant portion of the data needed for playing back the media program. As described above, in one embodiment, the recombined file 2710 and the first part 2716 are discarded 2754 after or during playback.

[0040] In one alternative embodiment, instead of transmitting 2744 the second parts 2718 over a network, the second parts 2718 may be stored on physical media (such as a compact disc or floppy disk). That physical media is then physically sent to the location of the jukebox 103, where it can act as a local storage device, or the second parts 2718 may be transferred from the physical media to desired local storage. Thus, even for slow network connections, or for very large files, the user may enjoy a streaming experience, while the server retains control of the program file.

[0041] In another embodiment, the file is further split according to circumstances surrounding its transmission. The stream delivery system 150 begins to transmit all or part of the program file, such as an audio file, to the jukebox 103. When the program file, or part of the program file is partially transmitted, transmission is stopped. This stop can occur because of a disconnection between the stream

delivery system 150 and the jukebox 103, because a user wishes to stop transmission and use the bandwidth for other purposes (such as when skipping to the next streamed song in a personalized radio station), or other reasons. The partially transmitted section of the program file or part of the program file is stored locally. Then, at a later time, the rest of the program file or part of the program file is transmitted and combined with the stored part. Such a process is more efficient than starting to transmit the entire program file or part of the program file from the beginning if it was not completely transmitted in a prior session.

[0042] In one embodiment, the size of the transmitted information is used to determine whether the entire file or section has been transmitted, and if not, what further information must be transmitted. At the beginning of transmission, the stream delivery system 150 sends information to the jukebox 103 indicating the size of the file and parts to be transmitted. This information may be sent to the jukebox 103 in other ways as well, as part of a sequence listing, for example. The jukebox 103 can then use the received size of the file in conjunction with the stored file size to determine what remaining information is needed from the stream delivery system 150. Other methods to identify what further information is needed to complete a partially received file may also be used.

[0043] For example, one embodiment splits a 1000 byte audio file into two parts, a first section 2716 of 50 bytes, and a second section 2718 of 950 bytes. The stream delivery system 150 transmits 800 bytes of the second section 2718 to the jukebox 103. At this point, a user chooses to start transmission of another audio file, and end transmission of the first audio file. The transmitted 800 bytes of the second section 2718 are stored locally. Thus, to allow the user to listen to the first audio file in its entirety, only the remaining 150 bytes of the second part 2718 need be transmitted to the jukebox. This subsequent transmission of the remaining 150 bytes may be done as needed, such as when a user begins to listen to the audio file again and the first 800 bytes are taken from local storage, then the last 150 bytes are received from the stream delivery system. This transmission can also be performed in advance of the time the user wishes to listen to the audio file, such as a scheme where the jukebox 103 periodically checks for partial file sections, such as partial second parts 2718, and auto-

Webgroup CZ a.s. Ex. 1002, Page 874 of 1406

matically request transmission of the rest of the second part 2718. The jukebox 103 may identify partial file sections by comparing the total file size to the stored size, and then requesting only the missing information, or through other methods.

[0044] In another alternative embodiment, instead of discarding the first part 2716, the jukebox 103 encrypts the first part 2716 and stores the first part 2716 locally. This further reduces the amount of data that must be transmitted for program file 2710 playback. The server 1614 may still retain control over playback of the program file 2710 by controlling when the jukebox 103 may decrypt the first part 2716, for recombination with the second part 2718 and playback of the program file 2710. The second part 2718 could also be encrypted in place of, or in addition to, the first part 2716.

[0045] In yet another embodiment, transmitter 121 employs scalable coding to increase the quality of audio output despite limitations in channel capacity. Fig. 4A is a block diagram illustrating an example of a scalably-coded program file, including data stored in two sections 2804, 2806 that together form a program file 2802. Primary set of data 2804 is sufficient to play back the program file 2802 at a low quality level. Secondary set of data 2806 may be added to the primary set 2804 for higher-quality playback. The sets of data 2804, 2806 may be stored separately in the content database 102 or with the signal files 1615, or may be stored in a combined state, to be separated and transmitted as needed.

[0046] Fig. 4B is a block diagram illustrating the use and combination of primary data 2804 and secondary data 2806 to provide different playback quality levels. As mentioned above, the primary data 2804 is sufficient to play back the program file 2802 at a low quality level 2808. In one embodiment, the secondary data 2806 alone does not provide information sufficient for playback 2810 of the program file 2802. However, when the secondary data 2806 is combined 2812 with the primary data 2804, the combined data 2812 is sufficient to play back the program file 2802 at a high quality level 2814. For example, if the program file 2802 is an audio file, low-quality audio can be produced using the primary data 2804. Audio cannot be produced with secondary information 2806 alone. If secondary information 2806 is combined with the primary information 2804, output quality is enhanced. In one em-

bodiment, additional levels of information may also be provided, each of which can be combined with the lower levels to further enhance output quality. This allows caching of lower-quality audio received in a first session and later receiving secondary information 2806 in a second session, which enables the jukebox 103 to combine the primary and secondary information to output audio of increased quality.

[0047] Since different sets of data are available that successively improve program file 2802 quality level, the quality of the output by the jukebox 103 depends on how much data can be transmitted in the time available. The first time an audio track is transmitted, transmitter 121 provides jukebox 103 with the primary information 2804 first, which allows the jukebox 103 to playback a representation of the program file 2802. Secondary 2806 (and additional) information is transmitted to allow improved quality levels as time permits. Jukebox 103 outputs the audio track with whatever level of information it has received at the time output is to commence. If only primary information 2804 has been received, jukebox 103 outputs lower-quality audio. If secondary information 2806 has also been received, it is combined with the primary information 2804 and jukebox 103 outputs higher-quality audio.

[0048] In addition, jukebox 103, in one embodiment, caches the received information. If the same audio track is requested at a later time, transmitter 121 provides jukebox 103 with the next level of information. Therefore, even if jukebox 103 was unable to provide higher-quality audio during the first listening, it may be able to provide higher-quality audio during subsequent listenings, by combining secondary (and/or additional) information with the previously cached primary information to generate the higher-quality audio output. Such a technique facilitates the output of high quality audio even when network transmission capacities are limited.

[0049] Referring now to Fig. 4C, there is shown an example of a transfer sequence for a channel with moderate bandwidth. Initially, tracks A and B are requested. Primary information for track A 2820 is downloaded. As primary information 2820 is downloaded, a low-quality representation of track A 2828 is played, according to conventional streaming audio techniques. Downloaded primary information 2820 is cached.

Webgroup CZ a.s. Ex. 1002, Page 876 of 1406

[0050] Once the download of primary information for track A 2820 is complete, jukebox 103 begins to download primary information for track B 2822. This download may begin even though track A is still playing 2828. In the example shown in Fig. 4C, the download of primary information for track B 2822 is completed while track A is still playing 2828. Therefore, jukebox 103 begins to download secondary information for track B 2824. Then, when playback 2828 of track A is finished, jukebox 103 is able to output a high quality representation of track B 2830, by combining secondary information 2824 with previously downloaded primary information 2822. The output of the high quality version 2830 may take place while secondary information 2824 is still being downloaded, again using streaming techniques.

[0051] In the example of Fig. 4C, a request to play track A a second time is received. Therefore, once secondary information 2824 has been downloaded, jukebox 103 begins to download secondary information for track A 2826. Once the high quality version of track B 2830 is finished playing, jukebox 103 outputs a high quality representation of track A 2832, by combining secondary information 2826 with previously downloaded primary information 2820.

[0052] Referring now to Fig. 4D, there is shown another example of a transfer sequence for a channel with a lower bandwidth than that of Fig. 4C. Here, the secondary information for track B 2824 is not downloaded, because it would not arrive in time to improve the output of track B. Accordingly, a lower quality version of track B 2834 is output in lieu of the higher quality version 2830 of Fig. 4C. However, the higher quality version of track A 2832 can still be presented, since there is sufficient time to download secondary information for track A 2826 before the second playback of track A commences.

[0053] One skilled in the art will recognize that the tracks depicted in Figs. 4C and 4D may refer to individual songs, or song segments, or any other unit of information. One skilled in the art will further recognize that the scalable coding techniques described herein may be applied to video data, or to any other type of data, and are not limited to audio data.

[0054] The scalable coding techniques of the present invention thus facilitate the trading off of quality in bandwidth-limited situations, without requiring

Webgroup CZ a.s. Ex. 1002, Page 877 of 1406

complex bandwidth estimation and determination. If insufficient bandwidth exists for the delivery of higher-quality versions, the system simply continues playing lower quality versions of tracks. No skipping, pausing, or other interruption of the audio stream is necessary. Jukebox 103 can determine whether to continue any particular transfer to improve the available quality or to download the next requested track, based on upcoming track selections. At any given moment, the next data segment to request can be determined by requesting the highest priority data segment from the next few audio segments. In one embodiment, priorities are defined to either play audio at a maximum short-term quality level or at a consistent quality level.

[0055] In one embodiment, jukebox 103 requests data for downloading according to the following order of priorities:

Priority	Type of value
1	Primary information, next track
2	Secondary information, next track
3	Primary information, track after next
4	Secondary information, track after next
5	Tertiary information, next track
6	Tertiary information, track after next
7	Data for subsequent tracks

[0056] One skilled in the art will recognize that any desired priority list may be provided. For example, if item 5 in this table is moved up to the third rank, the system will give more priority to high quality presentation at the possible expense of inconsistent quality on lower bandwidth connections.

[0057] In one embodiment, locally-cached downloaded data is stored in an encrypted or otherwise protected form, so as to prevent its abuse and to inhibit copyright infringement. In another embodiment, primary information is stored in an encrypted or otherwise protected form, but secondary and subsequent information is not, since the secondary and subsequent information is unusable without access to the primary information.

Webgroup CZ a.s. Ex. 1002, Page 878 of 1406

[0058] In one embodiment, jukebox 103 downloads data sets when the user is not actually listening to music, so as to facilitate improved usage of an otherwise idle network connection. Jukebox 103 determines which items are likely to be requested by a user, so that at idle times it can transfer data that is likely to be useful for rendering audio segments in the future. Such determination may be made in the same way as described above with respect to the split files of Fig. 3D. In one embodiment, secondary information 2806 for such "predicted" audio segments is downloaded first, so that encryption is not required unless and until the user actually requests the tracks and the primary information 2804 is to be downloaded. Scalable coding may also be used to process a signal of a conventional broadcast radio station that plays music. An audio recognition device, as is conventional, pre-processes the signal in order to identify individual songs. Those portions of audio information that are not music are compressed and stored, and a transfer sequence is sent to jukebox 103 that references these recently encoded non-music segments as well as previously known and cached musical segments. The recently encoded segments can be encoded at a lower quality level in order to allow a jukebox 103 connected by a low speed line to transfer the recently encoded segments in real-time while still playing the cached musical segments at a higher quality level.

[0059] As with file splitting, portions of scalably coded files may also be sent on physical media rather than transmitted over a network. Similarly, if sections of scalably coded information are only partially transmitted, they may be stored locally, and then only the information not previously received is transmitted in a subsequent session.

[0060] File splitting and scalable coding may also be used in combination. Fig. 5A is a block diagram illustrating how a program file 2902 may be divided into primary data 2904 and secondary data 2906, and the primary data 2904 file split into a first part 2908 and a second part 2910. The primary data 2904 is split as described above with respect to Figs. 3A and 3B. This allows almost all of the primary data 2904 and secondary data 2906 to be cached locally without requiring encryption. Since, in one embodiment, the second part 2910 of the primary data 2904 is not playable without the first part 2908, and the secondary data 2906 is not playable without a playable

set of primary data 2904, all of the program file 2902 except the first part 2908 of the primary data 2904 may be cached locally without providing the user with a usable copy of the program file 2902 that may be played back. This allows the server 1614 to retain control of playback of the program file 2902, as long as the first part 2908 of the primary data 2904 is not stored locally in a usable form.

[0061] Fig. 5B is a block diagram that illustrates how such a scheme provides advantages for streaming program files 2902. First, the first and second parts 2908, 2910 of the primary data 2904 are transmitted 2912 to the client by the server 1614. The first and second parts 2908, 2910 may be transmitted at roughly the same time in response to the jukebox 103 requesting the program file 2902. Alternatively, the second part 2910 may be transmitted in advance, after determination of what files 2902 are likely to be desired, as described above with respect to Fig. 3D. In an embodiment wherein the second part 2910 is transmitted in advance, the first part 2908 is transmitted in response to the jukebox 103 requesting the program file 2902. The first and second parts 2908, 2910 are sufficient to provide low quality playback 2914. The second part 2910 is then stored 2916 locally, and the first part 2908 is discarded. At a later time, such as when the jukebox 103 requests the program file 2902 again, the server 1614 transmits 2918 the first part of the primary data 2908 and the secondary data 2906. This allows sufficient information for the program file 2902 to be played back at a high quality level 2920. The secondary data 2906 is stored locally 2922, and the first part 2908 of the primary data 2904 is discarded. For subsequent playback of the program file 2902, only the first part 2908 of the primary data 2904 need be transmitted 2924 in order to enable high quality level playback 2920. Again, after such playback, the first part 2908 of the primary data 2904 is discarded, so that the server may retain control of program file 2902 playback. As an alternative to discarding the first part 2908, the first part 2908 may be encrypted, with decryption only occurring under the server's 1614 control.

[0062] Thus, a significant portion of the program file 2902 may be stored locally, with only the relatively small first part 2908 being transmitted from the server 1614 to provide the user with streaming file performance. This allows high quality streaming performance even over a relatively narrow bandwidth connection.

[0063] As described above, when scalable coding or file splitting is used, the jukebox 103 plays back a representation of the program file. This representation may be an exact digital replica of the program file, such as when the program file is split, all parts are transmitted to the jukebox 103, and the entire file is combined for playback. The representation may also be a less than exact replica, such as when only some portions of a scalably coded program file are combined and played back.

Recommendation Engine

[0064] One method of determining in advance what program files a user may want streamed is through use of a recommendation engine, described more fully in U.S. Patent Application Serial Number 09/846,823, filed on April 30, 2001, Patent No. X,XXX,XXX. Note that there are also many other ways to determine what program files a user may want streamed in advance. Referring now to Fig. 2, the jukebox 103 or personalized radio station accepts a user's selections of music tracks and makes additional recommendations as to music tracks the user is likely to enjoy. The user is able to search for particular tracks and/or artists, and to control the playback of selected tracks. The system monitors the user's behavior with regard to searching, listening, and playback control, and generates and analyzes logs of such behavior in order to refine recommendations. Advertising, offers, and other information may be selected and presented to the user based on observations of user behavior and analysis as to which material may be of interest to the user.

[0065] Compressed signal files 1615 contain descriptions of music tracks, and in one embodiment contains digitized representations of the music tracks themselves. Compressed signal files 1615 are stored, for example, using conventional database storage means or in a conventional file system, and in one embodiment include several fields providing descriptive information regarding music tracks, such as title, album, artist, type of music, track length, year, record label, and the like.

[0066] Selected tracks are played via jukebox 103, which is implemented in one embodiment as a standalone application, or as a plug-in or bundled feature in browser 105. Jukebox 103 receives digitized representations of music tracks and plays the tracks over a speaker or headphones at the user's computer. In one embodiment,

jukebox 103 can download and save music tracks in local storage (such as a hard disk drive, memory, or other local storage) in a compressed format, such as MP3, for playback on the user's computer or on a portable digital music listening device.

[0067] Recommendation engine 107 generates track preferences based on user information. Radio sequence generator 1613 uses track preferences, along with general constraints 1616 and format definitions 1611, to generate a sequence of tracks to be played. General constraints 1616 include particular rules and restrictions on the sequence of tracks, as may be required by law or as may be determined to be desirable for marketing or aesthetic purposes or for other reasons. Examples of constraints 1616 include: "no more than one song per hour from a particular album," or "do not play a fast song immediately after a slow song." Radio sequence generator 1613 may also incorporate a randomization element, if desired, and may be configurable by a website operator.

[0068] The track list is sent to jukebox 103 to be played to the user. A user activates jukebox 103 and selects music tracks for playback and/or purchase, via a user interface including controls and selectors. Authorization and content server 1614 checks that the appropriate security measures are in place (in order to prevent the user from "hacking" jukebox 103 to request unauthorized tracks from content server 1614), obtains the actual music tracks from files 1615, and provides them to jukebox 103 for output.

[0069] In one embodiment, the connections among the various elements of Figs. 1A and 2 are implemented over the Internet, using known protocols such as HTTP and TCP/IP. Secure sockets layer (SSL) or other encryption techniques may be employed for added security.

[0070] The recommendation engine may be employed in connection with conventional radio station programming techniques, to implement an improved personalized radio station. As is known in the art, conventional radio stations typically divide a programming block into a number of segments. Each segment is assigned a programming category, such as "power hit," "new release," "recurrent hit," and the like. For a particular programming block, music tracks are assigned to each of the segments based on the particular programming format of the radio station. Music

scheduling software, such as Selector® by RCS Sound Software, applies heuristic rules for repetition limits and classes of songs, to automatically generate track lists for use by radio stations. The recommendation engine may be combined with such existing radio station programming techniques, to populate the defined segments with music tracks that are likely to appeal to a particular listener. Additional rules may be applied in generating track lists, so as to limit undesired repetition and to comply with limiting legislation (such as the Digital Millennium Copyright Act) and other restrictions.

[0071] From the above description, it will be apparent that the invention disclosed herein provides a novel and advantageous system and method for providing a user with a streaming program file experience. The foregoing discussion discloses and describes merely exemplary methods and embodiments of the present invention. As will be understood by those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example, the invention may be applied to other domains and environments, and may be employed in connection with additional applications where personalized recommendations are desirable. Accordingly, the disclosure of the present invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

[0072] What is claimed is:

1. In a client connected to a network and including a local storage device, a computer-implemented method of receiving and playing a media file comprising at least a first part and a second part, comprising:

receiving over the network and from a remote server in a first session the second part of the media file;

storing the second part at the local storage device;

receiving over the network and from a remote server in a second session subsequent to the first session the first part of the media file and not the second part of the media file;

combining the first part received in the second session with the stored second part after the start of the second session; and

playing a representation of the media file at the local client after combining at least part of the first and second parts after the start of the second session.

2. The computer-implemented method of claim 1, wherein the second part is not sufficient to properly play the representation of the media file back without being combined with the first part.

3. The computer-implemented method of claim 2, wherein the received parts of the media file are encoded, and the second part may not be decoded without being combined with the first part.

4. The computer-implemented method of claim 1, wherein the representation of the media file may not be played back at the local client without authorization by a remote server.

5. The computer-implemented method of claim 4, wherein authorization comprises the reception over the network and from a remote server the first part of the media file.

Webgroup CZ a.s. Ex. 1002, Page 884 of 1406

6. The computer-implemented method of claim 1, wherein the neither the first part nor the second part may be used independently to recreate a recognizable facsimile of the content of the media file.

7. The computer-implemented method of claim 1, wherein the media file is divided into a plurality of sections, each section comprising a plurality of bits, wherein the first part comprises a first subset of bits from each section, and the second part comprises the remaining bits from each section.

8. The computer-implemented method of claim 1, wherein the media file is divided into a plurality of sections, each section comprising a plurality of bits, wherein the first part comprises a first bit from each section, and the second part comprises the remaining bits from each section.

9. The computer-implemented method of claim 7 or 8, wherein one of the sections contains exactly X bits, and wherein each of the remaining sections contains exactly Y bits, wherein X is less than or equal to Y.

10. The computer implemented method of claim 9, wherein Y equals 20.

11. The computer implemented method of claim 1, wherein the first part comprises headers, compression table selectors and scale factors of the media file.

12. The computer-implemented method of claim 1, further comprising:

receiving over the network and from a remote server during the first session the first part of the media file; and

playing the representation of the media file back at the local client during the first session.

13. The computer-implemented method of claim 1 or 12, wherein the first part is not stored at the local storage device after the playing of the media file.

Webgroup CZ a.s. Ex. 1002, Page 885 of 1406

14. The computer-implemented method of claim 1 or 12, wherein the combined first and second parts are not stored at the local storage device after the playing of the media file.

15. The computer-implemented method of claim 1, wherein the played representation of the media file is an exact digital copy of the media file.

16. The computer implemented method of claim 1, wherein:

the media file further comprises a third part;

the first and second parts are combinable to form a representation of the media file at a first quality level; and

the first, second, and third parts are combinable to form a representation of the media file at a second quality level higher than the first quality level.

17. The computer implemented method of claim 16, further comprising:

receiving over the network and from a remote server the third part of the media file;

storing the third part at the local storage device;

combining the received third part with the stored first part and the stored second part to form the representation of the media file at the second quality level; and

playing the representation of the media file after combining the first, second, and third parts.

18. The computer implemented method of claim 17, wherein the third part is received over the network and from a remote server in a session other than the first session.

19. The computer implemented method of claim 17, wherein the third part and not the second part is received over the network and from a remote server in a session other than the first session.

Webgroup CZ a.s. Ex. 1002, Page 886 of 1406

20. The computer-implemented method of claim 17, wherein the first part is not stored at the local storage device after the playing of the media file.

21. The computer-implemented method of claim 17, wherein the combined first, second, and third parts are not stored at the local storage device after the playing of the representation of the media file.

22. In a client connected to a network and including a local storage device, a computer-implemented method of receiving and playing a media file comprising at least a first part and a second part, comprising:

receiving over the network and from a remote server in a first session the first part of the media file, the first part of the media file a representation of the media file at a first quality level;

receiving over the network and from a remote server the second part of the media file, wherein the first and second parts are combinable to form a representation of the media file at a second quality level higher than the first quality level;

storing the second part at the local storage device;

receiving over the network and from a remote server in a second session subsequent to the first session the first part of the media file and not the second part of the media file;

combining the received first part with the stored second part; and

playing a representation of the media file at the local client.

23. The computer-implemented method of claim 22, wherein the first part is not stored at the local storage device after the playing of the media file.

24. The computer-implemented method of claim 22, wherein the representation of the media file is played after combining the first and second parts.

Webgroup CZ a.s. Ex. 1002, Page 887 of 1406

25. The computer-implemented method of claim 22, wherein the representation of the media file is played in response to a command, and the representation of the media file is generated from at least the first part.

26. The computer-implemented method of claim 25, wherein the representation of the media file is generated from the second part as well as the first part if both the first part and the second part have been received at the time of playback.

Webgroup CZ a.s. Ex. 1002, Page 888 of 1406

WO 03/042783 CA 02466482 2004-05-07 PCT/US02/35903

FIG. 1A

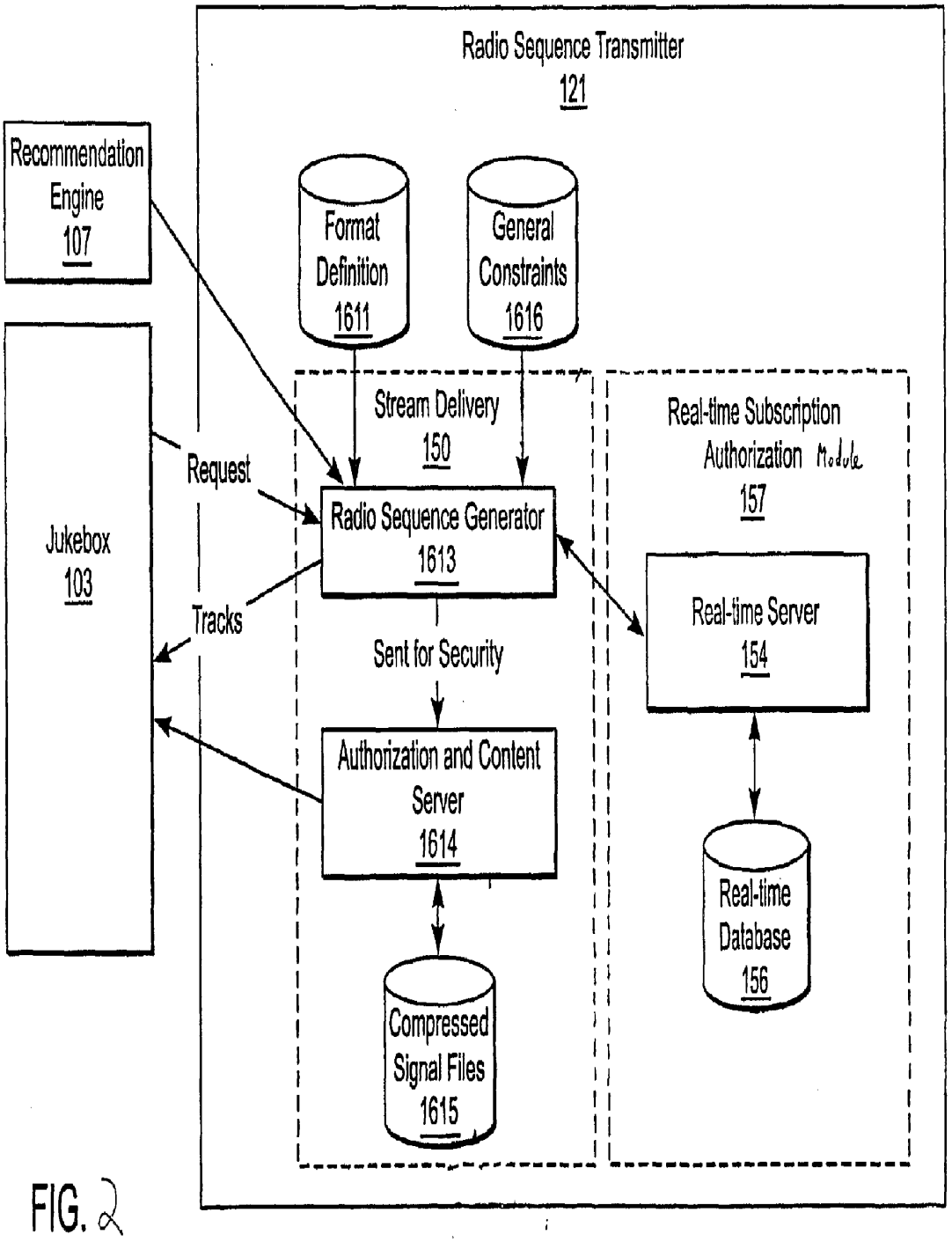

Radio Sequence Transmitter
121
Recommendation Engine
107
Format Definition
1611
General Constraints
1616
Stream Delivery
150
Real-time Subscription Authorization Module
157
Request
Jukebox
103
Radio Sequence Generator
1613
Tracks
Sent for Security
Real-time Server
154
Authorization and Content Server
1614
Real-time Database
156
Compressed Signal Files
1615

FIG. 2

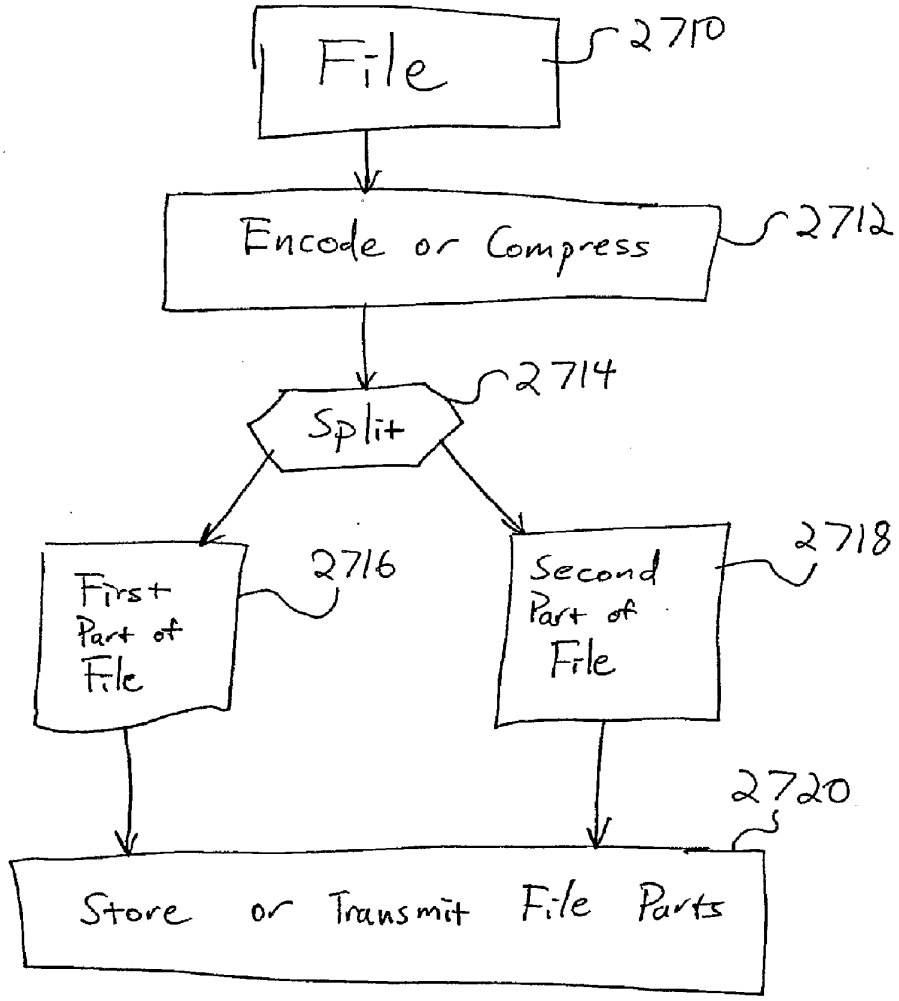

File
2710
Encode or Compress
2712
Split
2714
First Part of File
2716
Second Part of File
2718
2720
Store or Transmit File Parts

Fig. 3A

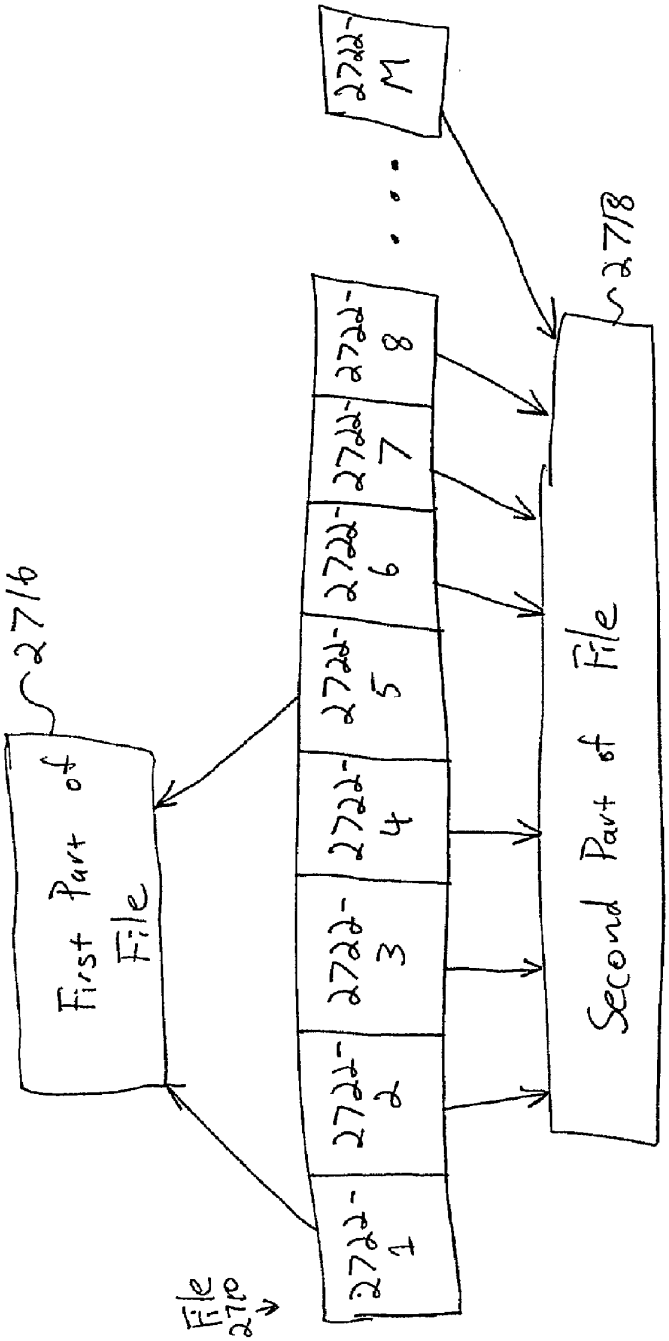

2722-1
2722-2
2722-3
2722-4
2722-5
2722-6
2722-7
2722-8
2722-M
2718
Second Part of File
2716
First Part of File
File 2720

Fig. 3B

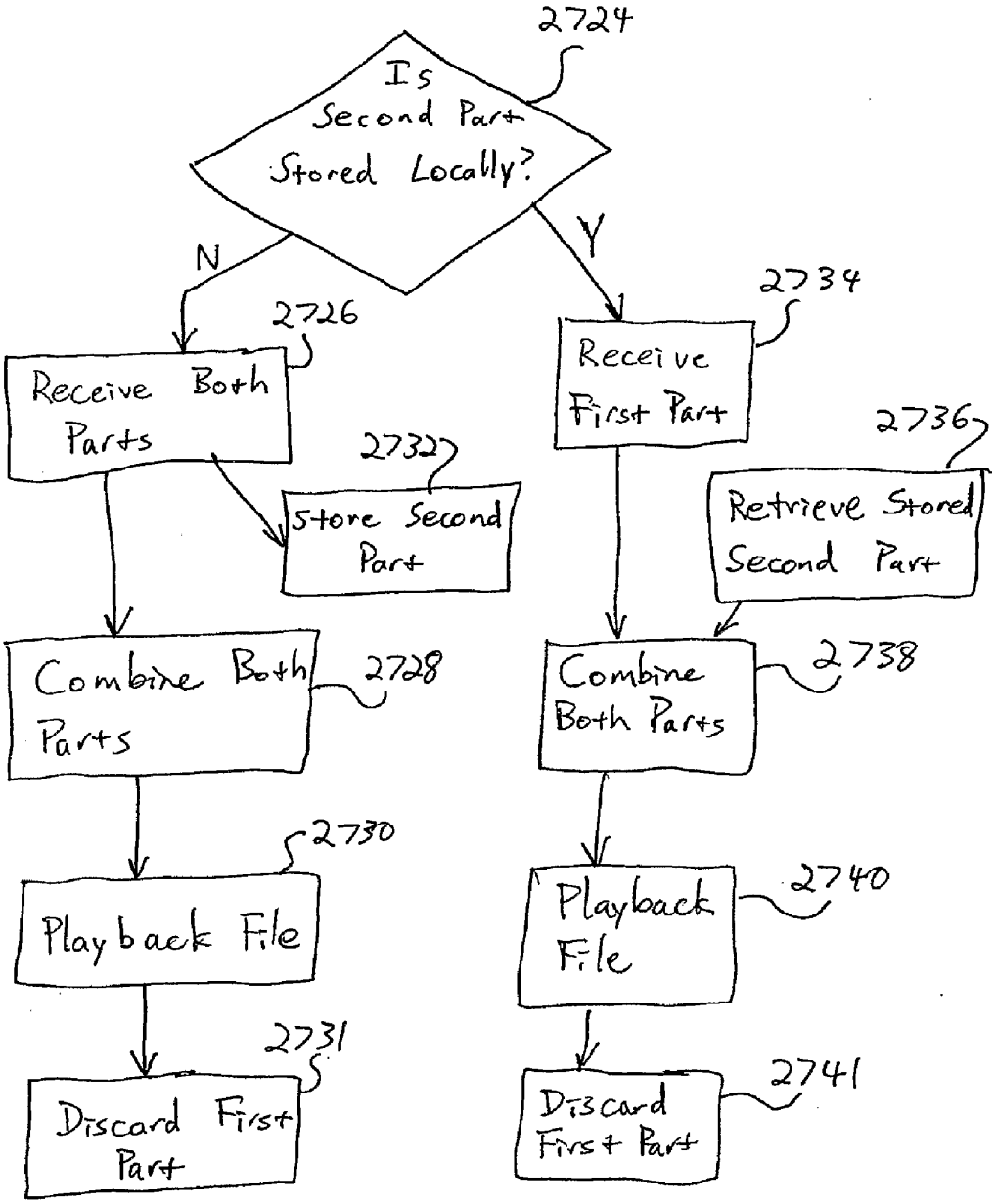

2724
Is Second Part Stored Locally?
N
Y
2726
Receive Both Parts
2732
Store Second Part
2734
Receive First Part
2736
Retrieve Stored Second Part
2728
Combine Both Parts
2738
Combine Both Parts
2730
Playback File
2740
Playback File
2731
Discard First Part
2741
Discard First Part

Fig. 3C

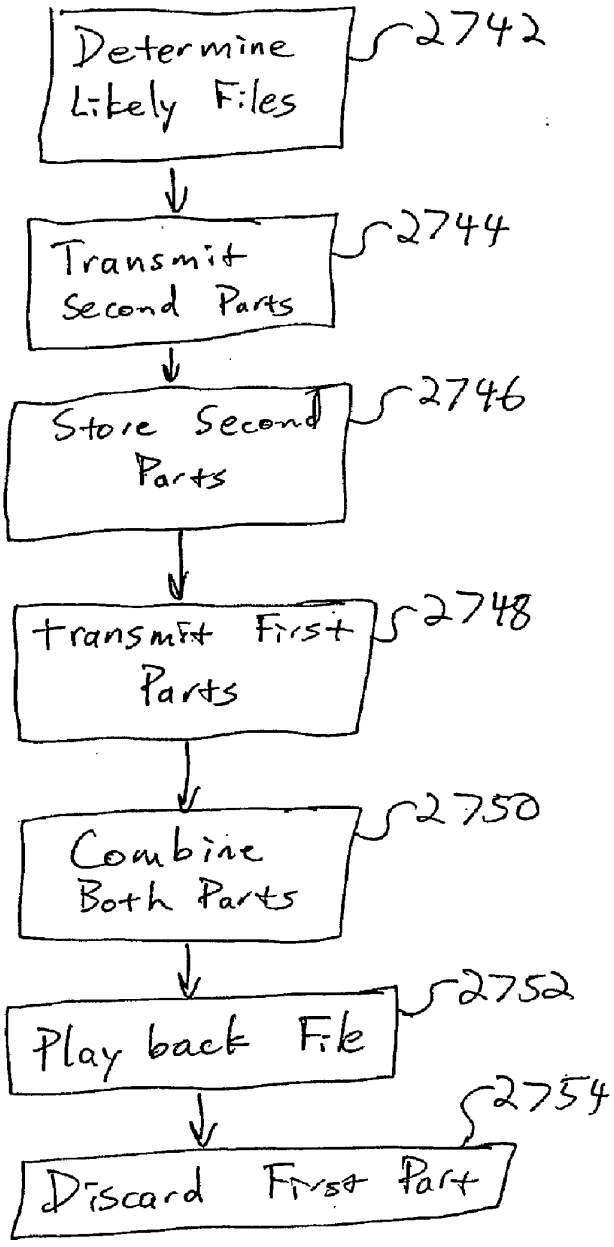
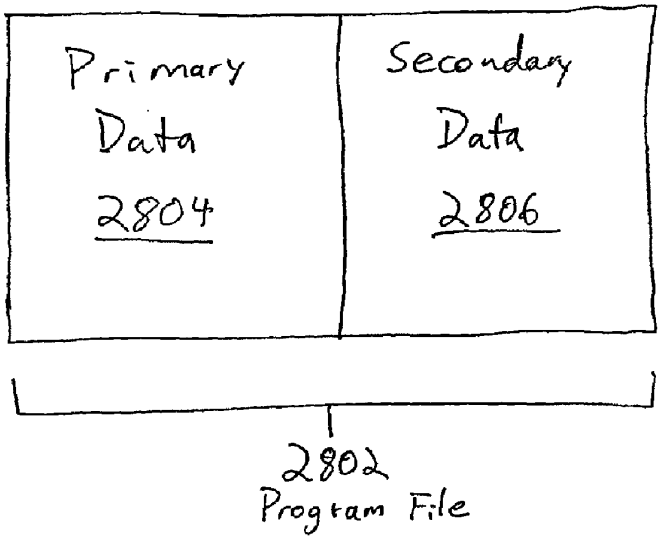

Determine Likely Files
2742
Transmit Second Parts
2744
Store Second Parts
2746
Transmit First Parts
2748
Combine Both Parts
2750
Play back File
2752
Discard First Part
2754

Fig. 3D

Fig. 4A


Primary Data 2804
Secondary Data 2806
2802 Program File

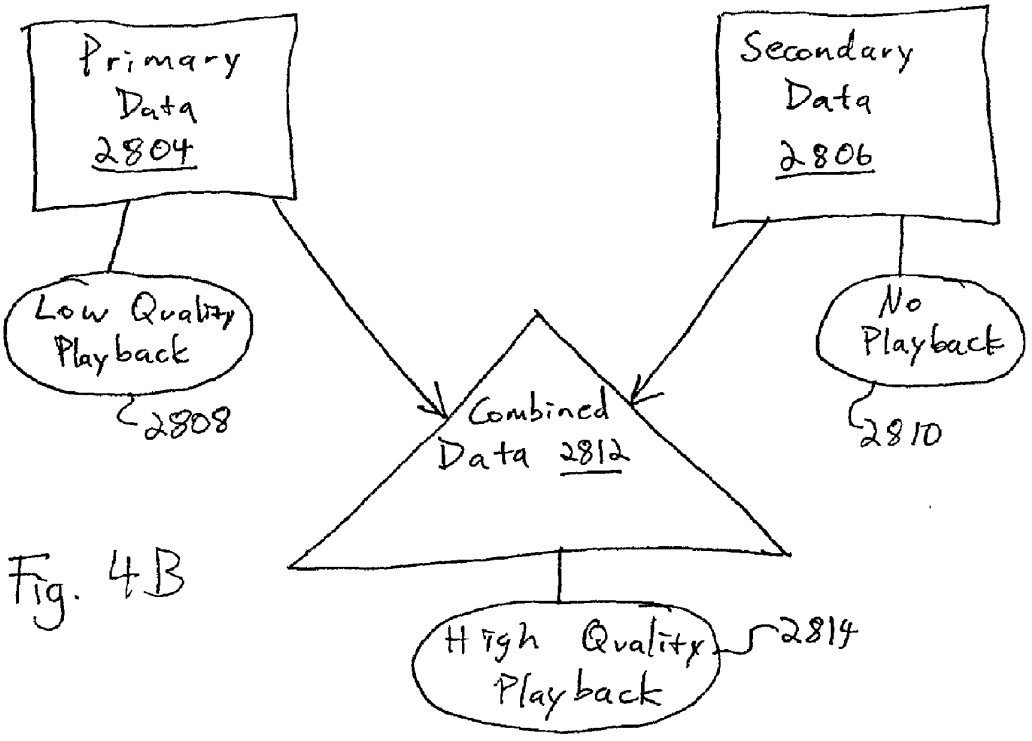

Primary Data 2804
Secondary Data 2806
Low Quality Playback
2808
Combined Data 2812
No Playback
2810
High Quality Playback
2814

Fig. 4B

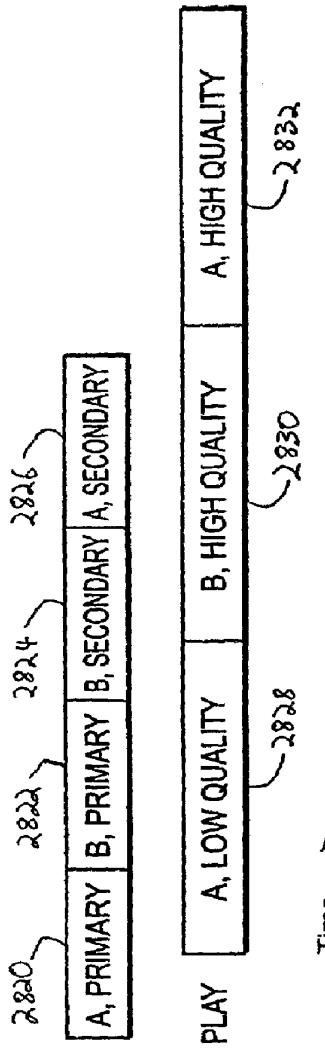

DOWNLOAD
A, PRIMARY
B, PRIMARY
B, SECONDARY
A, SECONDARY
2820
2822
2824
2826
PLAY
A, LOW QUALITY
B, HIGH QUALITY
A, HIGH QUALITY
2828
2830
2832
Time

FIG. 4C

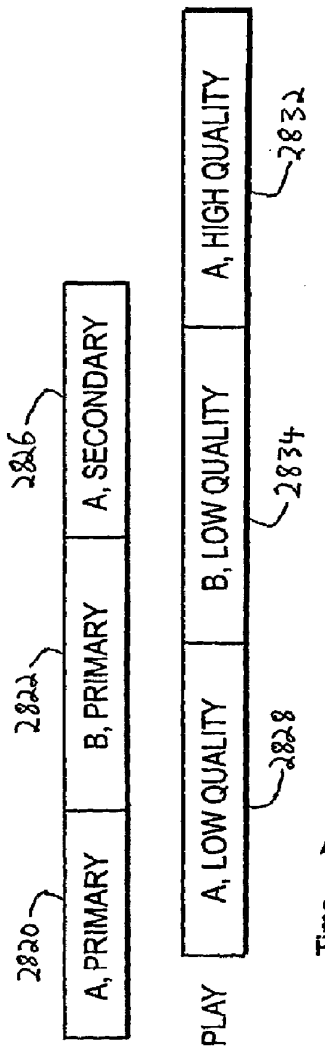

DOWNLOAD
A, PRIMARY
B, PRIMARY
A, SECONDARY
2820
2822
2826
PLAY
A, LOW QUALITY
B, LOW QUALITY
A, HIGH QUALITY
2828
2834
2832
Time

FIG. 4D

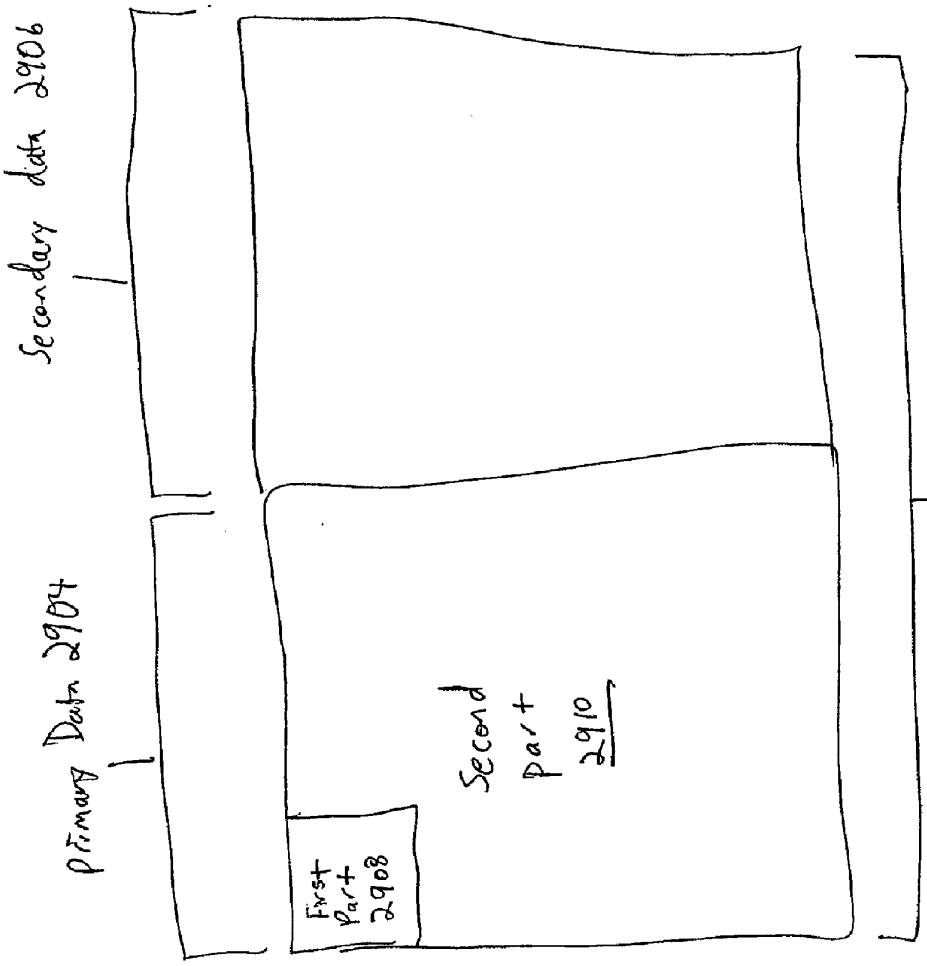

Secondary data 2906
Primary Data 2904
First Part 2908
Second Part 2910
Program File 2902

Fig. 5A

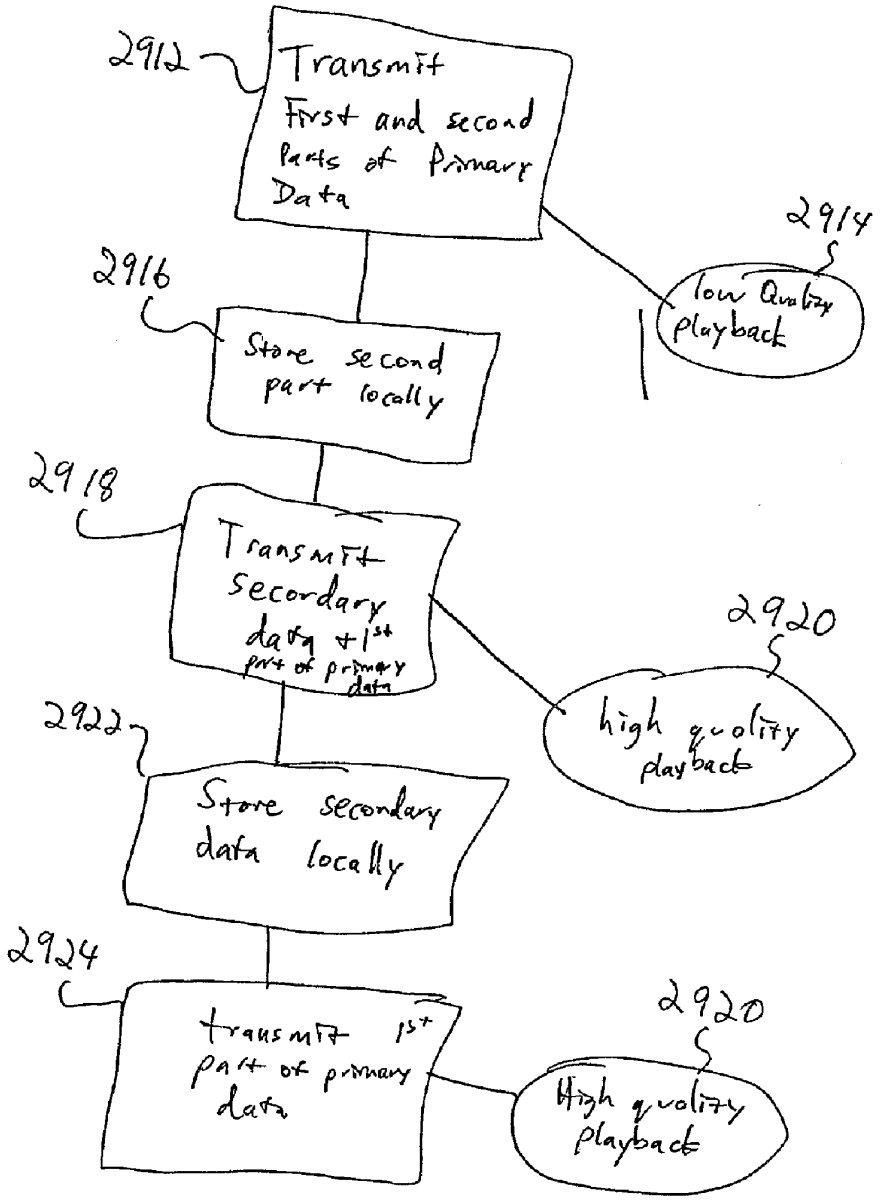

2912
Transmit First and second Parts of Primary Data
2914
low Quality playback
2916
Store second part locally
2918
Transmit Secondary data + 1st part of primary data
2920
high quality playback
2922
Store secondary data locally
2924
transmit 1st part of primary data
2920
High quality playback

Fig. 5B

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(71) Applicant:
ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE
1015 Lausanne (CH)

(72) Inventors:
- **Mattavelli, Marco**
1196 Gland (CH)
- **Brunetton, Sylvain**
1009 Pully (CH)

(74) Representative:
Ravenel, Thierry Gérard Louis et al
I C B,
Ingénieurs Conseils en Brevets SA,
7, rue des Sors
2074 Marin (CH)

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(54) Method for coding/decoding of a digital signal

(57) The invention concerns a method for primary processing a digital signal comprising the steps of :

- providing a digital signal to a primary processing unit ;
- primary processing said signal with said primary processing unit according to a plurality of primary processing algorithms to provide primary processed output signals,
- determining statistics of use of at least one of said primary processing algorithms,
- providing a digital statistics signal representative of said statistics for each of said primary processed output signals
- associating to each of said primary processed output signals its own statistics signal ;
- determining a complexity primary processing information signal based on said statistic signal.

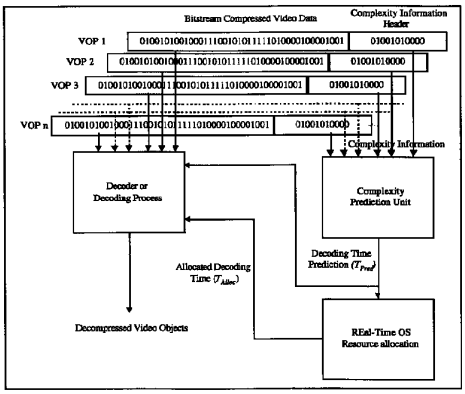


Figure 12

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Description

DEFINITION OF THE INVENTION

[0001] The present invention is a processing apparatus which aims at controlling and guaranteeing the real-time performance of data processing. The invention is based on the principle of collecting statistics of the algorithms used to process the data, on transmitting such statistics when necessary, and of associating a complexity information to such statistics. The real-time processing control can be done generating a processing time prediction signal which is a function of the complexity information, and use such prediction signal to provide processing resources which guarantee real-time processing or enables the definition of an associated degraded processing that guarantees real-time processing. Although the described invention is of general application, this document describes its application to video coding and decoding and suggests the straightforward extensions to audio coding-decoding, and to composition and rendering of media objects.

1. FIELD OF THE INVENTION

[0002] The implementation of software based video/audio decoders is an advantageous solution over traditional dedicated hardware systems. The main reason of this fact is the possibility of decoding several different video/audio compression standards, at different levels and profiles, by just changing the software while using the same hardware platform, main memory, and interfaces. Another favorable feature is the flexibility of the decoder able to cope with new developments and new tools included into future versions of the standards by just updating the decoding software. However, simultaneously guaranteeing real-time performance, needed when processing video/audio bit-streams, and an efficient use of the processing power, remains a very difficult task.

[0003] The present invention reports the main reasons of such difficulties and presents a new technique able to predict the decoding time of compressed video/audio bit-streams without the need of the actual decoding. This can be obtained if appropriate statistical information about the actual encoding processing is included and transmitted with the compressed video/audio data. Moreover, the present invention reports how such results can be used to implement new efficient processing resource allocation strategies. New possible schemes of such intelligent interactions between the encoder and the real-time OS are also proposed. An example of implementation for the MPEG-4 VM6 video algorithm based on these developments is presented. This implementation enables, at the same time, to guarantee real time performances even when the available processing resources are lower than the one theoretically necessary, and it yields optimal (minimal) image quality degradation. Such results are obtained by using the prediction of the decoding-resource needs to implement Computational Graceful Degradation techniques. The invention only reports simulation results for the MPEG-4 VM6.1 video compression algorithm, but the techniques and concepts presented here are of general application. Indeed, these techniques can be easily applied to audio coding, synthetic audio reproduction and to any future or existing compression and composition method. More precisely, they can be used for any video compression standard that is capable of transmitting in an appropriate form the statistical coding information (i.e. MPEG-1 and MPEG-2 using an appropriate transport system), and they can be implemented in any processor-based platform.

[0004] The present description is organized as follows. Section 2 discusses the problems and utility of defining and using worst case and average case complexities, justifying the need of complexity prediction. Section 3 presents the modeling of decoding complexity and the general principles of the prediction techniques. Section 4 presents the background of the invention. Section 5 summarizes the main concepts of the invention while section 6 summarizes the content of the diagrams and drawings illustrating the details and main characteristics of the invention.

[0005] In section 7, experimental results of the MPEG-4 VM6 texture coding algorithm are reported. Section 8 presents the definition of the proposed intelligent interactions between real-time OS-schedulers and video decoders. Section 9 presents the basic principles and the definition of the developed Computational Graceful Degradation (CGD) techniques, and section 10 reports overall experimental results of the control of decoding complexity using complexity prediction joint with the application of CDG techniques. Finally, section 11 concludes the description of the invention, summarizing the achievements of the invention by declaring the corresponding claims.

2. WORST-CASE AND AVERAGE-CASE DECODING COMPLEXITY

[0006] A simple solution to the problem of the variability of decoding complexity is to implement software/hardware solutions that always guarantee worst case complexity decoding. Such solutions are, in fact, the ones implicitly implemented in most of the dedicated hardware decoders. Dedicated hardware platforms, in general, are designed to guarantee worst case complexity decoding. The various hardware modules implementing the different decoding procedures are synchronized with the input/output data rate. These dedicated hardware modules can always handle any input bit-stream, not exceeding a maximum rate, and containing compressed sequences of appropriate maximum image reso-

Webgroup CZ a.s. Ex. 1002, Page 900 of 1406

lutions. This can be always guaranteed, irrespectively from the coding options selected to produce the compressed bitstream.

[0007] In contrast, in the case of programmable platforms it is necessary to define what is a worst case decoding complexity. Let us consider video coding even if the same concept can be extended to natural and synthetic audio and to other form of multimedia processing. In the video compressing field one can assume that the worst case decoding complexity is represented by the decoding of each bit/macroblock, using the coding options allowed by the considered standard that requires the highest decoding time. The coding algorithms/modes of H.263 can be approximately considered as a superset of the algorithms/modes of the various video compression standards (H.261, MPEG-1 and MPEG-2). The complete results and details of this worst-case/average-case study are omitted here for brevity. The conclusions resulting from this analysis can be summarized as follows :

1) Decoding functions can be divided into two classes. For one class a worst case can be easily defined. Let us denote this class as A. To this class belong function such as IDCT, inverse quantisation, motion compensated prediction in its various form (forward, backward, bi-directional, overlapped ... .). For the other class denoted as class B, complexity is extremely data dependent and cannot be easily characterized by the simple parameters of an hypothetical MPEG-2 like complexity profile. To this class belong operations such as VLD, VLC coding, Syntax-based Arithmetic Coding (SAC) and in general all parsing operations. The difficulty of defining a worst case is evident considering for instance SAC for which the difference between a theoretical worst-case and experimental cases is about two orders of magnitude.

2) A strict worst case complexity analysis, of both class A and B functions, leads to unrealistic results. In other words, the computational resources necessary to handle the strict worst-case complexity decoding is much higher than the resources used in average.

3) For class A functions, the actual decoding complexity depends on the actual coding options and reports a large range of variability.

4) For class B functions, the actual decoding complexity reports a dependence on coding options, but presents a reasonably narrow range of variability which is much lower than the range theoretical worst case-average case.

[0008] Worst case analysis, therefore, is not adequate to define a useful decoding complexity reference. This fact is true not only for operations which are strongly data dependent (class B), but in general for all functions even those that have a very well defined worst case such as all class A functions. From these results it is clear that guaranteeing a worst case decoding implies guaranteeing the decoding of pathologically complex sequences that in practice have an extremely low probability of occurrence. Moreover, such a guarantee would imply the allocation of a processing power up to two orders of magnitude higher than the one actually needed for the decoding of the standard test sequences. The processor in practice would work in normal conditions exploiting only a small fraction of the theoretically available processing power. Such solution to the problem of guaranteeing real-time performance is not economical and, obviously, not useful in practical applications.

[0009] Another possibility for the solution of the problem of guaranteeing real-time performance could be to consider as reference an average case decoding complexity. Before being able to successfully use such average complexity, a few questions need to be answered. Is it meaningful to define an average complexity? How can it be done? Is the average complexity sequence dependent? How can it be converted on different platforms? Can the average complexity accurately be described by parameters such as image resolution and bit-rate? Are average results characterized by sufficiently narrow variance bounds so as they can be used a priori without the need of knowing some information about the actual complexity of the incoming sequence?

[0010] One will here briefly summarize the main results and experiments that answer the mentioned questions. So as to try to define an average case for the complexity that have been considered in previously, the H.263 standard uses four typical test sequences over a wide bit-rate range from 16 kbit/sec up to 1024 kbit/sec. The sequences in CIF format are : Akiyo (300 frames), Coastguard (300 frames), Foreman (300 frames) and Mobile & Calendar (300 frames), and all these test sequences have been evaluated at fifteen different bit-rate values. Although a rigorous statistical analysis would have required a much higher number of sequences and specific statistical confidence tests, it is believed that the number of frames (1200) and the different contents of the test images are well representative of typical image sequence contents. One have considered separately the operations that have unrealistic worst case complexities (class B) from the one with a well-defined worst case behavior (class A). The experiments, for the class B operations, yield figures that are not strongly bit-rate dependent. Variance bounds for each frame are relatively narrow and these values do not report relevant variations depending on the test sequence. Such results confirm also the fact that it is not necessary to worry about strict worst case complexity. In the other case of class A, the complexity of the operations reports a relatively regular statistical behavior at very low bit-rates (< 16 kb/s), but complexity reports dependence on the bit-rate, on the image content and in particular on the used encoding options.

[0011] Figure 1 reports one example of H.263 complexity using different coding options for the same sequence (Akyio

Webgroup CZ a.s. Ex. 1002, Page 901 of 1406

CIF) and same bit-rate. On this figure, the decoding time or decoding complexity (expressed in μsec) is given versus the frame number for the sequence Akyio CIF encoded with H.263 at 128 Kb/sec using different coding options. Top curve options : advanced prediction modes (APM), syntax-based arithmetic coding and unrestricted motion vectors (UMV) ; middle curve options : APM and UMV ; bottom curve options : UMV. The same sequence presents, at the same bit-rate, average-decoding complexities that range up to a factor 4 (from about 0.05 to 0.2 sec per frame). Local fluctuations for a relatively static sequence such as Akyio are also considerably large. The decoder is the Telenor H.263 software release running on a Sun Ultrasparc platform.

[0012] Figure 2 reports the same experiment for the sequence Coastguard. The range of the complexity figures considering both average and local values is very large as can be easily noticed. On this figure, decoding time or decoding complexity (expressed in msec) is given versus frame number for the sequence Coastguard encoded with H.263 at 128 Kb/sec using different coding options. Top curve : advanced prediction modes (APM), syntactic arithmetic coding and unrestricted motion vectors (UMV) ; middle curve APM and UMV ; bottom curve : UMV. The same sequence at the same bit-rate has average decoding complexities that range within a factor 4 from about 0.05 to 0.2 sec per frame. The decoder is the Telenor H.263 software release on a Sun Ultrasparc platform.

[0013] Although far from the theoretical worst case complexities, the variation range is less than one order of magnitude, experimental results reports behaviors for which it is difficult to be able to predict the average complexity values only relying on resolution and bit-rate. Image content and coding options (i.e. intra or inter prediction modes, advanced prediction modes, half pixel vector prediction and so on) play a fundamental role. As it will be reported in the next sections, the situation of the complexity variations for MPEG-4 sequences is much higher due to the presence of different sized VOPs arbitrarily shaped objects, of static and dynamic sprites, and the large variety of coding modes.

[0014] From a pure mathematical point of view an average complexity value can always be defined considering a large data-base of encoded sequences and using the more probable occurrence of encoding options. Conversely, such a theoretical average value is not useful at all for the aim of the present invention that is the efficient scheduling of each decoding task and the efficient use of the available processing power. Even the local average values of the actual sequence often are not stationary, and their variations around the mathematical average one are so unpredictable that no useful scheduling policy can be realized.

[0015] Therefore, the consequences of this study are that straightforward solutions to the problem of real-time resource allocation policy are of two kinds. The first is a sustained over-sizing of the processing resources. The second is to accept interruptions of the audio/video output stream when the needed decoding resources exceed the ones available on the system. Obviously, both are not desirable being respectively not efficient and economical, or they provide a quality of the services which may easily results perceptually unacceptable.

[0016] The ideal solution would be to develop techniques that are able to accurately predict such unknown behaviors and, therefore, make feasible resource allocation policies that can guarantee real-time and minimize QoS degradation.

[0017] The description of such techniques and the presentation of the results are the subjects of the next sections.

[0018] As discussed above, the key issue for the implementation of any real-time application on a software-based platform is to be able to understand when the required decoding processing time exceeds the available processing time without the need of performing the actual decoding. This is particularly important, for instance, in MPEG-4 systems in which a number of bit-streams containing a variable number of VOPs and sprites need to be decoded respecting real-time constraints, but it is also important for existing compression standards (MPEG-1, MPEG-2). The available processing time is known, in general, because it is allocated by the OS-scheduler to each decoding process. The problem is how to estimate the necessary decoding processing requirements without the need of an actual decoding of each of the incoming VOP bit-streams. Decoding each bit-stream using a priori allocated processing could result in exceeding the time slot and, therefore, in missing real-time requirements. Real-time requirements are generally defined implicitly by the frame/sampling rate of video audio bit-streams or can be easily extracted by an appropriate relative time information associated to each video frame or audio object (also denoted as time stamp). Such extraction of the real-time constraints is trivial and is not discussed here. The consequence of missing real-time constraints is the introduction of sudden interruptions on the video content. A complete analysis of the conditions which lead to miss real time-constraints for the various OS scheduling algorithm (pre-emptive multi-threading, etc.) is out of the scope of this document and it is not discussed here. The reader can refer to the included reference S. Battista, F. Gasperoni, B. Klaiber, M. Mattavelli, L. Pautet, S. Tardieu, Concurrent over Sequential Modeling for MSDL, ISO/IEC JTC1/SC29/WG11, Doc. M1525, Maceio, Brazil, November 1996 incorporated herein by reference.

3. BACKGROUND OF THE INVENTION

[0019] Without any doubt, the recent trend in multimedia system implementation technology is towards moving from dedicated real-time hardware to software/processor based platforms. The processing power of the last on the market processors, and of the newly announced video/audio-processor families, enables the software implementation of video/audio decoding of various compression standards and different resolution levels. Unfortunately, simply relying on

Webgroup CZ a.s. Ex. 1002, Page 902 of 1406

the average processing power does not guarantee to respect real-time constraints of video/audio decoding ; furthermore it does not solve the problem of an efficient processing resource allocation. The fundamental reason of these facts is that the complexity of the video/audio decoding process is a fluctuating function of the time, as described in M. Mattavelli and S. Brunetton, A statistical study of MPEG-4 VM texture decoding complexity, ISO/IEC JTC1/SC29/WG11, Doc. M924, Tampere Finland, July 1996 incorporated herein by reference.

[0020] The term complexity here simply means the time needed by the decoding process. Other more abstract measures of complexity such as the amount and type of executed algorithmic elementary operations, the executed processor cycles, the amount of memory transfers to and from the external frame memories, and their combinations could be used as more precise and specific complexity measures. In the context of the present invention however, one is interested on the final results of these complexity factors. Without any loss of generality, one can consider, for any specific target software-hardware implementation, the actual processor decoding time. Indeed all the above mentioned measures of complexity can be converted for each specific platform into a single complexity measure given by the execution time.

[0021] Even by considering a specific processor platform or a specific compression standard with a relative level and profile, the complexity of video decoding is a variable and unpredictable quantity, as described in ISO/IEC MPEG2 incorporated herein by reference. The actual figures of decoding complexity depend in a complex way on many different factors. One can mention, for instance, the actual bit-rate, the image content, the options used for encoding, the Group Of Picture (GOP) structure, or the Group Of Video Object Planes (noted as VOP) structure (GOV) which can change on the fly, the state of the buffer that controls the quantization parameters and many others, as described in M. Mattavelli and S. Brunetton, Scalability of MPEG-4 VM based on the computational power of texture decoding, ISO/IEC JTC1/SC29/WG11, Doc. M925, Tampere, Finland, July 1996 incorporated herein by reference.

[0022] The complexity variability range increases with the richness of the standard. Richness means the number of implemented coding algorithms or coding modes and the number of possible coding options having different complexities. For instance, the richness of H.263 is much higher than H.261, but it is lower than the new MPEG-4 standard under development where multiple Video Object Planes (VOPs) of different sizes and characteristics need to be decoded.

[0023] In this description, Video Object (VO) means a temporal sequence of two-dimensional or three-dimensional arbitrarily shaped Video Object Planes (VOP). In case of rectangular or square shapes, these video object planes, also called hereinafter video planes, are denoted by the classical name of frames. An audio object means a stream of packets containing digital audio samples, or audio events in mono or multichannel format which can be associated to a VO. One or more audio packets can be associated to one VOP or video frame. By three-dimensional arbitrarily shaped video object planes we mean the projection or view of any three-dimensional natural or synthetic 3-dimensional object or 3-dimensional model.

In summary, the processor decoding time of each incoming frame or VOP for any given compression standard is highly variable and impossible to predict just relying on resolution and bit-rate information. Therefore, an efficient resource allocation policy (process scheduling) which aims at guaranteeing real-time performances is very difficult in these conditions. Scheduling policies that release the thread to the decoding process and receive it back after the task is completed are clearly not adequate. The same conclusion is true for a priori allocated processing time intervals. If more processing time than the one actually allocated is needed, real-time constraints are already violated by the video application. The implementation of emergency measures such as skipping frames or portions of images, on one hand might succeed in recovering the correct timing, on the other could have catastrophic effects on the Quality of Services (QoS) of the video application.

4. SUMMARY OF THE INVENTION

[0024] It is an object of the present invention to control and to guarantee real-time performance of data processing. It is another object of the present invention to provide a processing apparatus that associates a complexity information to the processed data.

[0025] It is another object of the present invention to provide a coding-decoding apparatus that further includes the associated complexity information to be transmitted to the decoder.

[0026] It is another object of the present invention to provide a system that, on the basis of said complexity information, provides a complexity prediction signal to be used to allocate processing resources to optimize real-time data processing.

[0027] It is another object of the present invention to provide a processing system that supervises the processing using an allocated resource signal, a predicted complexity signal, a complexity information signal and provide a processing that satisfy specified real-time constraints. According to the present invention, there is provided a processing apparatus comprising a method for processing a digital signal including the steps of : providing a digital signal, processing said signal using a plurality of processing algorithms, determining statistics of use of processing algorithms, providing a digital statistical signal representative of the statistics, associating to each of the processed signal its own

Webgroup CZ a.s. Ex. 1002, Page 903 of 1406

associated statistics and determining a complexity information signal based on said statistic signal.

[0028] According to the present invention, there is also provided a coding apparatus that further inserts the said complexity information signal into a transmission layer containing or not the associated data and transmits the said complexity information to a decoder apparatus.

[0029] According to the present invention, there is also provided a processing apparatus that generates from the complexity information signal a processing prediction signal which is used to allocate processing resources in order to optimize the real-time processing of the associated data.

[0030] According to the present invention, there is also provided a processing apparatus that receives the processing prediction signal, the allocated processing resources and the complexity information signal, and uses the said signals to generate processing directives so as the data is processed according to the system real-time constraints.

[0031] Although the described invention is of general application, the present description describes its application to the preferred embodiment of the video coding and decoding, and suggests the straightforward extensions to audio coding-decoding and to composition and rendering of media objects.

[0032] The technique provided by the present invention is capable of predicting with an excellent degree of approximation the complexity of video or audio decoding, without the need of the actual decoding of the incoming bit-stream. These results are possible when an appropriate coding information can be included in the incoming bit-streams. The experiments demonstrate that the degree of approximation achievable is excellent considering the range of variability of the actual decoding complexity of video or audio compression standards, and that such degree is more than adequate to enable an efficient processor resource allocation. One application of the proposed technique to the MPEG-4 VM6 video coding algorithm is also demonstrated. Real-time video performances are guaranteed using the predicted decoding complexity to implement Computational Graceful Degradation (CGD) features whenever the video decoding complexity exceeds the available processing resources. By means of the proposed technique, it can be guaranteed at the same time the satisfaction of the real-time constraints and the aim of minimizing the unavoidable degradation of the QoS due to temporary lack of processing resources or to peaks of the intrinsic video decoding complexity. The same approach can obviously be used for audio decoders.

[0033] It is clear that the approach is not limited to the coding/decoding process for compression purposes, but that it can be applied to the process of composing and rendering media objects (i.e. video, audio, text, graphics, two-dimensional and three-dimensional graphic primitives and models) to the display output. The term composition means the action of putting these objects together in the same representation space. The action of transforming the media objects from a common representation space to a rendering device (speakers and viewing window) is called rendering. An illustrative example of the terminal environment for the handling of multimedia object is reported in Figure 19. More specific possible examples of the decoding, composition and rendering processes are reported in Figure 20 and 21. Figure 19 reports the processing stages in an audiovisual terminal illustrating inputs outputs and processing of audiovisual objects. Figure 20 reports an example of a decoder which provides uncompressed audiovisual objects to the audio/video compositor. Figure 21 reports an illustrative example of composition of audiovisual objects.

[0034] Additional objectives and advantages of the invention will be set forth in the description that follows, and in parts will be obvious from the description, or may be learned by practice of the invention. The objectives and advantages of the invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

5. BRIEF DESCRIPTION OF THE DRAWINGS

[0035] The accompanying drawings constitute a part of the specification and illustrate the principles of the invention.

- Figures 1 and 2 report a graphical representation of the decoding complexity of H.263 video illustrating the needs and background of the invention for the video decoding embodiments ;
- Figure 3 reports the an example of the modeling of processing algorithms. It includes the association of processing statistic to each state associated to the execution of a specific algorithm ;
- Figure 4 reports the extension of the model of figure 3 for a more complete and accurate model of the algorithmic complexity ;
- Figure 5 reports one preferred embodiment of the invention for the MPEG-4 video decoding. It illustrates a complexity model with the associated statistics for MPEG-4 texture decoding ;
- Figure 6 extends the model of figure 5 including additional coding modes and coding parameters plus the associated statistics ;
- Figures 7 and 8 report simulation results of a preferred embodiment of the invention. By associating a complexity measure to the statistics of the data processing (video decoding in the preferred embodiment), it is possible to predict the processing complexity of data ; actual decoding time, predicted decoding time and prediction error are represented.

Webgroup CZ a.s. Ex. 1002, Page 904 of 1406

- Figure 9 reports the measured decoding time and Decoding Time Prediction (expressed in μsec) versus the sequence VOP number of the MPEG-4 VM6 for the sequence Coastguard (Background, Small boat, Big Boat and Water VOPs) at 64 Kb/s ; these results being obtained on a specific decoder.
- Figure 10 reports the measured decoding time and Decoding Prediction Time (expressed in μsec) versus the sequence VOP number of the MPEG-4 VM6 for the sequence Coastguard (Background, Small boat, Big Boat and Water VOPs) at 128 Kb/s ; these results being obtained on a specific decoder.
- Figure 11 reports the measured decoding time and Decoding Prediction Time (expressed in μsec) versus the sequence VOP number of the MPEG-4 VM6 for the sequence Coastguard (Background, Small boat, Big Boat and Water VOPs) at 128 Kb/s ; these results being obtained on a specific decoder
- Figure 12 reports a block diagram of part of the invention. The statistics carrying the complexity information and associated to each data to be processed are read by a prediction unit which generates a prediction signal sent to the OS scheduler which allocates resources as function of the prediction signal. The figure is reporting one example of preferred embodiment for the video decoding of multiple VOP ;
- Figure 13 reports a block diagram of part of the invention relative to the construction of the complexity information header at the encoder side. Statistics of the coding and/or decoding algorithms/modes/parameters are generated at the encoder side and then inserted in a bit-stream to be transmitted to the decoder ;
- Figure 14 reports a block diagram of part of the invention relative to the interaction between the decoder supervisor and the decoder using various signals in order to guarantee real-time decoding of the data ;
- Figure 15 reports the diagram of a complexity model including associated degradation algorithms ;
- Figures 16, 17, 18 report examples of results of a preferred embodiment of the invention. The video decoding for the MPEG-4 texture decoding is provided imposing a maximum constant decoding time (complexity) for each VOP. Degradation results are also reported ;
- Figure 19 reports an example of a possible preferred embodiment of the invention illustrating the various interactions and processing related to the handling of media objects (audio, video, text, graphic, 2-D and 3D models) in a multimedia terminal ;
- Figure 20 reports an example of a portion of multimedia terminal block diagram that is another possible embodiment of the invention, and
- Figure 21 reports a drawing illustrating the composition and rendering processes, both being possible preferred embodiments of the invention.

6. PREDICTING DECODING COMPLEXITY BY MEANS OF ENCODING STATISTIC INFORMATION

6.1 A model of decoding complexity for data dependent processing

[0036] To achieve the objectives of the present invention, one need a simple model of data processing complexity that preferably has the following properties :

1) it is only related to the processing of the incoming data,
2) it is as compact as possible so that its description requires the minimum amount of information (number of bits),
3) it is representative in terms of processing complexity,
4) it is not related to the any specific software or hardware implementation of the given processing,
5) it can be easily mapped on any software/hardware platform implementation,
6) it is sufficiently accurate to yield useful predictions of the processing execution time.

[0037] A way of describing the operations of processing incoming data can be to consider the sequence of ensembles of operations as appropriate distinct algorithms. If the sequence of algorithms is not dependent explicitly on the actual content of the data to be processed or by the intermediate results of the processing, the complexity of the processing can be easily calculated a priori and the complexity-modeling problem is trivial.

[0038] In general, if the sequence of operations is explicitly data dependent (i.e. the processing instructions are contained in the data themselves) and depends also on intermediate results of the processing, the problem of modeling algorithmic complexity is much more difficult.

[0039] It is well known that any processing can be modeled by a finite-state-machine for which next state depends on the input, current state and current output (the well-known machine of Mealy). This formulation is rigorous and general. In theory it could also be used to measure the processing complexity. If one assume to associate a complexity measure to each state transition, one could measure the global complexity of the processing by monitoring the state of the machine at each step, and adding up the complexity related to each state transition. In practice, such model is not useful for two main reasons. The state machine description of usual video decoding would result extremely complex. The global complexity associated to the sequence of state transition would result too abstract to make feasible the mapping

Webgroup CZ a.s. Ex. 1002, Page 905 of 1406

on different implementations than the canonical state machine. In practice, it would be extremely difficult to derive a complexity expressed as total execution time for different specific platforms.

[0040] A more useful model is to represent the decoding process by a flux diagram for which each data state corresponds to the execution of a specific algorithm f. Such representation is more naturally related to the usual representations of the execution of software programs. Let us associate to each data state a measure of the occurrence of such state, which is incremented each time the data processing falls in each state. Let us suppose to monitor the execution of the decoding process and, for the occurrence of each algorithm execution, to increment the associated measure. The result of this model is a representation of the data processing given by a sequence of measures associated to each algorithm composing the complexity model. In general, any encoder knows which algorithm sequence is needed for the decoding, since the encoding and the coding syntax define without ambiguities the decoding algorithms . In particular, video decoders have to implement a decoder, to build, reference images, therefore they are able indeed to generate the described complexity representation.

[0041] This modeling approach has the nice feature that admits different levels of complexity resolution. One can consider only a very limited number of main algorithms, or partitioning into a large set of sub-algorithms or any intermediate representation. The cost of the representation, obviously, depends on the number of algorithms that compose the model. The accuracy of the complexity representation depends on the number and type of algorithms, in other words on their relevance in terms of complexity. A simple example of a complexity model is reported in figure 3 which reports a flow graph for the modeling of a processing composed by three algorithms f and associated occurrence complexity measures c. In this model, the processing is represented by tree algorithms f and by the associated counters c. Figure 4 reports a flow graph of the model of Figure 3 for which the complexity modeling of algorithms f1 and f3 have been designed by partitioning f1 and f3 in two new algorithms and their associated complexity models, the model is more accurate since the algorithms 1 and 3 are partitioned into other algorithms associated to new algorithm occurrence measures. It must be noted that what are considered as coding modes associated to specific coding options in the usual coding language, are from the point of view of the invention distinct algorithms, since different complexities correspond to different coding modes. It must be also noted that the executions of the same algorithm using different parameters can be considered as the executions of distinct algorithms associated to the corresponding parameters.

[0042] The mapping of the complexity into any software/hardware implementation is straightforward. By knowing the complexity (execution time) of each algorithm on a specific platform and by using the information of the actual occurrence measure of each algorithms in the decoding process, one can easily calculate the total execution time (what is denoted as complexity) for the processing of an incoming bit-stream.

[0043] The key issue of this approach is to be able to find the representation in terms of minimal set of algorithms and sub-algorithms (tools) that being representative of the processing complexity, yields the best approximation of the execution time. This is particularly evident for very complex processing task such as video decoding. The importance of a minimal set is to keep as compact as possible the cost of the complexity representation and, therefore, make possible its separate transmission at a low cost.

[0044] Another feature of the proposed model is that it can easily take into account parallel software or hardware implementations. No hypothesis has been done on the internal implementation of each algorithms. In fact, they can be implemented at any level of hardware or software parallelism. The case for which different algorithms of the model have parallel implementations can also be treated by simplifying the model and just ignoring some counters associated to algorithms implemented in parallel. Simple practical examples of these cases are given below after the complete definition of the modeling-prediction complexity problem.

6.2 A technique to predict video decoding complexity : Decoding Complexity Prediction by Coding Statistics (DCPCS)

[0045] Let us consider a specific software/hardware implementation of a video decoder, running on a specific hardware platform. Since no hypothesis is made on the architecture of the software or on the architecture of the hardware, the approach doesn't loose any generality.

[0046] Let us consider that the true complexity C^* (execution time) for the decoding of a given input data (i.e. a single frame or a MPEG-4 VOP) is a function P^*, specific for the software/hardware implementation at hand, of the sequence of all the various processing operations p_l 1=1,...,L needed to decode the incoming data :

$$C^* = P^*(p_1, p_2, .., p_l, ... p_L). \quad (1)$$

[0047] The p_l describe the sequence of operations that define the decoding process. They are, for instance, the parsing of the bit-stream, the sequence of operations for decoding the in various form Intra, Inter, Not-Coded, Shape, Padding, the inverse quantisation, the IDCT, the motion compensation in its various form OBMC, simple prediction, 4 vector prediction , the parameter that characterize the processing of each prediction mode (integer pel vector prediction, half pel vector prediction), the number of bitwise parsing operations, the number of non-zero DCT coefficients and so on.

Webgroup CZ a.s. Ex. 1002, Page 906 of 1406

[0048] The actual expression of the function P* is certainly extremely difficult to obtain. On the other hand, the objective of the present invention is to avoid the necessity to know all the parameters that define the complexity, but just to be able to predict the true complexity C* with a good degree of approximation. The cost of the description of the exact complexity function P* in terms of all coding parameters would be, indeed, prohibitive for the purposes of the present invention.

[0049] Therefore, let us leave the problem of finding the exact expression of the complexity function P* and try to find a sufficiently accurate approximation F of the function P* which provides a prediction C, using the model proposed in the previous section. One is therefore limited to consider a number I of algorithms fi, with i=1,...,I with I << L, and the associated model counters c_i :

$$C = F(c_1 \cdot f_1, c_2 \cdot f_2, .. c_i \cdot f_i, .. c_1 \cdot f_1) = c_1 \cdot w_1 + c_2 \cdot w_2 + ... + c_i \cdot w_i + ... + c_1 \cdot w_1 \approx C^* \quad (2)$$

where the coefficients w_i related to each c_i are complexity weight corresponding to the model algorithm f_i which accounts for the specific software and hardware architecture at hand.

[0050] Let us suppose now, that the values of the vector c for the incoming data (frame or VOP) are known. If the vector w of the w_i weights is known, one can predict the complexity of the incoming VOP bit-stream by a simple linear combination.

6.3 A method to estimate the algorithms weight coefficients w

[0051] The values of the vector w can be obtained by direct measurements on the platform, if the complexity values (execution time) of each function are accessible. In general, they can be also indirectly estimated by means of a simple linear regression applied on a set of measures of the true complexities C^*_k, with k =1 ... K, obtained by K samples of data processing (i.e. K frames or K VOPs taken from different sequences) on the selected platform :

$$\begin{cases} C^*_1 = W_1 \cdot C_{11} + W_2 \cdot C_{12} + ... + W_i \cdot C_{1i} + ... + W_I \cdot C_{1I} \\ C^*_2 = W_1 \cdot C_{21} + W_2 \cdot C_{22} + ... + W_i \cdot C_{2i} + ... + W_I \cdot C_{2I} \\ ..... \\ C^*_k = ... \\ ..... \\ C^*_K = W_1 \cdot C_{K1} + W_2 \cdot C_{K2} + ... + W_i \cdot C_{Ki} + ... + W_I \cdot C_{KI} \end{cases} \quad (3)$$

[0052] In matrix form the estimated vector of weights w can be expressed by the classical least square minimization expression :

$$\hat{w} = (c^T c)^{-1} c^T C, \quad (4)$$

where T indicates the transpose matrix,
and -1 indicates the inverse matrix.

[0053] Obviously, the linear regression and the measures of the C_k complexities can be made off-line since they have as objective the estimation of the vector w which is characteristic of a specific software/hardware decoder implementation and do not depend on the incoming data.

[0054] Once the vector of the w parameters is estimated, the evaluation of the actual complexity C of the incoming bit-stream can be simply done by calculating the linear combination of the complexity function. In practice, this can be done by reading the actual c_i counter values written in an appropriate form in the incoming data, and calculating the value of F(c). This fact implies, for instance, that video compression standards should be able to insert complexity information in appropriate headers of frames or VOPs, or transmit them as accompanying information. Figure 7 reports the measured decoding time and Decoding Time Prediction (expressed in msec) versus the sequence VOP number of the texture decoding of MPEG-4 VM6 for the sequence Akyio (Background and Akyio VOPs) at different bit-rates. The decoder is the Momusys VM6 on a Sun Ultrasparc. The absolute value of the Decoding Time Prediction error is

Webgroup CZ a.s. Ex. 1002, Page 907 of 1406

reported in the bottom curve near the 0 value.

6.4 Definition of the complexity models for the texture decoding of MPEG-4 VM6 VOPs

[0055] In the previous section, a model for decoding complexity has been developed, aiming at being at the same time related only to the processing and apt to be mapped on any platform implementation. These ideal requirements have been expressed in six points. A last requirement needs to be verified. Does the model and the associated complexity representation provide complexity (time) predictions sufficiently compact but accurate enough for the aims of the present invention? There is described in this paragraph an example of application of the modeling to the texture decoding of MPEG-4 VM6 VOPsm, excluding the processing of shape coding and the padding of macroblocks. This exclusion is just motivated by the fact that at the time of the modeling and simulations, one have investigated only the stable coding modules of the MPEG-4 VM. The same modeling principles can be applied to those and to all new MPEG-4 coding algorithms and modes.

[0056] Let us partition the decoding of each MPEG-4 VOP in the following seven algorithms which represent all the texture coding process of any VOP including luminance and chrominance (Intra, Inter, Skip, Advanced Prediction Mode (ADM), Normal Prediction Mode (NPM), DCT coefficient processing (DCT_coeff), and DCT line processing (DCT_line)). Let us associate to each coding-decoding algorithm a statistic measure defined as follows. For Intra, Inter and Skip, it counts each time a macroblock is coded by using the Intra, Inter or Non-Coded coding mode. For ADM and NPM the statistic measure indicates the number of blocks 8x8 predicted using advanced prediction modes (OBMC or four vectors for macroblock) or normal prediction modes. For DCT_coeff, the measure counts the total number of DCT coefficients per VOP, and DCT_line the total number of executed DCT 8x1 per VOP. All these counters can be easily inserted in any MPEG-4 compliant or any other video/audio encoder. Figure 13 reports a schematic diagram of the process of counting coding algorithms/modes/parameters and provides a statistic description of the decoding process according to any complexity model. This diagram represents the generation of the Complexity Information Header at the encoder side. The encoder increments the counters of the coding algorithms/modes/parameters that are used to encode the video frame or video object to generate the associated statistics signal (known as complexity information). At the end of the encoding of each video frame or video object the statistics of the used coding algorithms/modes/parameters is inserted in the Complexity Information Header. Figure 1 reports a simplified flow graph of the MPEG-4 VM6 texture decoding algorithms. Note that, in the proposed technique, it is not necessary to explicitly model the actual decoder flow graph. The above graph represents the schematic flow diagram of a possible simple VOP texture decoding model of MPEG-4. It has to be noticed that by estimating the complexity weights using the total VOP decoding measures as explained in the previous paragraph, it is not even necessary to explicitly specify all transitions in the decoding flow diagram model.

[0057] More accurate complexity models could be designed by introducing new algorithms and the associated measures of occurrences. An example of a more accurate model including the partitioning of APM and NPM into predicted or bi-directional modes and into half-pel motion compensation modes is reported in Figure 6 which represents an example of extension of the MPEG-4 texture decoding complexity model including the different mode prediction and half-pel motion compensation functions.

[0058] A reduction to simpler decoding models when many counters of different algorithms are available is straightforward. Some counters can be ignored if, in a specific software/hardware implementation, they do not implies any or any relevant complexity difference. For instance, if the implementation does not yields different processing time if a macroblock is predicted by a full pel or half pel vector, or if there is no difference between APM or NPM, all these counters can be ignored or can be combined. The specific action depends on the architecture and on the complexity features of the software/hardware decoding platform used.

[0059] As reported in these model examples, a meaningful partitioning of the algorithms in terms of complexity can be easily done only referring to the processing of the data and without the need of specifying any software or hardware implementation. Only in the phase of estimating the weights w_i and to perform the actual prediction it is necessary to refer to a specific hardware/software implementation.

[0060] The two simple models presented here are also capable of taking into account parallel implementations which are implemented in each algorithm such as any packed arithmetic implementation or higher levels of parallelism. Parallel implementations at levels of macroblock decoding are not likely to occur in MPEG-4 systems. Decoders need to respect a given sequential order in decoding the macroblocks that is intrinsic in the syntax of the video data flow. Moreover, for multimedia processor implementations, the ones that are particularly considered in this description, parallelism is likely to be implemented at much lower levels than macroblock decoding. Higher levels are indeed very unlikely to appear.

[0061] Platforms that include also some hardware module accelerators, can be taken into account for the model. If one have, for instance, the hardware implementation of a 8x8 DCT module, one can simply discard the DCT_coeff and DCT_line counters and simply use the combination of Intra and Inter counters to predict the DCT decoding complexity.

Webgroup CZ a.s. Ex. 1002, Page 908 of 1406

Similar measures can be taken for other hardware accelerator modules.

[0062] The present complexity modeling approach can be applied to the audio/video decoding, composition and rendering of media objects or to any real-time processing of data.

7. EXPERIMENTAL RESULTS OF VIDEO DECODING COMPLEXITY PREDICTION

[0063] This section reports simulation results of the prediction of VOP decoding complexity for the MPEG-4 VM6 compression standard. Counters corresponding to the algorithms defined by the model of Figure 5 have been inserted in the Momusys VM6 encoder implementation to generate the mentioned statistic measures. These integer figures have been converted into percentage values referred to the actual number of VOP macroblocks, normalized to 8 bit values and have been supposed to be transmitted as a VOP complexity header for each VOP. The cost of this information transmission results of a few tenths of bits and can be considered negligible if compared to the total video bit-rate. Obviously, any other representation of the statistical coding information which has a sufficient precision can be employed. A schematic diagram of this decoding time (complexity) prediction signal generation process is reported in figure 14 which represents a schematic diagram of VOP video decompression interactions between the Video Decoder and the Video Decoder Supervisor when the Allocated Decoding Time (T_{Alloc})is lower than the Decoding Time Prediction (T_{Pred}). The Target Decoding Time and Decoder Time Reference are used to verify that the Decompressed Video elements are made available at the desired time. The Target Decoding Time is derived implicitly by the frame or sampling rate or by the information associated to each VOP or video frame (associated time stamps).

[0064] Measures of the texture decoding time of each VOP for different video sequence have been performed on a Sun UltraSparc platform. The decoder is the Momusys VM6 decoder.

[0065] The estimation of the weight w vector has been obtained by a linear regression applied on the measured decoding time of each VOP using the expression of equation (4). To demonstrate the robustness of the proposed technique, the complexity prediction results have been generated using a vector w, estimated using the complexity measurements of all the test sequences, except the one for which the prediction is calculated. For instance, to predict a sequence A, the weights estimated on sequences B and C have been used, and so on respectively for the other test sequences. Table 1 reports the results of the different estimates of the vector w for the sequences Akyio, Coastguard and Bream. As can be easily noticed, complexity (time) estimates from different sequences do not differ relevantly from one to the other. Disposing of a relatively large set of sequences with the associated measurements, one can easily perform off-line estimates of decoder weights w characteristic of the decoder at hand.

[0066] Figure 7 reports the measured VOP decoding time, the VOP decoding time prediction and the time prediction errors (in absolute value) for the two VOPs of the sequence Akyio. Figure 8 represents the measured decoding time and Decoding Time Prediction (expressed in msec) versus the sequence VOP number of the MPEG-4 VM6 for the sequence Bream (Background and Fish VOP) at different bit-rates. The decoder is the Momusys VM6 on a Sun Ultrasparc. The absolute value of the Decoding Time Prediction error is reported in the bottom curve near the 0 value. The results have been obtained at different bit-rates and all measures are expressed in msec. The same experiment results are reported for the sequences Bream and Coastguard. In figures 9, 10 and 11, as can be easily noticed, while the measured actual decoding time has strong variations for each VOP, the decoding time prediction is very accurate and the two curves for most of the samples are difficult to distinguish one from the other. In these experiments, the error of the prediction is lower than 5% for each VOP and in average is around 1-2%.

Webgroup CZ a.s. Ex. 1002, Page 909 of 1406

W (msec/f)	Akiyo	Bream	Coastguard
Intra	38.68	38.84	38.15
Inter	30.95	29.60	29.56
Skip	5.55	5.53	5.51
DCT_line	2.15	0.37	1.24
DCT_coeff	1.47	6.58	6.18
APM	226.47	230.23	228.70
NPM	36.30	37.60	36.01

Table 1. Estimated complexity weights vector w for the texture decoding complexity model of Figure 5 for different sets of measures. The complexity relevance for each weight is given by the product of the algorithm count and by the weight itself.

[0067] The excellent results demonstrate that a relatively simple complexity model is able to predict the decoding time (complexity) with a very good degree of approximation, when appropriate coding statistics are available. The degree of approximation resulting from the proposed method, indeed, is more than adequate to enable an intelligent and efficient resource allocation strategy.

[0068] The description and discussion of the new possible schemes of interaction between the real-time OS and the video decoder are the subject of next sections.

[0069] Another important conclusion is the fact that a very complex process such as MPEG-4 texture video decoding can be described by a suitable high level coding statistic information which is not directly related to any software or hardware implementation. The vector of coding mode counter values is, in fact, a compact coding parameter and coding mode information of the compressed bit-stream. Moreover, the obtained results reports that it is not necessary to define a very detailed model of the software/hardware decoder platform. Very complex decoder features such as cash strategy or memory accesses which could have a non-strictly deterministic behavior, can be taken into account in a statistical sense when one estimate the value of the weight vector characteristic of the decoder platform used.

8. NEW SCHEMES OF DECODER-OS SCHEDULER INTERACTIONS

[0070] New schemes of interaction between the decoder and the OS scheduler of the multimedia processor are possible when decoding time prediction is feasible. These schemes of interaction can be designed in order to provide the best resource allocation policy able to guarantee real-time performances.

[0071] In Figure 12, an example of decoding scheme employing decoding time prediction is reported. This figure represents a decoding scheme example in which the Complexity Information of each VOP is processed by the Complexity Prediction Unit which provides the Decoding Time Prediction signal to the decoder and to the real-time OS/scheduler that allocates the necessary resources (Allocated Decoding Time) to the decoder or decoding processes. The Decoding Time Prediction unit reads the Complexity Information Header carried in each VOP/frame bit-stream header or transmitted as side information in any format, produces the decoding time prediction for each frame/VOP, and provides this information to the real-time OS scheduler. In this way, the OS scheduler can allocate the necessary resources (i.e. Allocated Decoding Time) for the decoding of each or all the VOPs respecting the associated real-time constraints. In case of non real-time encoding, the complexity information can be compressed and transmitted before the real-time transmission and real-time decoding of the video/audio bit-streams. The usefulness of such scheme is evident considering that many VOPs of unknown complexity (decoding time) need to be decoded within an associated time interval

Webgroup CZ a.s. Ex. 1002, Page 910 of 1406

T_c. This scheme is able to guarantee real-time performances if the available video processing resources T_{Alloc} (i.e. Allocated Decoding Time) are sufficient for the decoding of all N incoming VOPs within the given time interval. Formally, the following relation has to be satisfied :

$$T_c \geq T_{Alloc} \geq \sum_{n=1}^{N} T_n(t) \tag{5}$$

where T_n is the decoding time of the nth VOP, with n=1,..., N, where N being the VO and VOP index and t being the VOP sampling time.

[0072] This simple procedure scheme is applicable in two cases. The first is when all the VOPs belongs to the same sampling time t (implicitly defined by the sampling rate or also carried by time stamps associated to each VOP). In this case, there is no additional delay introduced by the decoder. The second case occurs when the VOPs can also belong to sequential sampling periods, i.e. M sampling intervals of the reference time t denoted as Dt (also referred as different time stamps). In this case, an additional delay has to be considered and an output buffer needs to be added to the decoder :

$$T_c \geq T_{Alloc} \geq \sum_{n=1}^{N} \sum_{m=1}^{M} T_n(t+m\Delta t) \tag{6}$$

[0073] This second scheme enables to smooth out computational peaks on a larger number of VOPs and on a larger time interval than a single image sampling period Dt. In other words, expression (6) might be satisfied even when expression (5) is not for some values of the sampling time t. Obviously, this result is obtained at the cost of an additional delay and an additional output buffer.

[0074] When the available processing resources (i.e. time) are not sufficient to decode all VOPs, this simple strategy cannot guarantee the respect of the real-time constraints. In such cases, other form of interactions and new decoding techniques are needed.

[0075] The main idea is to reduce the complexity of the decoding in order to satisfy relation (5) and (6) accepting some degradation to the resulting image quality. These techniques are called here Computational Graceful Degradation (CGD).

[0076] A schematic diagram of the construction of the complexity information header at the encoder side is reported in Figure 13. The encoder, during the encoding process, increments the registers (counters) corresponding to a set of encoding algorithms/modes/parameters used for the actual VOP or frame compression. At the end of the process, the counters contains a compact encoding/decoding statistical information that is written in the Complexity Information Header.

9. COMPUTATIONAL GRACEFUL DEGRADATION (CGD)

[0077] The main idea of CGD is to make available results of poorer quality when the results of the desirable quality cannot be obtained in real time. When the complexity of the task exceeds the available processing power, real-time services, possibly of degraded quality, are nevertheless provided respecting all real-time constraints. This approach makes the guarantee of the correct scheduling of tasks possible, even when the computational system load fluctuates and relation (5) and (6) cannot be satisfied.

[0078] The concept of graceful system degradation using imprecise results has been previously introduced in the field of real-time computing with applications to control system and automation. In these contexts, imprecise results are defined as intermediate results with the property that the more recent and intermediate result is the closer one that approximates the final result (i.e. the idea only works in monotonically improving computations). For more details, the reader can refer to W.A. Halang, A.D. Stoyenko, Constructing predictable real time systems, Kluwer Academic Publisher, 1991 ; K. Lin, S. Natarjan, J. Liu, Imprecise results : Utilizing partial computations in real-time systems, Proceedings of IEEE Real-Time System Symposium, December 1987 ; J. Liu, K. Lin, S. Natarjan, Scheduling real time periodic jobs using imprecise results, Proceedings of the IEEE Real-Time System Symposium, December 1987 incorporated herein by reference.

[0079] In these cases the problems to be solved are more concerned with fault tolerance, I/O overloads, stability and reactivity to unexpected inputs, and the corresponding techniques are not suitable for purposes of real-time decoding of compressed video/audio bit-streams.

[0080] In contrast, the aim of the present invention is to be able to provide the guarantee of real-time video decoding

Webgroup CZ a.s. Ex. 1002, Page 911 of 1406

with possible degradations of the image quality, i.e. reductions of the peak signal to noise ratio (PSNR), without loosing parts of the image or parts of the audio content. Such alternative is certainly much more desirable than other straightforward options such as cutting image portions or simply skipping frames. These latter options, as can be easily understood, can have catastrophic consequences on prediction based coding systems. In H.263 systems, for instance, skipping the decoding of a single frame or a portion of it implies the skipping of all future incoming frames (or portion of them) before the next incoming Intra frame. The time interval of such skipping operation might cover many seconds, and the information content loss might be very relevant. Such abrupt interruptions, which are perceptually very annoying, might he caused not only by the simple fluctuation of the decoding complexity load as discussed in the previous sections, but also by the fluctuations of the load of other non-video/audio processing tasks which reduce the available processing resources (time). Moreover, such events are in general out of the control of the video/audio decoder system and cannot be easily forecasted. Considering these facts, the importance of techniques able to filter out complexity decoding peak loads or able to reduce the average decoding computation load without causing perceptually annoying consequences is evident. Skipping B-VOP could be, in some cases, a viable option for video accepting the introduction of motion judder in the sequence reproduction. Unfortunately, the presence of B-frames or B-VOP cannot be guaranteed in any bit-stream and just at the right time for which a reduction of the complexity is needed to respect the real time constraints. For audio applications, any skip of part of the content has perceptually a very annoying result.

[0081] In contrast with what could be commonly thought, also the classical multi-resolution coding features such as spatial or temporal scalabilities are not really useful for the aims of the present invention. In general, they are used to optimize the transmission bandwidth usage, enabling the compatibility of services at different bit-rates and spatial resolutions, but they must be embedded in the original bit-stream at the encoder side. If they are not embedded, the changes of resolution at the decoder size can results more computationally expansive than the simple decoding at the given resolution.

[0082] Another important reason for the introduction of CGD is given by the definition of profiles, levels and conformance tests for video compression standards based on software/processor platforms. For the MPEG-4 standard, it is expected to have a range of applications that will be much broader than the one of MPEG-1 and MPEG-2. Two possible scenarios can be identified. The first is the definition of a limited number of profiles and levels based on computational power. The second is the possibility of a continuum of decoders of different computational power. The first scenario faces very difficult tasks such as the definition of decoder conformance testing, and at the end it may result in a jungle of too many different levels and profiles.

[0083] The second scenario is completely open to platforms of different computational power. It requires pure functional decoder conformance testing and is able to provide the maximum quality of the service that is achievable by the capabilities of each platform.

[0084] The second scenario, although much more attractive than the first, poses new questions and problems have not yet been studied in video and audio coding. It is mandatory that all decoders can decode all MPEG-4 services but at different levels of quality. It means that a scalability-based on computational power is needed. This new type of scalability should enable a graceful degradation of the video quality when less than theoretically necessary computational power is available at the decoding side. In contrast with MPEG-2 scalabilities that are discrete, embedded in the bit-stream and designed for specific applications, this computational power based scalability should be continuous and implemented in all MPEG-4 bit-streams.

[0085] From these arguments, the usefulness of CGD and its important features and applications are clear. The last key point that has left CGD as a good idea but of difficult usage and implementation for video coding was that it was not clear how to implement it efficiently. Now that the present invention has developed a technique able to predict with a good degree of approximation the required decoding time of each decoding process, one have the key for useful and efficient implementation of CGD techniques.

9.1 Principles of decoding using CGD techniques

[0086] Let us consider a complexity model such as the one of Figure 3 composed by a set of I algorithms fi, with i = I,...,I and suppose to be able to design for all, or only for a subset S^{CGD} of the functions f_i composing the model, new functions f_i^{CGD} which have the following three properties :

1) the execution of a function f_i^{CGD} yields results that are an approximation of the ones produced by the original function f_i,
2) the execution of f_i^{CGD} does not prevent the exact execution of any subsequent decoding functions,
3) the weight w_i^{CGD} associated to f_i^{CGD} in the considered decoder implementation is lower than the corresponding w_i associated at f_i (i.e. $w_i^{CGD} < w_i$).

[0087] For a schematic representation of a complexity model which includes new degraded functions, one can refer

Webgroup CZ a.s. Ex. 1002, Page 912 of 1406

to Figure 15 which represents a schematic diagram of a complexity model including CGD algorithms, CGD counters (b_i) and new state transitions generated by the new CGD functions. In this example $f_1, f_3 \hat{I} S^{CGD}$, and $f_2 \hat{I} S^{orig}$. In other words, for video decoding for instance, the execution of any f_i^{CGD} might produces PSNR degradations in the reconstruction of some image parts, but not prevents from correctly decoding the rest of the frame or VOP.

[0088] Let us partition the functions forming the complexity model into two disjoint sets, S^{Orig} and S^{CGD} respectively, for the ones that do not admit a CGD version and for the ones for which it is possible to design a CGD version.

[0089] Let us consider for simplicity an image sequence composed by a sequence of single frames or single VOPs (i.e. N=1) and suppose that expression (5) is not satisfied for some values of the decoder reference time t :

$$T(t) > T_{Alloc} \tag{7}$$

where T(t) is the decoding time of the VOP at hand at the sampling time t, and to define as processing deficit T_{Def} the time for which the decoding complexity exceeds the Allocated Decoding Time :

$$T(t) - T_{Alloc} = T_{Def} \tag{8}$$

[0090] Since the decoding time can be approximated by its prediction (Decoding Time Prediction) it can be expressed by :

$$T(t) \simeq T_{Pred}(t) = \sum_{i=1}^{I} c_i w_i \tag{9}$$

where the c_i are the counters of the complexity model and the w_i are the corresponding complexity weights.

[0091] The lower limit of the decoding time executing all CGD algorithms f_i^{CGD} at the place of f_i for any $i \hat{I} S^{CGD}$, is given by :

$$T_{CGD} = \sum_{i \in S_{CGD}} c_i w_i^{CGD} + \sum_{i \in S_{Orig}} c_i w_i \tag{10}$$

[0092] If $T_{CGD} < T_{Alloc} < T_{Pred}$ it is therefore possible to guarantee the real-time constraints by executing the f_i^{CGD} algorithms and accepting approximate decoding results. The difference $T_{Pred} - T_{CGD}$ can also be expressed as :

$$T_{Pred} - T_{CGD} = \sum_{i \in S_{CGD}} c_i (w_i - w_i^{CGD}) \tag{11}$$

[0093] If $T_{CGD} < T_{Alloc} < T_{Pred}$, it is therefore possible to find for each c_i with $i \hat{I} S^{CGD}$, a couple of integer coefficients a_i, b_i, for which :

$$a_i + b_i = c_i \tag{12}$$

and denoting as $T_{Process}$ any decoding time interval which respects the real time constraints (obtained by the implicit sampling rate or expressed using appropriate time stamps associated to each VOP or video frames, or audio packet), one can express the desired process decoding time as any decoding time value that satisfy the expression :

$$T_{process} = \sum_{i \in S_{CGD}} (a_i w_i^{CGD} + b_i w_i) + \sum_{i \in S_{Orig}} c_i w_i \leq T_{Alloc} \tag{13}$$

Webgroup CZ a.s. Ex. 1002, Page 913 of 1406

[0094] Obviously for any Allocated Decoding Time the aim is to respect the real-time constraints with the lowest degradation in the video/audio content. Associating a degradation measure to each w_i^{CGD} it is possible to minimize the degradation for a given TAlloc. Therefore, the aim is to find the set $S_{a,b}$ of couple of coefficients a_i, b_i, with $i \hat{I}\ S^{CGD}$, that satisfy expression (12) and minimize the video or audio degradations expressed as difference with the non degraded output :

$$S_{a,b}=\text{argmin}(a,b)_{i \in S_{CGD}}:(PSNR\text{-}PSNR(a_i,b_i)) \tag{14}$$

[0095] The determination of the set $S_{a,b}$ can be done by means of any suitable optimization method or any suitable optimization heuristic by the Video Decoder Supervisor, schematically represented in Figure 14. In summary, the Video Decoder Supervisor receives from the OS the Allocated Decoding Time signal (T_{Alloc}), the decoding time prediction signal (TPred) from the Complexity Prediction unit, and the Complexity Information signal represented by the actual values of the coding/decoding statistic (set of ci coefficients) for the VO. Since the Video Decoder Supervisor knows the values of the set of w_i and w_i^{CGD} it can determine, by a suitable standard optimization technique, the corresponding set of coefficients a_i,b_i such that expression (12) is satisfied. Having defined the set of a_i,b_i coefficients the CGD decoding is partially defined. In other words, the set of coefficients defines for each $i \hat{I}\ S^{CGD}$ how many degraded algorithms (f_j^{CGD}) at the place of original algorithms (f_j) need to be executed.

[0096] Since the determination of the degradation coefficients is done on the basis of the decoding time prediction, the video decoder can generate a Decoding Status signal reporting the status of the decoding (i.e. the fraction of the bit-stream or the fraction of the VO already decoded). The signal representing the Decoding Status of the decoding process reports to the Video Decoder Supervisor an information which can be used to correct the Computational Graceful Degradation Directive signal (i.e. the setting of the a_j,b_j coefficients in this example) if the Current Decoding Time and the Current Decoding Time Prediction signal are not conformant. Current Predicted Decoding Time means the Decoding Time Prediction calculated by using elation (13), only counting the occurrences of the decoding algorithms actually used to decode the fraction of the decoded bit-stream at the current reference time (time for which the decoding status signal is generated). The term not conformant means that the actual Decoding Time is greater than the Decoding Time Prediction of an amount of time which overcomes statistical variations which are functions of the complexity information, thus reporting possible errors in the Decoding Time Prediction signal.

[0097] The described interactions between OS, the Decoder and Video Decoder Supervisor can be easily extended for the case of sequences containing multiple VO at the same sampling time (associated time stamps), or belonging to a defined time interval containing several sampling periods (several associated time stamps). Expressions (10,11,13,14) can be easily modified including the appropriate summation over all VOP. Therefore, in the case of N VOP at the same sampling time t, one have :

$$T_N(t)=\sum_{n=1}^{N} T_n(t) > T_{Alloc} \tag{15}$$

where T_N (t) is the total decoding time of the N VOP.

$$T_N(t) \cong T_{Pred,N}=\sum_{n=1}^{N} T_{Predn}(t)=\sum_{n=1}^{N}\sum_{i=1}^{I} c_{i,n}w_i \tag{16}$$

$$T_{CGD,N}=\sum_{n=1}^{N}\left(\sum_{i \in S_{CGD}} c_{i,n}w_i^{CGD}+\sum_{i \in S_{Orig}} c_{i,n}w_i\right) \tag{17}$$

$$T_{Pred,N}\text{-}T_{CGD,N}=\sum_{n=1}^{N}\sum_{i \in S_{CGD}} c_{i,n}(w_i\text{-}w_i^{CGD}) \tag{18}$$

$$a_{i,n}+b_{i,n}=c_{i,n} \tag{19}$$

Webgroup CZ a.s. Ex. 1002, Page 914 of 1406

$$T_{Process,N}=\sum_{n=1}^{N}\Big(\sum_{i\in S_{CGD}}(a_{i,n}w_i^{CGD}+b_{i,n}w_i)+\sum_{i\in S_{Orig}}c_{i,n}w_i\Big)\le T_{Alloc} \tag{20}$$

$$S_{a,b,N}=\mathrm{argmin}_{(a,b)\in S_{CGD}}\Big(\sum_{n=1}^{N}(PSNR-PSNR(a_{i,n},b_{i,n}))\Big) \tag{21}$$

or :

$$S_{a,b,N}=\mathrm{argmin}_{(a,b)\in S_{CGD}}\Big(\sum_{n=1}^{N}\alpha_n(PSNR-PSNR(a_{i,n},b_{i,n}))\Big) \tag{22}$$

where a_n is a semantic degradation coefficient which might be available in the coded bitstreams.

[0098] For N Video Objects and M sampling time intervals Dt (denoted also as time stamps) one have :

$$T_{N,M}=\sum_{m=1}^{M}T_N(t+m\Delta t)=\sum_{m=1}^{M}\sum_{n=1}^{N}T_n(t+m\Delta t)>T_{Alloc} \tag{23}$$

$$T_{N,M}\cong T_{Pred,N,M}=\sum_{m=1}^{M}\sum_{n=1}^{N}T_{Predn}(t+m\Delta t)=\sum_{m=1}^{M}\sum_{n=1}^{N}\sum_{i=1}^{I}c_{i,n,m}w_i \tag{24}$$

$$T_{CGD,N,M}=\sum_{m=1}^{M}\sum_{n=1}^{N}\Big(\sum_{i\in S_{CGD}}c_{i,n,m}w_i^{CGD}+\sum_{i\in S_{Orig}}c_{i,n,m}w_i\Big) \tag{25}$$

$$T_{Pred,N,M}-T_{CGD,N,M}=\sum_{m=1}^{M}\sum_{n=1}^{N}\sum_{i\in S_{CGD}}c_{i,n,m}(w_i-w_i^{CGD}) \tag{26}$$

$$a_{i,n,m}+b_{i,n,m}=c_{i,n,m} \tag{27}$$

$$T_{Process,N,M}=\sum_{m=1}^{M}\sum_{n=1}^{N}\Big(\sum_{i\in S_{CGD}}(a_{i,n,m}w_i^{CGD}+b_{i,n,m}w_i)+\sum_{i\in S_{Orig}}c_{i,n,m}w_i\Big)\le T_{Alloc} \tag{28}$$

Webgroup CZ a.s. Ex. 1002, Page 915 of 1406

$$S_{a,b,N,M} = \text{argmin}_{(a,b)_i \in S_{CGD}} \left(\sum_{m=1}^{M} \sum_{n=1}^{N} (PSNR - PSNR(a_{i,n,m}, b_{i,n,m})) \right) \quad (29)$$

or

$$S_{a,b,N,M} = \text{argmin}_{(a,b)_i \in S_{CGD}} \left(\sum_{m=1}^{M} \sum_{n=1}^{N} \alpha_n (PSNR - PSNR(a_{i,n,m}, b_{i,n,m})) \right) \quad (30)$$

9.2 Extension of the techniques to video/audio composition

[0099] The methods aiming at predicting the decoding time (i.e. generating a Decoding Time prediction Signal) of video frames or video objects, so as to respect the real-time constraints specified implicitly by the audio/video rates or by the timing information carried by the associated time stamps, can be easily extended to the video/audio composition processes. Composition process means the action of putting decompressed video or audio objects together in the same representation space. In a similar way of the decoding process, one can generate a Composition Time Prediction for each composition process according to the interactions described in Figure 12. Such Composition Time Prediction is a function of the occurrence of composition algorithms, composition modes and composition parameters (associated composition statistics). Differently from the decoding process, composition algorithms, modes and parameters can be also provided by an interactive user interface. In a similar way the Composition Allocated Time can be generated as function of the Composition Time Prediction. The interactions between the compositor and the OS can be described as in Figure 12 where the Decoder is substituted by the Compositor.

[0100] The technique of associating Decoding Degradation Algorithms and decoding by using degradation algorithms described in section 6.1 and Figure 14 can be applied by substituting respectively the Allocated Decoding Time by the Decoding Time Prediction, the Target Decoding Time and the Decoder Reference Time by the Allocated Composition Time, the Composition Time Prediction by the Target Composition Time and the Compositor Reference Time. All relations and equations reported in section 6.1 referring to the decoding process can be referred to the composition process.

9.3 Examples of possible degradation modes

[0101] The decoding operations of a video compression algorithm can be divided into two main categories :

1) operations that cannot be simplified since they may prevent the extraction and usage of relevant coding information,
2) operations that can be simplified, possibly leading to imprecise or degraded video results.

[0102] To the first category typically belong all bit-stream parsing operations, entropy decoding (i.e. VLD and arithmetic coding), and all operations related to synchronization and to the syntax of the decoding process. For these operations, no degradation mode definition is possible, otherwise it would imply skipping image portions or entire frames since either the data or the coding modes and coding parameters are lost.

[0103] To the second category, for instance, belong operations such as the IDCT, the prediction with and without motion compensation in its various forms (PB/B-frame prediction, overlapped block motion compensation (OBMC), half pixel interpolation and so on, padding, shape coding. Simplifications of such operations applied to pixels or transform coefficients are always possible but at the expenses of imprecise results. The challenge can be expressed as follows : given a specific compression standard, software and processor architecture, implement it and find the f_i^{CGD} which provides the maximum complexity reduction ($w_i - w_i^{CGD}$) versus the minimum image/audio quality degradation (usually measured in PSNR). Many are the algorithms that can be simplified. We report here only two examples that illustrate the idea.

9.3.1 IDCT simplified modes

[0104] IDCT on a 8x8 block can be decomposed into 16 IDCT operation on a 8x1 block, or on IDCT considering only

Webgroup CZ a.s. Ex. 1002, Page 916 of 1406

the lowest 4x4 or 2x2 coefficients. Skipping higher order 8x1 IDCT or enabling processing only 2x2 or 4x4 coefficients constitute some alternatives which are less complex than the standard 8x8 IDCT. Obviously, these less demanding alternatives yield a filtering of the high frequency possibly contained in the higher order coefficients.

9.3.2 Simplified prediction modes

[0105] Many prediction modes can be simplified at the expenses of some PSNR degradations. In particular, the most complex such as the OBMC with or without half-pel motion compensation can yield relevant complexity decreases of both computational complexity and memory bandwidth by implementing simpler algorithms.

10. EXAMPLES OF RESULTS FOR THE MPEG-4 VIDEO COMPRESSION STANDARD

[0106] This section reports simulation results of the decoding of VOP using the complexity model and decoding time prediction results described in Section 4. The MPEG-4 VM6 algorithm in the Momusys VM6 implementation modified adding degradation functions to the advanced prediction modes has been used for the simulations. A fixed amount of processing time is allocated for each VOP composing the sequences. In case the decoding time prediction (T_{Pred}) for each VOP exceeds the fixed allocated time (T_{Alloc}), an appropriate number of advanced prediction modes are executed using degraded functions in order to satisfy relation (13).

[0107] Figures 16, 17, 18 report the decoding results at 64, 128 and 256 kb/s for the four VO (Small Boat, Big Boat, background and Water) of the sequence Coastguard. On the left, the diagrams report the decoding time of each VO expressed in msec versus the VOP number. Two curves are reported : original decoding and decoding using degradation function in order to satisfy the decoding time limits. The PSNR image degradations corresponding to the execution of degraded functions are reported on the right.

[0108] Figure 16 reports on the left standard decoding time and CGD decoding time (in msec) for the four VO of the sequence Coastguard at 64 kb/s. Each VO has a upper bound for the CGD decoding time. On the right the PSNR loss of the CGD decoding with reference to the standard decoding.

[0109] Figure 17 reports on the left standard decoding time and CGD decoding time (in msec) for the four VO of the sequence Coastguard at 128 kb/s. Each VOP has a upper bound for the CGD decoding time. On the right the PSNR loss of the CGD decoding with reference to the standard decoding.

[0110] Figure 18 reports on the left standard decoding time and CGD decoding time (in msec) for the four VO of the sequence Coastguard at 256 kb/s. Each VO has a upper bound for the CGD decoding time. On the right the PSNR loss of the CGD decoding with reference to the standard decoding.

[0111] The implementation of CGD base on the decoding time prediction generation technique enables, within the discussed limits, the a priori setting of the decoding time guaranteeing the possibility of a scheduling of each decoding task that satisfy real time constraints, even if the available resources (Allocated Decoding Time) are inferior to the theoretically necessary ones. Moreover, the degradations introduced are visually acceptable and they can be minimized according to expression (14) by suitable techniques. The results obtained with a PSNR degradated are certainly much more desirable than introducing sudden interruptions and image content losses to the video sequence, and enables an efficient resource allocation policy.

Claims

1. Method for primary processing a digital signal comprising the steps of :

   - providing a digital signal to a primary processing unit ;
   - primary processing said signal with said primary processing unit according to a plurality of primary processing algorithms to provide primary processed output signals,
   - determining statistics of use of at least one of said primary processing algorithms,
   - providing a digital statistics signal representative of said statistics for each of said primary processed output signals
   - associating to each of said primary processed output signals its own statistics signal ;
   - determining a complexity primary processing information signal based on said statistic signal.

2. Digital primary processed output signal, generated by a primary processing unit using primary processing algorithms and being intended to be transmitted to a receiving device wherein said primary processed output signal comprises data bit streams, each of said data bit streams comprising a main bit string representative of said primary processed output signal and a secondary bit string representative of the statistics of use of said primary processing algorithms associated to said main bit string.

Webgroup CZ a.s. Ex. 1002, Page 917 of 1406

3. Method for secondary processing a secondary digital output signal according to claim 2 comprising the steps of :

(a) reading said secondary bit string ;
(b) determining, from the secondary bit string, primary processing algorithms to be used to secondary process said primary output signal associated to said main bit string, for generating a complexity primary processed information signal for each signal ;
(c) allocating a secondary processing time and/or operating system resources as a function of said complexity primary processed information signal for secondary processing of said primary output signal ;
(d) sending main bit string to secondary processing means ;
(e) secondary processing said main bit string using said allocated secondary processing time and/or operating system resources, according to a secondary process and
(f) generating a secondary processed signal.

4. Method for coding a digital signal comprising the steps of :

- providing an uncompressed digital signal including audio packets, video frames, video planes, or audio/video objects to an encoder ;
- compressing said signal with said encoder according to a compression syntax, said encoder using a plurality of coding algorithms to provide a compressed signal including coded audio packets, video frames, video planes or audio/video objects,
- determining statistics of use of at least one of decoding algorithms necessary to decode each of said coded audio packets, video frames, video planes or audio/video objects from said associated coding algorithms, and/or determining statistic of use of at least one of coding algorithms,
- providing a digital statistics signal representative of said statistics for each of said coded audio packets, video frames, video planes or audio/video objects,
- associating to each of said coded audio packets, video frames, video planes or audio/video objects its own statistics signal.

5. Coding method according to claim 3, wherein the step of determining statistics consists in determining the statistics of use of some of decoding algorithms, wherein to each decoding algorithm is associated at least one decoding mode and/or decoding parameter and wherein the statistics signal is based on the decoding modes and/or decoding parameters.

6. Coding method according to claim 3 or 4, wherein the step of determining statistics further consists in determining the statistics of use of some of coding algorithms when said coding algorithms and the compression syntax allow the determination of corresponding decoding algorithms necessary to decode each of said coded audio packets, video frames, video planes or audio/video objects wherein to each coding algorithm is associated at least one coding mode and/or coding parameter and wherein the statistics signal is based on the coding modes and/or coding parameters necessary to decode when using said coding algorithms.

7. Coding method according to claim 4, wherein the statistic signal is generated by juxtaposing digital words each representing the occurrences of use of a decoding mode and/or decoding parameter necessary to decode said associated audio packet, video frame, video plane or audio/video object.

8. Coding method according to claim 5 and/or 6, wherein the statistic signal is generated by juxtaposing digital words each representing the occurrences of use of a coding mode and/or coding parameter necessary to decode said associated audio packet, video frame, video plane or audio/video object.

9. Coding method according to any of claims 3 to 7, wherein the step of associating consists in inserting said statistics signal into said compressed signal for each associated coded audio packet, video frame, video plane or audio/video object.

10. Coding method according to any of claims 3 to 8, wherein the step of determining statistics consists in computing the occurrence of use of said coding and/or decoding algorithms for determining a complexity information for each coded audio packet, video frame, video plane or audio/video object.

11. Digital compressed signal including coded audio packets, video frames, video planes or audio/video objects, said signal being generated by an encoder using a compression syntax and coding algorithms and being intended to be

Webgroup CZ a.s. Ex. 1002, Page 918 of 1406

transmitted to a receiving device wherein said signal is decoded according to decoding algorithms, and wherein said signal comprises at least a layer of coded audio packets, video frames, video planes or audio/video objects bit streams, each of said bit streams comprising a main bit string representative of the coded audio packets, video frames, video planes or audio/video objects and a secondary bit string representative of the statistics of use of said coding and/or decoding algorithms associated to said main bit string.

12. Digital compressed signal, according to claim 10, wherein said secondary bit string is inserted in said layer of said bit streams.

13. Digital compressed signal, according to claim 10, further comprising a plurality of parallel layers of coded audio packets, video frames, video planes, or audio/video objects bit streams, wherein said main bit string is inserted or transmitted in a layer different to said second bit string.

14. Digital compressed signal, according to claim 11 or 12, wherein said secondary bit string is inserted or transmitted prior to said main bit string.

15. Digital compressed signal, according to any of claims 10 to 13, wherein to each decoding algorithm is associated at least one decoding mode and/or decoding parameter and wherein said secondary bit string consists of words each representing the occurrences of use of the decoding modes and/or decoding parameters.

16. Digital compressed signal, according to claim 10 or 14, wherein to each coding algorithm is further associated at least one coding mode and/or coding parameter and wherein said secondary bit string consists of words each representing the occurrences of use of the coding modes and/or coding parameters, said coding algorithms and the compression syntax allowing the determination of corresponding decoding algorithms necessary to decode each of said coded audio packets, video frames, video planes or audio/video objects.

17. Method for decoding a digital compressed signal according to any of claims 10 to 15 comprising the steps of :

(a) reading said secondary bit string ;
(b) determining, from the secondary bit string, decoding algorithms to be used to decode said coded audio packets, video frames, video planes or audio/video objects, associated to said main bit string, for generating a complexity information signal for each coded audio packet, video frame, video plane or audio/video object ;
(c) allocating a decoding time and/or operating system resources as a function of said complexity information signal for the decoding process of said compressed audio packet, video frames, video planes or audio/video objects ;
(d) sending main bit string to decoding means ;
(e) decoding said main bit string using said allocated decoding time and/or operating system resources, according to a decoding process and
(f) generating a decompressed signal including decoded audio packets, video frames, video planes or audio/video objects.

18. Method for decoding a digital compressed signal according to claim 16 wherein the step determining decoding algorithms is also based on the occurrence of use of the decoding modes and/or decoding parameters necessary to decode the said audio packets, video frames, video planes or audio/video objects.

19. Method for decoding a digital compressed signal according to claim 16 or 17 wherein the step determining decoding algorithms is further based on the occurrence of use of the coding modes and/or coding parameters used by said coding algorithms, wherein said coding algorithms and the compression syntax allow the determination of corresponding decoding algorithms necessary to decode each of said coded audio packets, video frames, video planes or audio/video objects

20. Decoding method according to any of claims 16 to 18 further comprising the step of determining a decoding time prediction signal as a function of said complexity information signal ; said decoding time prediction signal being used for the step of allocating said decoding time and/or operating system resources for optimizing said decoding process and or decoding processes.

21. Decoding method according to claim 19 wherein the step of decoding the main bit string consists in

Webgroup CZ a.s. Ex. 1002, Page 919 of 1406

- generating an allocated decoding time signal,
- sending said decoding time prediction signal and allocated decoding time signal to decoder supervisor means ;
- generating and sending a degradation directive signal to said decoding means, as a function of said decoding time prediction signal, allocated decoding time, so as to define the use of number and type of decoding algorithms and degradation algorithms to be used in the decoding process of said main bit string.

22. Decoding method according to claim 20 wherein the step of decoding the main bit string further consists in :

- generating a decoder time reference signal and a target decoding time signal,
- sending said decoder time reference signal and said target decoding time signal to decoder supervisor means ;
- generating and sending said degradation directive signal to said decoding means while also taking into account said decoder time reference signal and said target decoding time signal.

23. Decoding method according to claim 20 or 21 wherein the step of decoding the main bit string further consists in :

- generating a decoding status signal from said decoding means
- sending said decoding status signal to said decoder supervisor means from the said decoding means ;
- generating and sending said degradation directive signal to said decoding means while also taking into account said decoding status signal.

24. Decoding method according to claim 16 wherein steps (a) to (c) are carried out prior to step (e).

25. Decoding method according to any of claims 20 to 23, further comprising the step of sending said complexity information signal to said decoder supervisor means.

26. Decoding method according to any of claims 20 to 24 wherein the step of generating said degradation directive signal consists in associating at least one degradation algorithm to at least one decoding algorithm, said decoding algorithm and said degradation algorithm being associated to a complexity coefficient/weight representative of the execution time of said decoding algorithm and said degradation algorithm.

27. Decoding method according to claim 25 wherein said complexity coefficients/weights are dependent on the decoder used for implementing said decoding method.

28. Decoding method according to claim 25 or 26, wherein said decoding time prediction is a function of the occurrence of use of said decoding algorithm and said complexity coefficients/weights according to the following equation :

$$T(t) \cong T_{Pred}(t) = \sum_{i=1}^{I} c_i w_i \qquad (9),$$

where T is the time necessary to decode a coded audio packet, video frame, video plane or audio/video object, T_{Pred} is the decoding time prediction of said audio packets, video frames, video planes or audio/video objects, c_i is the occurrence of said decoding algorithm, and w_i is the complexity coefficient/weight.

29. Decoding method according to claim 27, wherein when the decoding time prediction is a function of the occurrence of use of said decoding algorithms and degradation algorithms, said degradation algorithms being associated to a complexity coefficient/weight.

30. Decoding method according to claim 27 or 28, wherein when the decoding time prediction is greater than the allocated decoding time, one uses a degradation method according to which one selects the degradation algorithm instead of its associated decoding algorithm according to equation :

$$T_{process} = \sum_{i \in S_{CGD}} (a_i w_i^{C_{GD}} + b_i w_i) + \sum_{i \in S_{Orig}} c_i w_i \leq T_{Alloc} \qquad (13)$$

Webgroup CZ a.s. Ex. 1002, Page 920 of 1406

where, $T_{Process}$ is the prediction time necessary to decode a audio packets, video frames, video planes or audio/video objects, said decoding time prediction taking account the degradation, c_i is the occurrence of decoding algorithm, a_i is the number the selected degradation algorithms, w_i^{CGD} is the complexity coefficient/weight of the degradation algorithm, b_i is the number of the non selected degradation algorithms, and w_i is the complexity coefficient/weight, where $a_i + b_i = c_i$, so as to reach a $T_{Process}$ lesser than or equal to said allocated decoding time.

31. 30. Decoding method according to claim 28 or 29, wherein said decoding status signal is also used for monitoring the current decoding time of a coded audio packets, video frames, video planes or audio/video objects and make sure that said current decoding time is in conformity with the associated decoding time prediction.

32. Decoding method according to claim 30, wherein if said current decoding time is not in conformity with the associated predicted decoding time, then said decoder supervisor means uses at least one further degradation algorithm defined in claim 29.

33. Decoding method according to claim 31, wherein if said current decoding time is not in conformity with the associated decoding time prediction, then said decoder supervisor means further uses said complexity information signal.

34. Decoding method according to any of claims 29 to 32 for a plurality of audio packets, video frames, or video planes, some of them belonging to different audio/video objects, wherein when the decoding time prediction is the sum of the decoding time prediction of each of said audio packets, video frames or video planes of said plurality, said decoding time prediction being defined in claim 28.

35. Coding system for an uncompressed digital signal including audio packets, video frames, video planes or audio/video objects, comprising :

- an audio/video encoder receiving said audio packets, video frames, video planes or audio/video objects on one input terminal, said encoder being intended to code said signal according to a compression syntax by using a plurality of coding algorithms, and to provide, on one output terminal, a compressed signal including coded audio packets, video frames, video planes or audio/video objects intended to be decompressed according to associated decoding algorithms ;
- means for determining statistic of use of at least one of said coding algorithms, and/or means for determining statistic of use of at least one of said decoding algorithms ;
- and means for generating a digital statistic signal representative of said statistics for each of said coded audio packets, video frames, video planes or audio/video objects.

36. Coding system according to claim 27, wherein said statistics determining means comprise computing means for counting the occurrence of use of coding modes and/or coding parameters used by the encoder for encoding said signal, when using said coding algorithms.

37. Coding system according to claim 34 or 35, wherein said statistics determining means further comprise computing means for counting the occurrence of use of decoding modes and/or decoding parameters from said coding algorithms used by the encoder for encoding said signal.

38. Coding system according to any of claim 34 to 36, further comprising means for generating a compressed output signal including coded audio packets, video frames, video planes or audio/video objects wherein each of said coded audio packet, video frame, video plane or audio/video object is associated with its statistics signal.

39. Decoding system for a digital signal including coded audio packets, video frames, video planes or audio/video objects according to any of claims 5 to 15, comprising :

- a decoder receiving said main bit string, representative of a coded audio packets, video frames, video planes or audio/video objects, on a first input terminal and providing, on an output terminal, a decompressed signal including decoded audio packets, video frames, video planes or audio/video objects,
- resource allocation means ;
- means for complexity prediction receiving, on one input terminal, said secondary bit string, and providing to resource allocation means a decoding time prediction signal which is determined as a function of the information contained in said secondary bit string, said resource allocation means providing to the decoder information representative of the allocated decoding time.

Webgroup CZ a.s. Ex. 1002, Page 921 of 1406

40. Decoding system according to claim 38 wherein said resource allocation means comprises an operating system or a layer of an operating system.

41. Decoding system according to claim 38 or 39 wherein said decoding time prediction signal is also provided to a second input terminal of said decoder.

42. Decoding system according to any of claims 38 to 40, wherein

- said decoder comprises decoder supervisor means and audio/video decoding means,
- said decoder supervisor means receiving, on a first input terminal, said allocated decoding time signal and, on a second input terminal, said predicted decoding time signal and providing on one output terminal a degradation directive signal,
- said decoding means receiving on a first input terminal said main bit string and on a second input terminal said degradation directive signal and providing on an output terminal said decompressed signal including decoded audio packets, video frames, video planes or audio/video objects.

43. Decoding system according to claim 41 wherein said decoder further receive a complexity information signal on third input terminal.

44. Decoding system according to claim 41 wherein said decoder further receive a decoder time reference signal and a target decoding time signal respectively on fourth and fifth input.

45. Decoding system according to any of claims 41 at 43 wherein said decoding means are arranged to provide a decoding status signal to a sixth input of the decoder supervisor means.

46. Decoding system according to claim 44 wherein said complexity information signal is applied to said decoder supervisor means.

47. Method for composing a digital signal comprising the steps of :

- providing an uncompressed video element including video frames and/or video planes and/or video objects, textures, texts, 2 and 3 dimensional graphic primitives, 2 and 3 dimensional models to a composing device ;
- composing said video element with said composing device according to a composition syntax an/or a interactivity information, said composing device using a plurality of composing algorithms necessary to compose each of said video elements and provide a representation in a common visual representation space of the said multiple elements,
- determining statistics of use of at least one of said composing algorithms for generating a complexity information
- associating to each of said video elements its own complexity information.

48. Composition method according to claim 46 further consisting in :

- providing an uncompressed digital audio element including audio packets, audio objects, synthetic audio objects
- composing said audio element with said composing device according to a composition syntax, said audio composing device using a plurality of composing algorithms necessary to compose each of said audio elements and provide a representation in a common audio representation space
- determining statistics of use of at least one of said algorithms for generating a complexity information.
- associating to each of said audio element its own complexity information.

49. Composition method according to claim 46 or 47, wherein to each composition algorithm is associated at least one composition mode and/or composition parameter and wherein the statistics is based on the occurrence of use of composition modes and/or composition parameters.

50. Method for composing a digital signal according to any of claims 46 to 48 comprising the steps of :

(a) reading the complexity information associated to at least one of said video element and/or audio element
(c) allocating a composition time and/or operating system resources as a function of said complexity informa-

Webgroup CZ a.s. Ex. 1002, Page 922 of 1406

tion signal for the composition process of said associated video element and/or audio element ;
(d) sending said video element and/or audio element to composition means ;
(e) compose in a common representation space said video element and/or audio element using said allocated composition time and/or operating system resources, according to a composition process, and
(f) generating a common representation space including said video element and/or audio element according to the composition syntax.

51. Method for composing digital video/audio elements according to claim 49 wherein the step determining composition algorithms is also based on the occurrence of use of the composition modes and/or composition parameters necessary to compose the said composition elements in a common composition space.

52. Composition method according to any of claims 48 to 50 further comprising the step of determining a composition time prediction signal as a function of said complexity information ; said composition time prediction signal being used for the step of allocating said composition time and/or operating system resources for optimizing said composition process and or composition processes.

53. Composition method according to claim 50 wherein the step of composing the audio/video elements consists in

- generating an allocated composition time signal,
- sending said composition time prediction signal and allocated composition time signal to composition supervisor means ;
- generating and sending a degradation directive signal to said composition means, as a function of said composition time prediction signal, allocated composition time, so as to define the use of number and type of composition algorithms and degradation algorithms to be used in the composition process of said video/audio composition elements.

54. Composition method according to claim 52 wherein the step of composing the video/audio elements further consists in :

- generating a compositor time reference signal and a target composition time signal,
- sending said compositor time reference signal and said target composition time signal to composition supervisor means ;
- generating and sending said degradation directive signal to said composition means while also taking into account said compositor time reference signal and said target composition time signal.

55. Composition method according to claim 52 or 53 wherein the step of composing the audio/video elements further consists in :

- generating a compositor status signal from said composition means
- sending said compositor status signal to said composition supervisor means from the said composition means ;
- generating and sending said degradation directive signal to said means while also taking into account said compositor status signal.

56. Composition method according to claim 48 wherein steps (a) to (c) are carried out prior to step (e).

57. Composition method according to any of claims 51 to 55, further comprising the step of sending said complexity information signal to said compositor supervisor means.

58. Decoding method according to any of claims 53 to 56 wherein the step of generating said degradation directive signal consists in associating at least a degradation algorithm to at least one composition algorithm, said composition algorithm and said degradation algorithm being associated to a complexity coefficient/weight representative of the execution time of said composition algorithm and said degradation algorithm.

59. Composition method according to claim 57 wherein said complexity coefficients/weights are dependent on the compositor used for implementing said composition method.

60. Composition method according to claim 57 or 58, wherein said composition time prediction signal is a function of

Webgroup CZ a.s. Ex. 1002, Page 923 of 1406

the occurrence of use of said composition algorithms and said complexity coefficients/weights according to the following equation :

$$T(t) \cong T_{Pred}(t) = \sum_{i=1}^{I} c_i w_i \quad (9),$$

where T is the time necessary to compose a audio/video element, T_{Pred} is the composition time prediction of said audio/video element, c_i is the occurrence of said composition algorithm, and w_i is the complexity coefficient/weight.

61. Composition method according to claim 59, wherein when the composition time prediction is a function of the occurrence of use of said composition algorithms and degradation algorithms, said degradation algorithms being associated to a complexity coefficient/weight.

62. Composition method according to claim 59 or 60, wherein when the composition time prediction is greater than the allocated composition time, one uses a degradation method according to which one selects the degradation algorithm instead of its associated composition algorithm according to equation :

$$T_{process} = \sum_{i \in S_{CGD}} (a_i w_i^{CGD} + b_i w_i) + \sum_{i \in S_{Orig}} c_i w_i \leq T_{Alloc} \quad (13)$$

where, $T_{Process}$ is the prediction time necessary to compose a audio/video element, said composition time prediction taking account the degradation, c_i is the occurrence of composition algorithm, a_i is the number the selected degradation algorithms, w_i^{CGD} is the complexity coefficient/weight of the degradation algorithm, b_i is the number of the non selected degradation algorithms, and w_i is the complexity coefficient/weight, where $a_i + b_i = c_i$, so as to reach a $T_{Process}$ lesser than or equal to said allocated composition time.

63. Composition method according to claim 60 or 61, wherein said composition status signal is also used for monitoring the current composition time of a composition video/audio element and make sure that said current composition time is in conformity with the associated composition time prediction.

64. Composition method according to claim 62, wherein if said current composition time is not in conformity with the associated composition time prediction, then said composition supervisor means uses at least one further degradation algorithm defined in claim 61.

65. Composition method according to claim 63 wherein if said current composition time is not in conformity with the associated composition time prediction, then said decoder supervisor means further uses said complexity information signal.

66. Composition method according to any of claims 51 to 63 for a plurality of audio/video composition elements wherein when the composition time prediction is the sum of the composition prediction time of each of said audio/video composition elements, said composition time prediction being defined in claim 50.

67. Composition system for an uncompressed digital video element including video frames and/or video planes and/or video objects, textures, texts, 2 and 3 dimensional graphic primitives, 2 and 3 dimensional models, comprising :

- a video compositor receiving said video element on one input terminal, said compositor being intended to compose said video element using a composition syntax using a plurality of composing algorithms, and to provide, on one output terminal, a representation in a common video representation space said video element ;
- means for determining statistic of use of at least one of said composition algorithms,
- and means for generating a digital statistic signal representative of said statistics for each of said composed video element.

68. Composition system for an uncompressed digital audio element including audio packets, audio objects, synthetic audio objects, comprising :

Webgroup CZ a.s. Ex. 1002, Page 924 of 1406

- a audio compositor receiving said audio element on one input terminal, said compositor being intended to compose said audio element using a composition syntax using a plurality of composing algorithms, and to provide, on one output terminal, a representation in a common audio representation space said audio element ;
- means for determining statistic of use of at least one of said composition algorithms,
- and means for generating a digital statistic signal representative of said statistics for each of said composed audio element.

69. Composition system for an audio-visual object comprising a composition system according to claim 66 combined with a composition system according to claim 67.

Webgroup CZ a.s. Ex. 1002, Page 925 of 1406

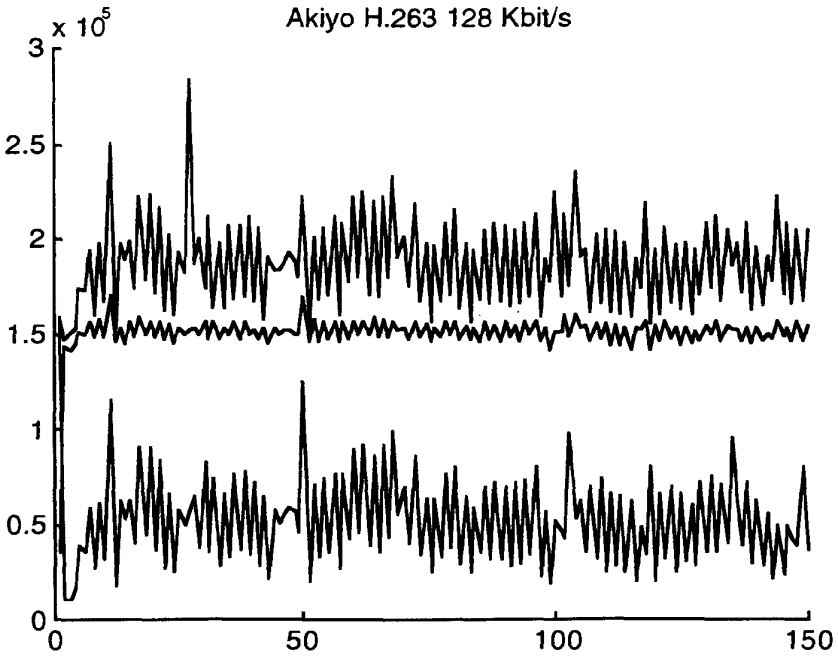


Figure 1

Webgroup CZ a.s. Ex. 1002, Page 926 of 1406

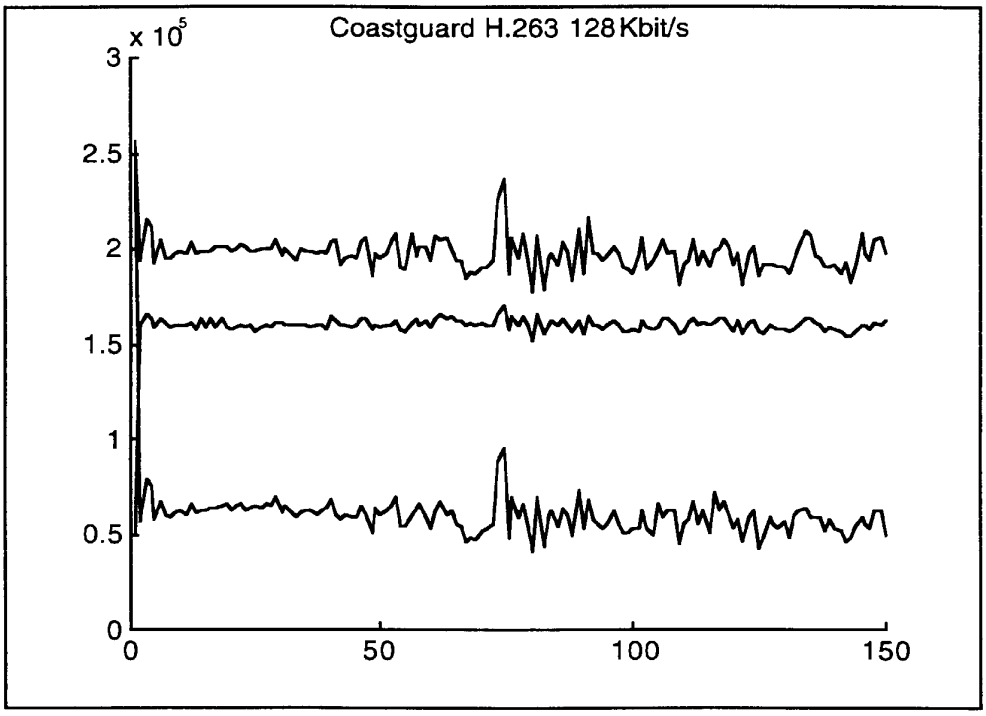


Figure 2

Webgroup CZ a.s. Ex. 1002, Page 927 of 1406

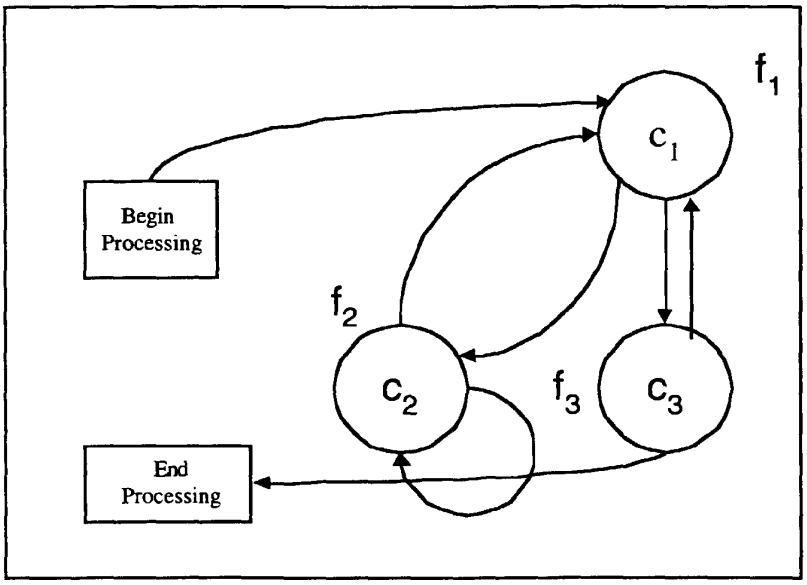


Figure 3

Webgroup CZ a.s. Ex. 1002, Page 928 of 1406

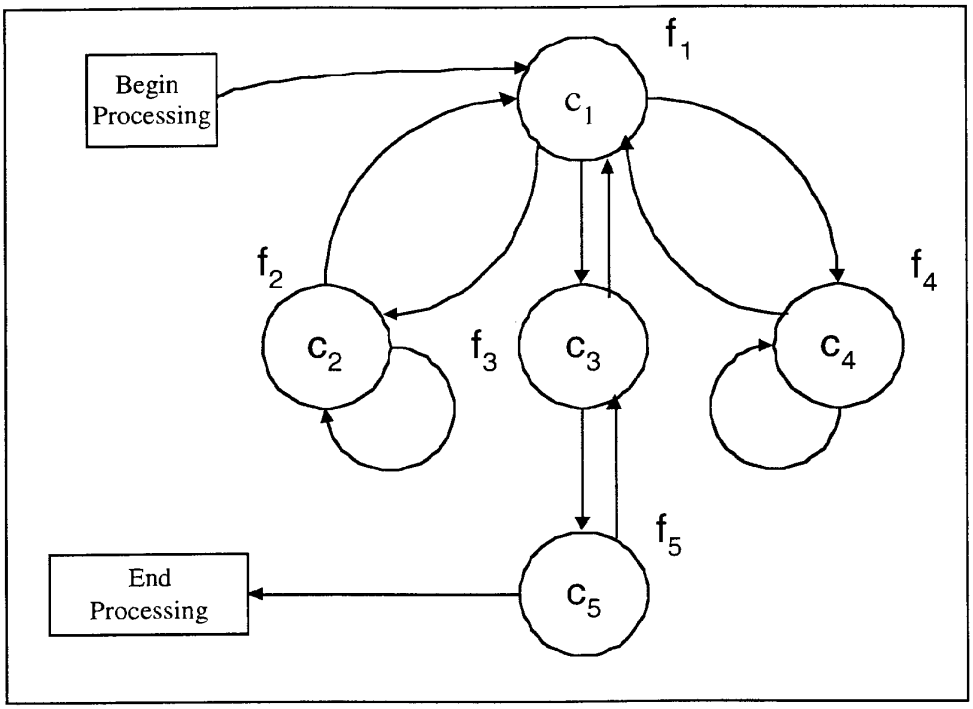


Figure 4

Webgroup CZ a.s. Ex. 1002, Page 929 of 1406

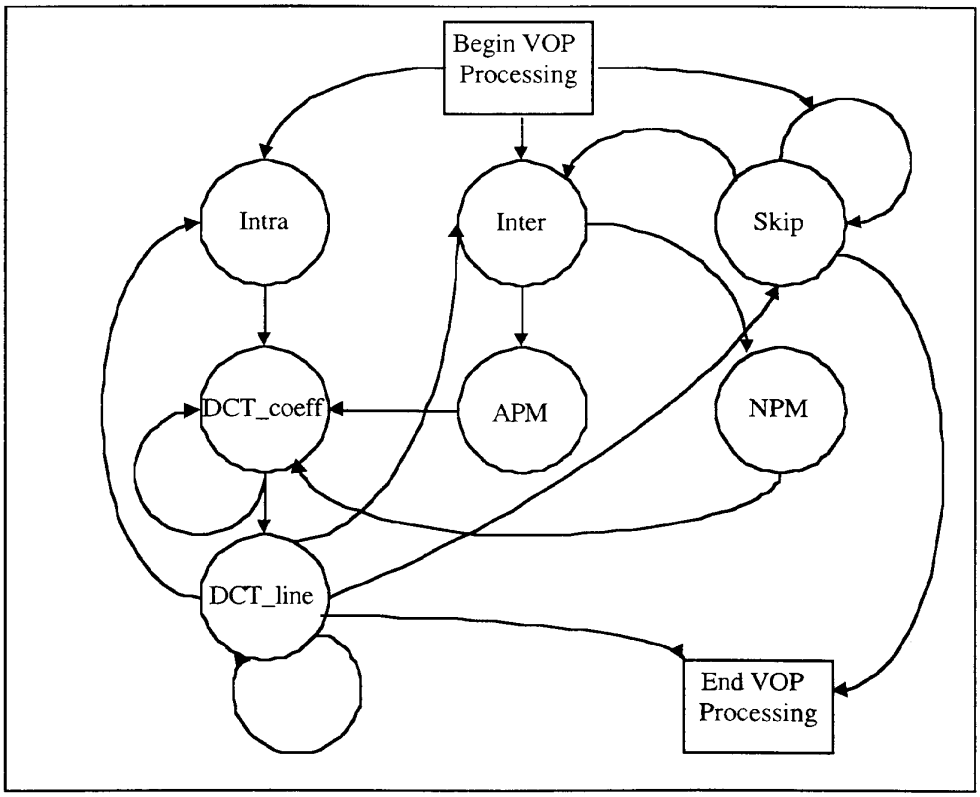


Figure 5

Webgroup CZ a.s. Ex. 1002, Page 930 of 1406

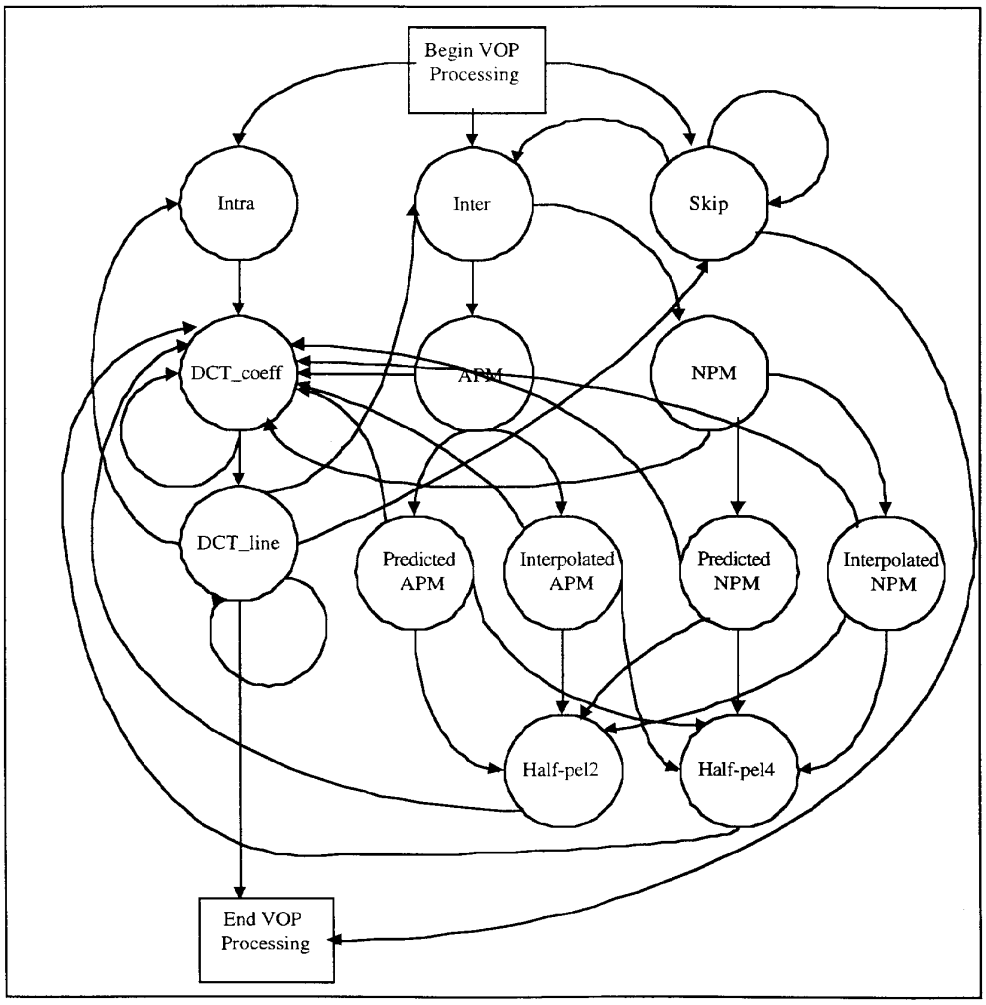


Figure 6

Webgroup CZ a.s. Ex. 1002, Page 931 of 1406

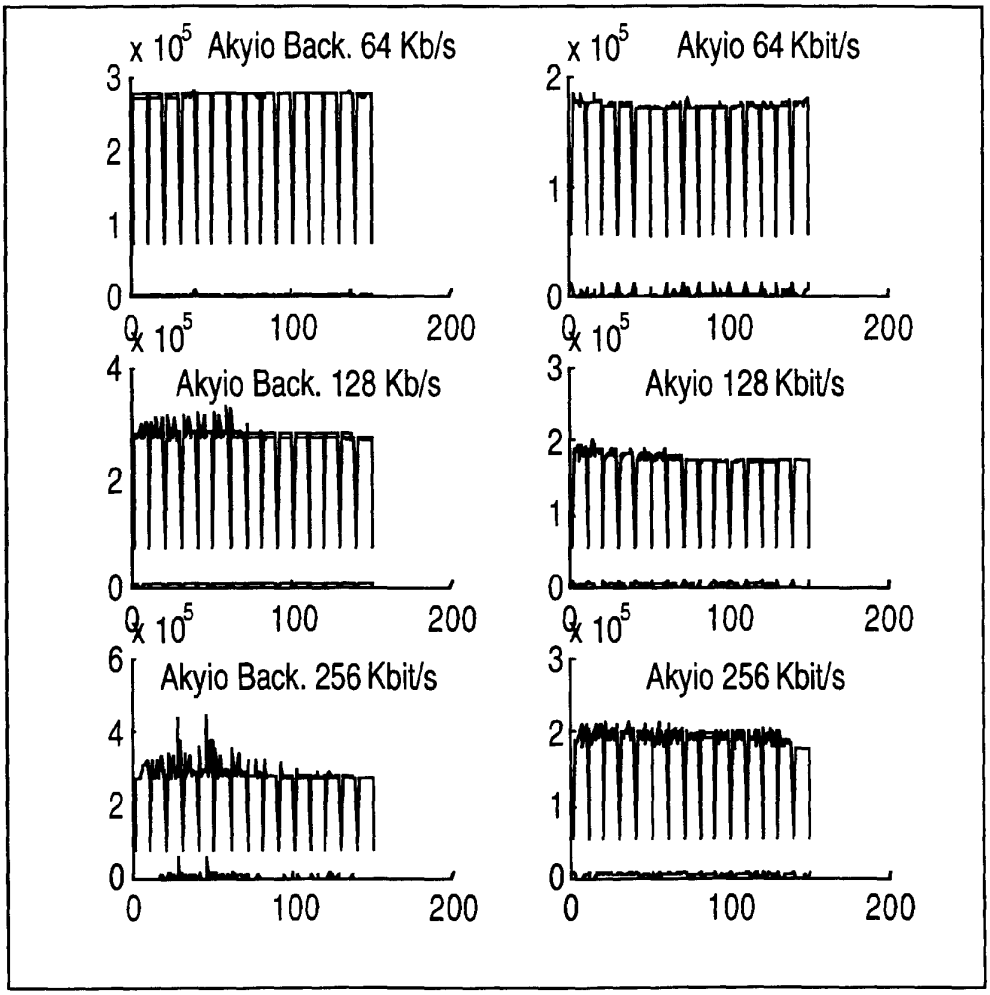


Figure 7

Webgroup CZ a.s. Ex. 1002, Page 932 of 1406

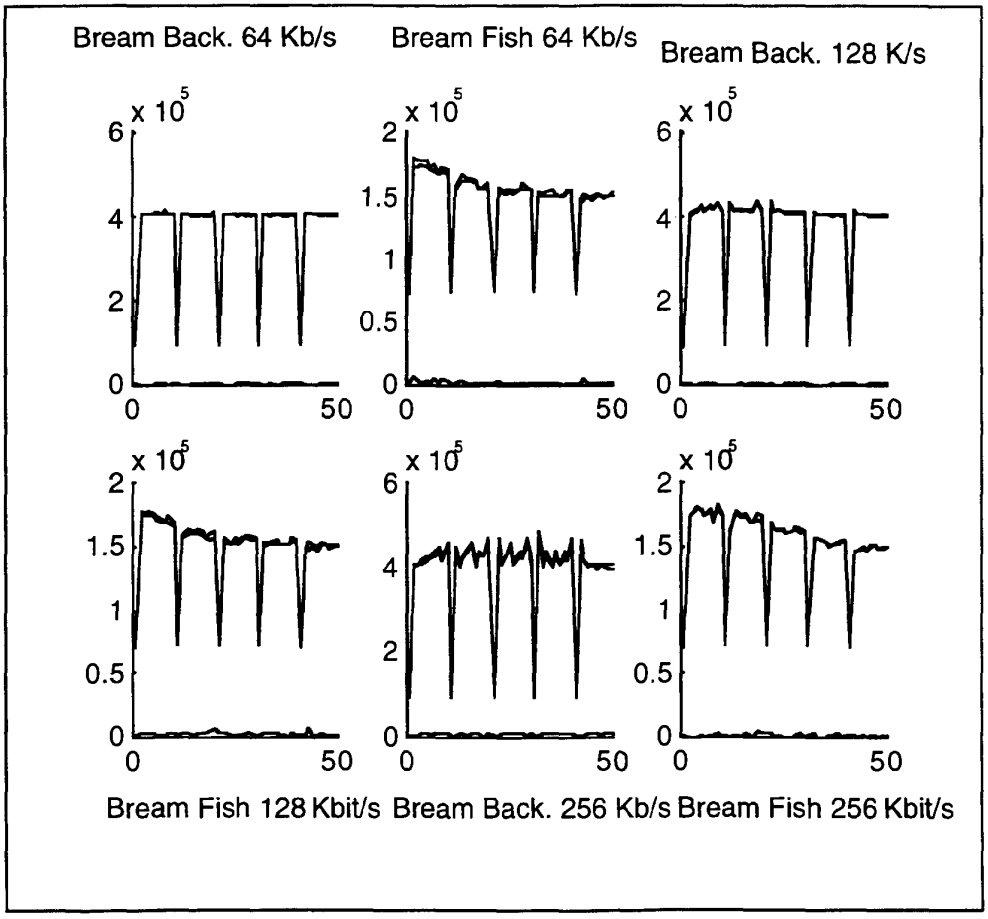


Figure 8

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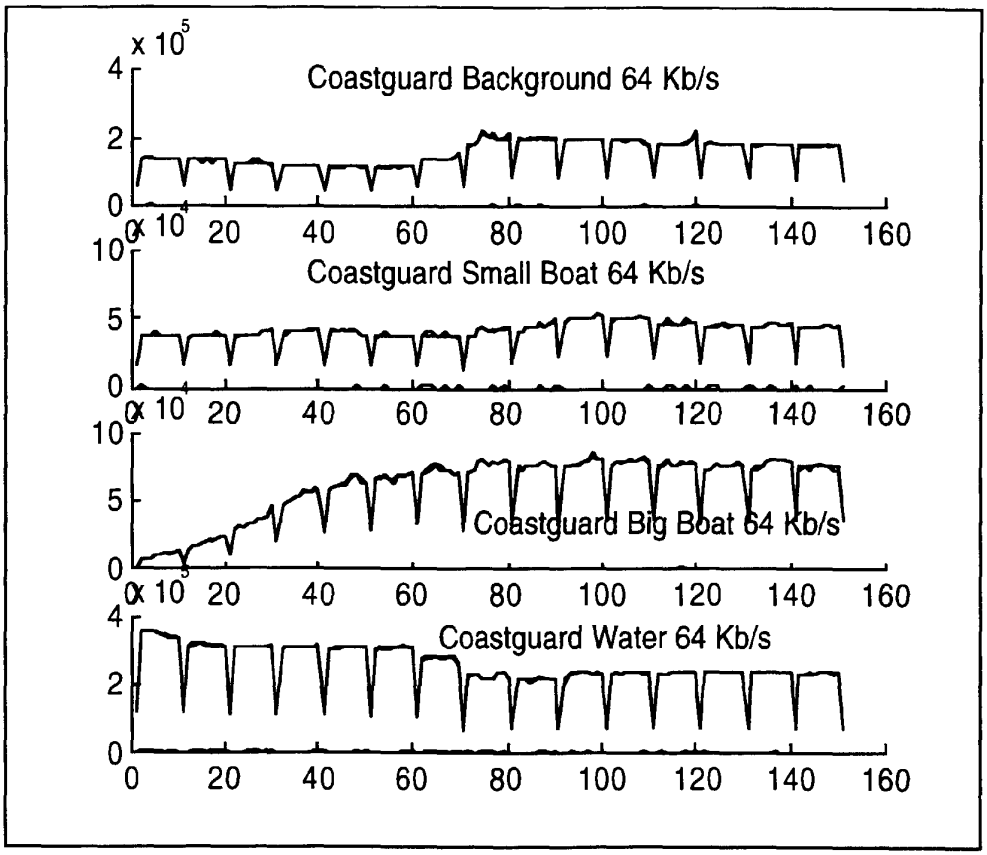


Figure 9

Webgroup CZ a.s. Ex. 1002, Page 934 of 1406

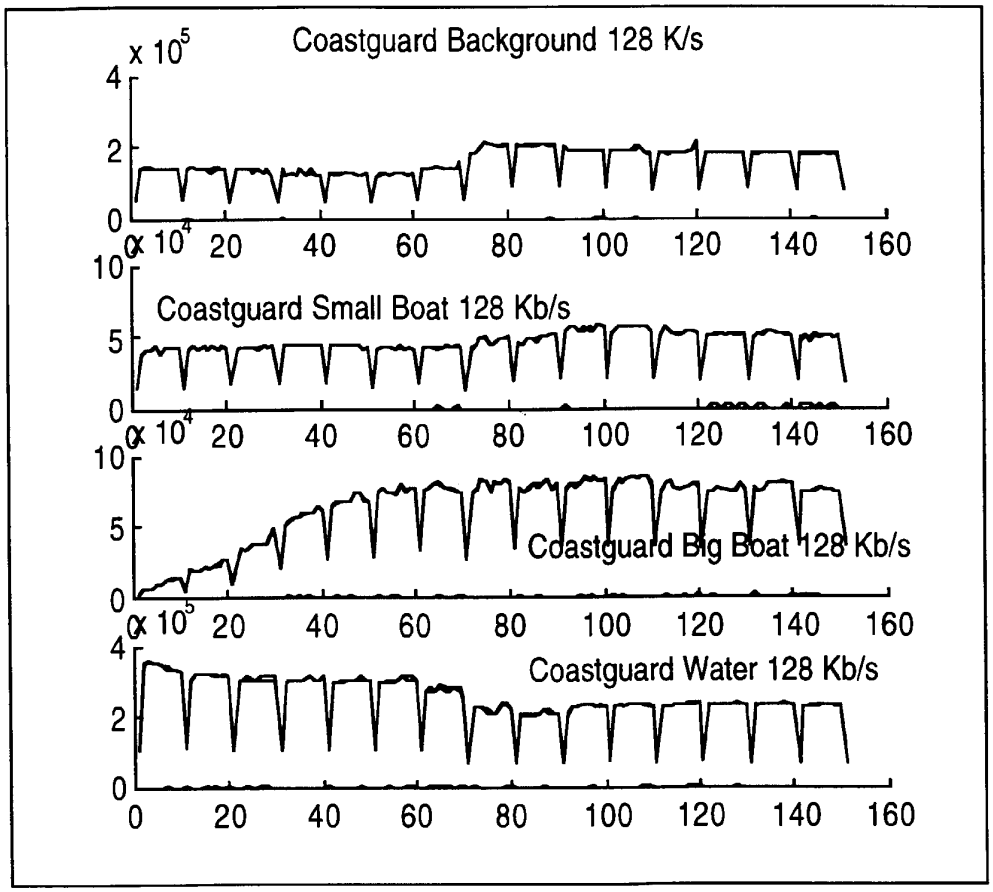


Figure 10

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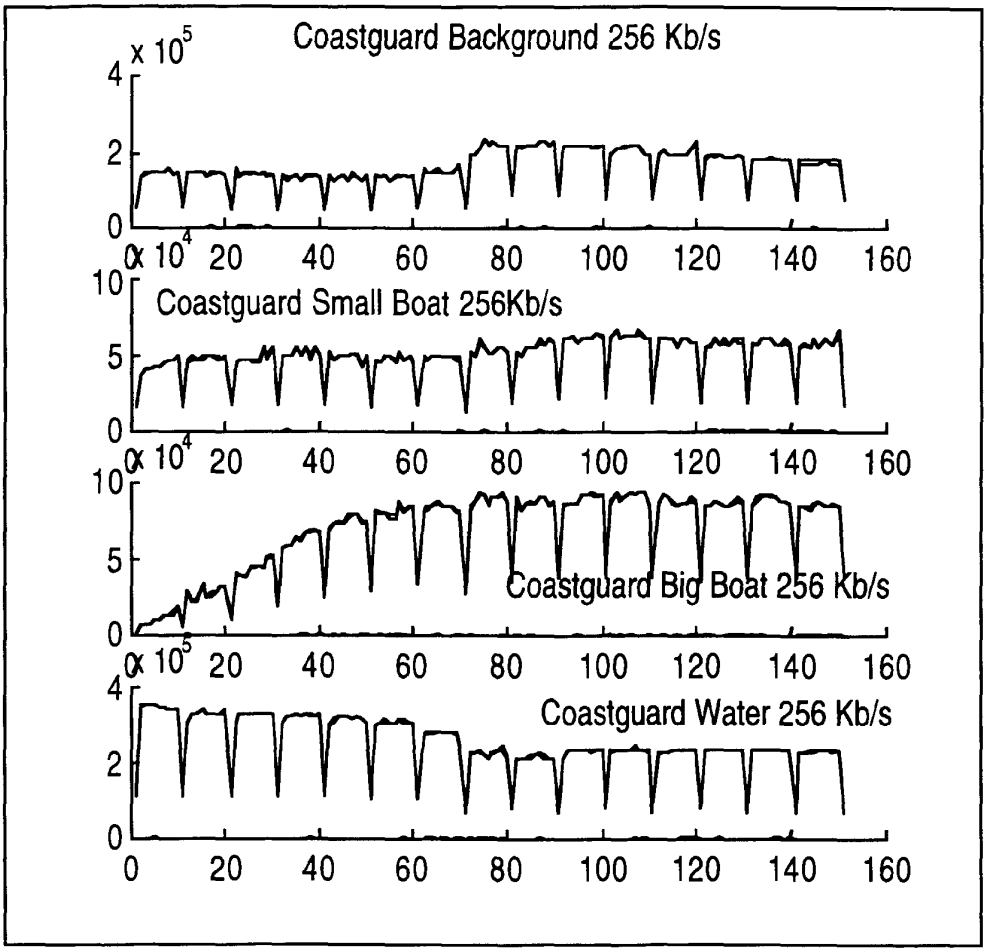

Coastguard Background 256 Kb/s
x 10^5
4
2
0
0 x 10^4 20 40 60 80 100 120 140 160
Coastguard Small Boat 256Kb/s
10
5
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0 x 10^4 20 40 60 80 100 120 140 160
Coastguard Big Boat 256 Kb/s
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Figure 11

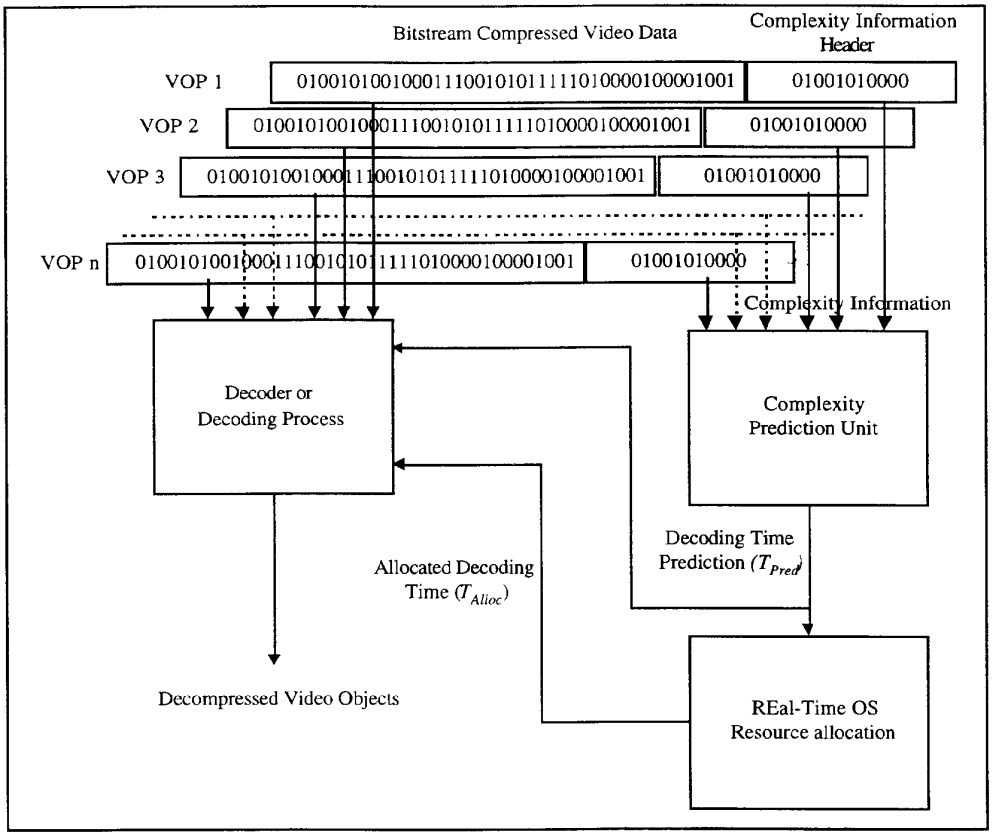


Figure 12

Webgroup CZ a.s. Ex. 1002, Page 937 of 1406

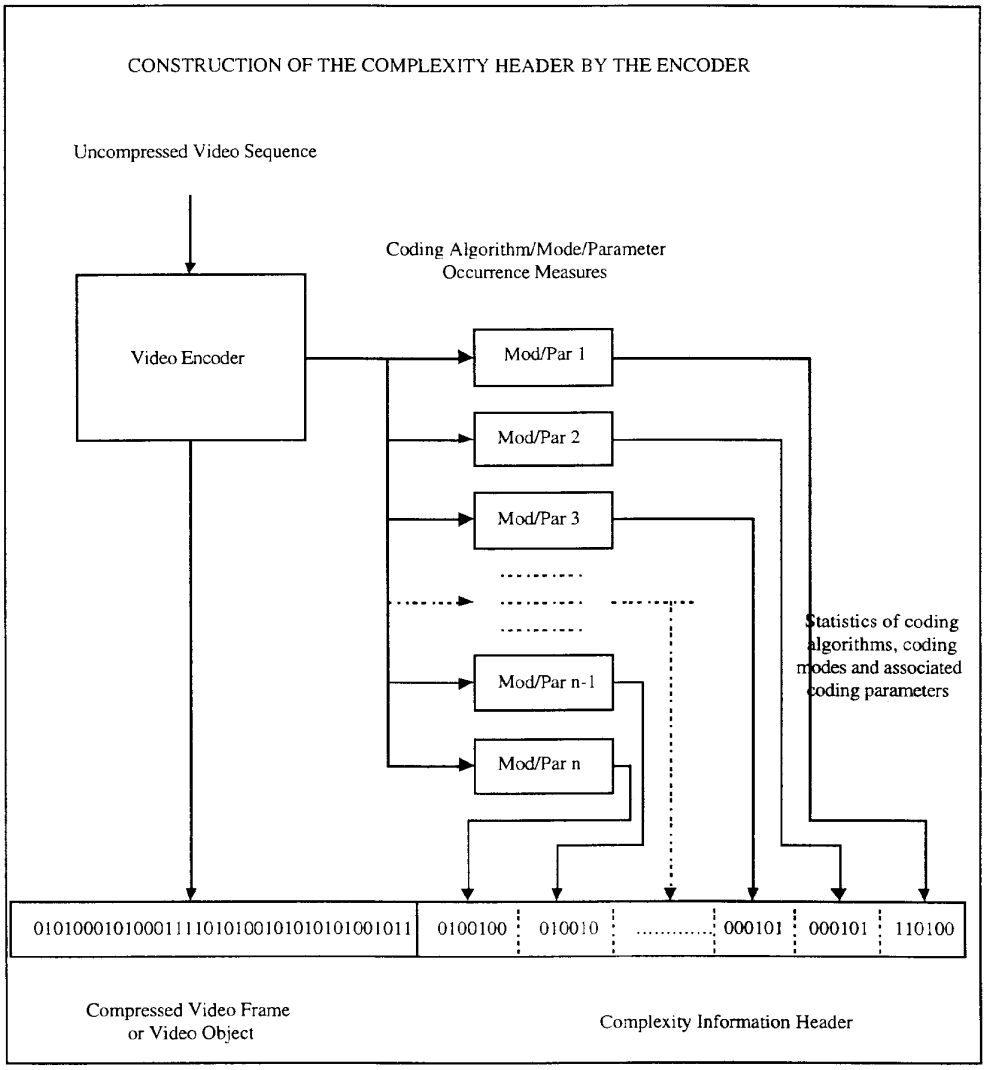


Figure 13

Webgroup CZ a.s. Ex. 1002, Page 938 of 1406

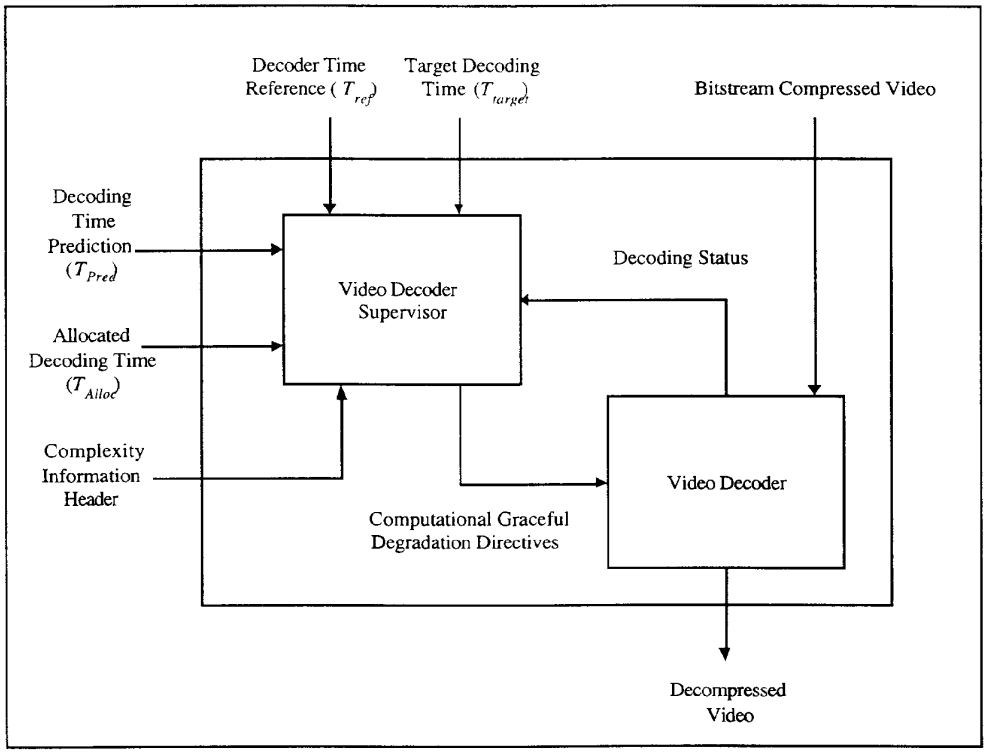


Figure 14

Webgroup CZ a.s. Ex. 1002, Page 939 of 1406

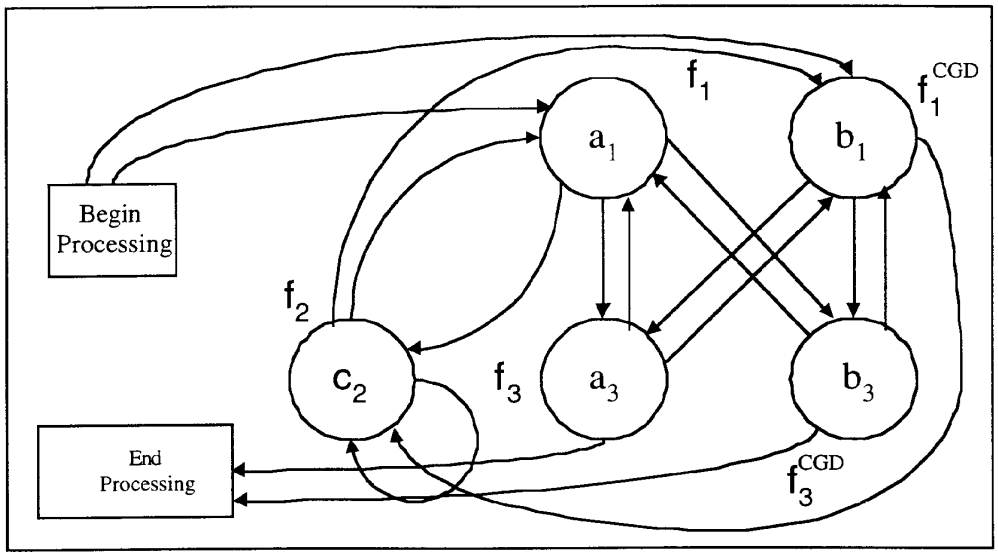


Figure 15

Webgroup CZ a.s. Ex. 1002, Page 940 of 1406

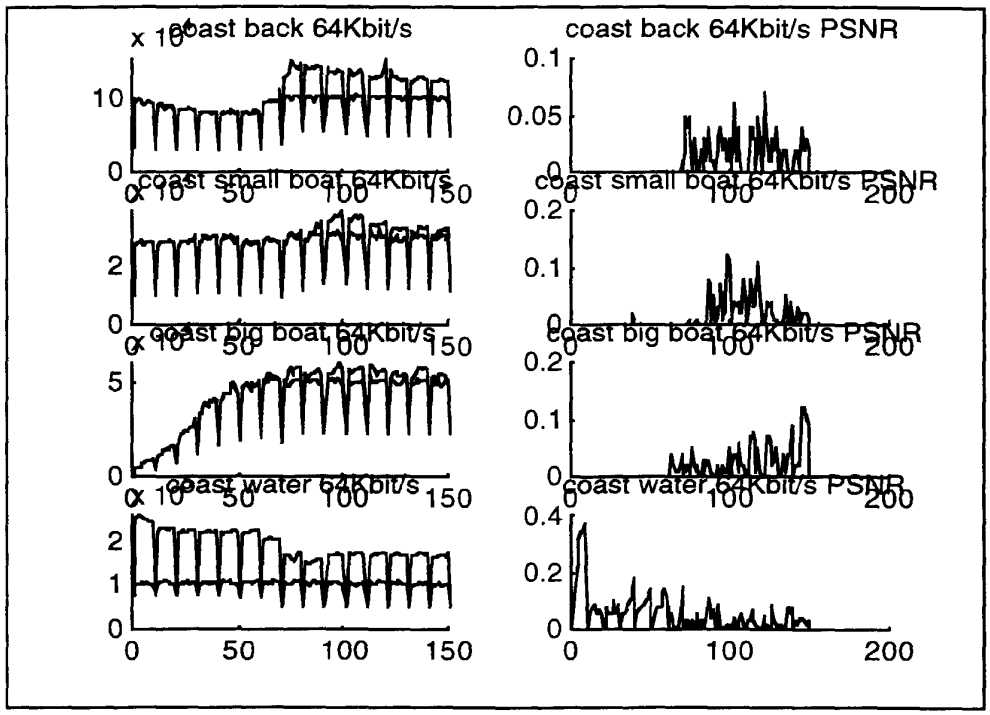


Figure 16

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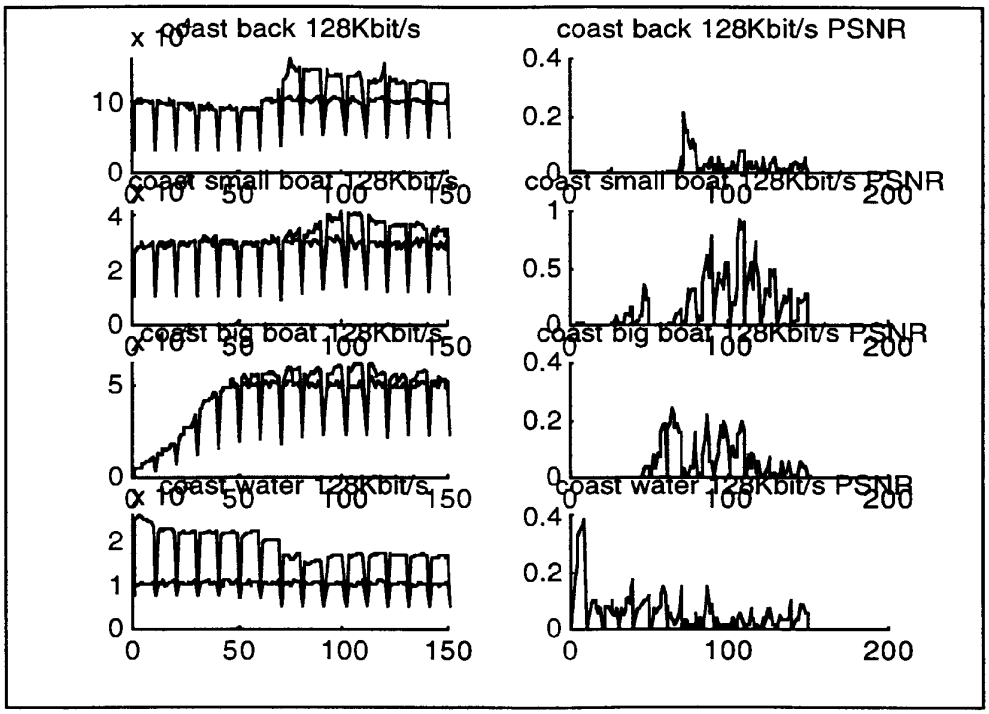


Figure 17

Webgroup CZ a.s. Ex. 1002, Page 942 of 1406

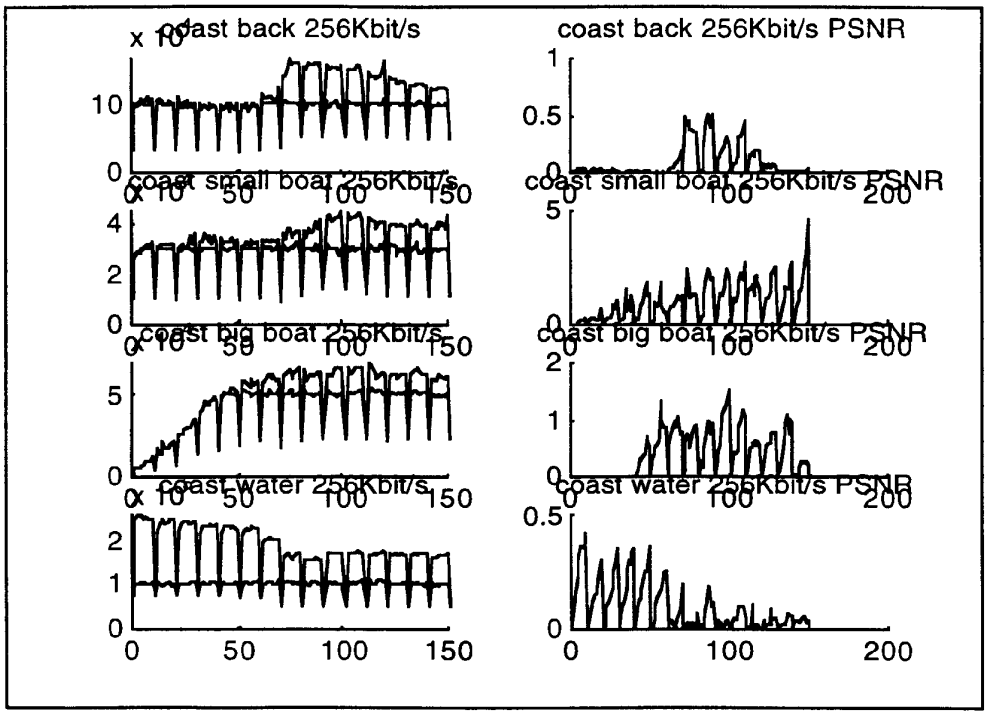


Figure 18

Webgroup CZ a.s. Ex. 1002, Page 943 of 1406

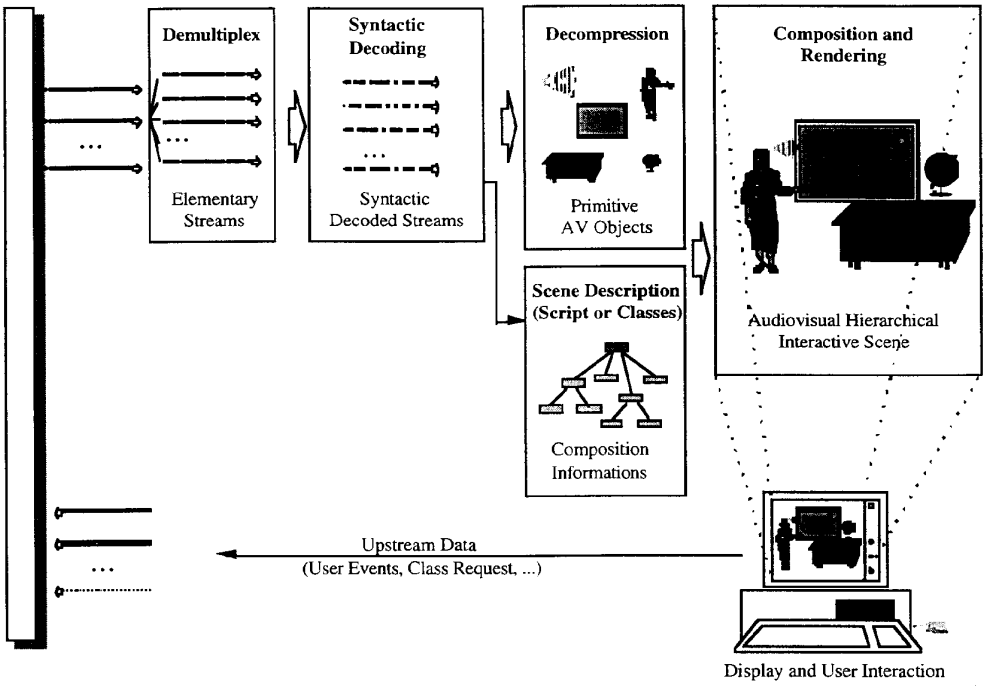

Demultiplex
Elementary Streams
Syntactic Decoding
Syntactic Decoded Streams
Decompression
Primitive AV Objects
Scene Description (Script or Classes)
Composition Informations
Composition and Rendering
Audiovisual Hierarchical Interactive Scene
Upstream Data
(User Events, Class Request, ...)
Display and User Interaction

Figure 19

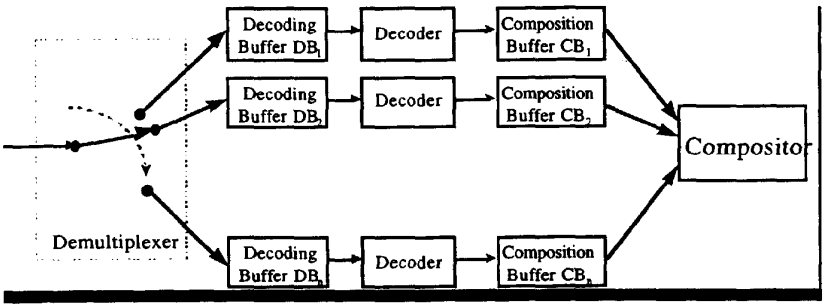


Figure 20

Webgroup CZ a.s. Ex. 1002, Page 945 of 1406

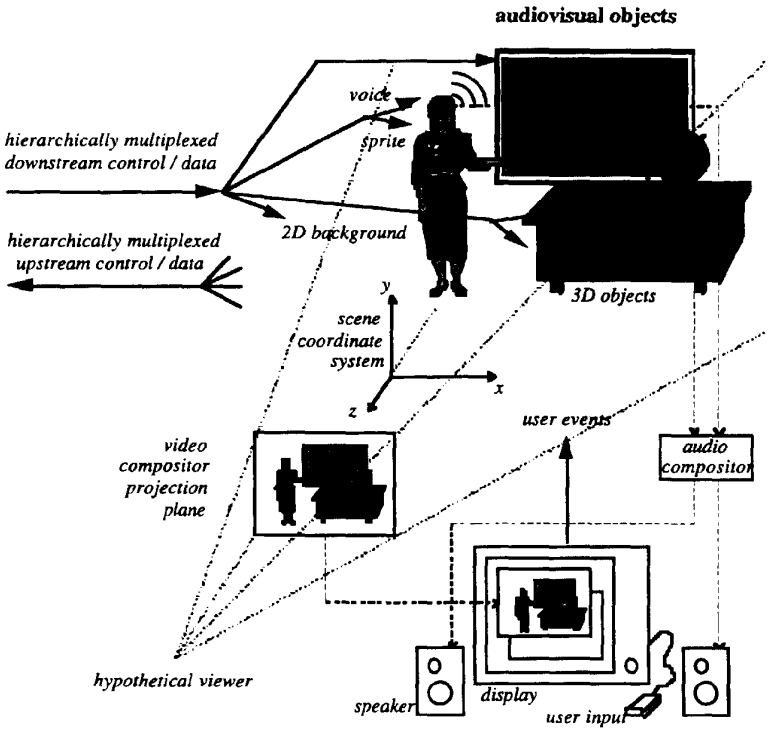


Figure 21

Webgroup CZ a.s. Ex. 1002, Page 946 of 1406

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 9423

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
E	EP 0 866 426 A (ALSTHOM CGE ALCATEL) 23 September 1998 * abstract; claims 1,5,6 *	1-68	G06T9/00
A	EP 0 512 174 A (SEMAPHORE INC) 11 November 1992 * page 2, line 40 - line 43 * * page 3, line 32 - line 36 *	1-68	
A	MATTAVELLI M ET AL: "Computational graceful degradation for video sequence decoding" PROCEEDINGS. INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (CAT. NO.97CB36144), PROCEEDINGS OF INTERNATIONAL CONFERENCE ON IMAGE PROCESSING, SANTA BARBARA, CA, USA, 26-29 OCT. 1997, pages 330-333 vol.1, XP002080307 ISBN 0-8186-8183-7, 1997, Los Alamitos, CA, USA, IEEE Comput. Soc, USA		

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CATEGORY OF CITED DOCUMENTS

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Webgroup CZ a.s. Ex. 1002, Page 947 of 1406

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(71) Applicant: **Kabushiki Kaisha Toshiba**
Tokyo 105-8001 (JP)

(72) Inventors:
- **Nagai, Takeshi, c/o Kabushiki Kaisha Toshiba**
  Minato-ku, Tokyo 105-8001 (JP)
- **Kikuchi, Yoshihiro,**
  c/o Kabushiki Kaisha Toshiba
  Minato-ku, Tokyo 105-8001 (JP)
- **Masuda, Tadaaki, c/o Kabushiki Kaisha Toshiba**
  Minato-ku, Tokyo 105-8001 (JP)

(74) Representative: **Midgley, Jonathan Lee**
Marks & Clerk
57-60 Lincoln's Inn Fields
GB-London WC2A 3LS (GB)

(54) Data transmission apparatus and method

(57) A data transmission apparatus comprises a network condition determination device for determining a transmission condition of the transmission channel in the transmitter (103) based on at least Jitter information or a packet loss rate obtained from a receiver (104), and a video encoder (102) including means for changing at least one of a bit rate of transmission data and a error resilience level according to the transmission condition.

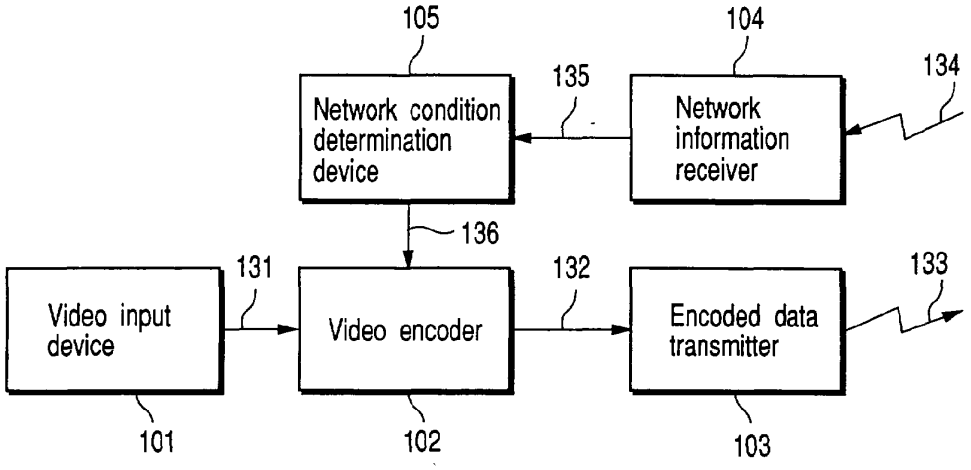


FIG. 1

EP 1 202 487 A2

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Description

[0001] The present invention relates to a data transmission method for transmitting encoded moving/still picture by using a wired communication network such as ISDN (Integrated Services Digital Network) or a wireless communication network such as PHS (Personal handy-phone System) or satellite communication and a data transmission apparatus to which such method is applied.

[0002] In recent years, with progress of digital encoding technology of a variety of information such as image and a broadband network technology, the development of applications using these technologies becomes active, and a system of transmitting compression-encoded image by utilizing a communication network is developed.

[0003] For example, an input video signal is encoded at a video encoder, the obtained encoded data is provided to an encoded data transmitter, and transmission data is transmitted to a transmission channel. In this way, a video is encoded and transmitted. In recent years, with the spread of Internet/Intranet, there has been increased an application or system of transmitting/receiving a packet of data. Providing data as a packet is very effective means for efficiently sharing a bandwidth of a communication channel by a plurality of users.

[0004] In the meantime, as a protocol for transmitting/receiving packet data via Internet/Intranet, there exists TCP/IP (Transmission Control Protocol/Internet Protocol) or UDP/IP (User Datagram Protocol/Internet Protocol) and the like.

[0005] Among them, TCP/IP is an Internet standard protocol. This protocol is applied as the world's best known protocol to Intranet or LAN as well as Internet. TCP works in a transport layer that is a fourth layer of an OSI basic reference model, and IP works in a network layer that is a third layer.

[0006] In addition, UDP/IP is one of the TCP/IP suite transport layer protocols. TCP is a connection type protocol. UDP is a disconnection type protocol. As with TCP, a host application is identified by using a port number. This protocol is often used to carry short data for monitor control of a network or real time oriented data such as audio data or video data.

[0007] TCP/IP incorporates a frame such as retransmission. Thus, this protocol is strong against errors or the like. Even if a large amount of time is required, this protocol is effective to download type applications if an attempt is made to validly receive data. However, this protocol is not powerful for applications requiring real time properties.

[0008] In contrast, although UDP/IP does not have a retransmission frame, a delay associated with retransmission does not occur. Thus, this protocol is very effective to applications requiring real time processing.

[0009] Transmission of moving picture is exemplified as a typical example of application requiring real time processing. However, in the case of general video communication, video data has a very large amount of data, and overflows a network bandwidth in most cases. In this case, a technique for encoding a video data signal, and transmitting a reduced amount of data is used. Techniques such as motion compensation, discrete cosine transform (DCT), sub-band encoding, pyramid encoding, and variable-length encoding or a combination of these techniques are developed as compression-encoding of a video signal.

[0010] As an international standard system for moving picture encoding, there are ISO MPEG-1, MPEG-2, ITU-T H. 261, H. 262, and H. 263. In addition, as an international standard system for multiplying an encoded data stream having a speech/audio signal compressed or other data, there are an ISO MPEG system, ITU-T H. 221, and H. 223.

[0011] Internet or the like is encompassed via an infinite number of networks. Usually, no one knows which network is used or what state is. In addition, an amount of data flowing a network changes from time to time. Thus, a system of judging what amount of data can be communicated in a real time is required.

[0012] Therefore, with further advancement from real time applications utilizing UDP/IP, there have been increased in number applications using a packet format called RTP (Real-time Transport Protocol) for adding and transmitting time information or the like to a packet.

[0013] This RTP is a protocol for transferring audio data signal or video data signal ruled in RFC 1889 in real time. Usually, data is carried on UDP (User Datagram Protocol). This protocol is assumed to be applied to a multimedia system such as video conference, and data can be exchanged in a real time interactive scheme. However, the protocol has no sound quality or picture quality assurance function. Sequential number or time stamp data is assigned into an RTP header, thereby supporting a read time operation.

[0014] RFC is an abbreviation of Request for Comments, and denotes a document such as technical proposal or comments disclosed by TETF (Internet Engineering Task Force). Many de-fact standards such as a variety of protocols of TCP/IP suite are described in RFC.

[0015] By utilizing this RTP, time information and a packet number are added to a packet, so that a receiver can display a voice or image by using correct time information, can determine a packet or the like whose order is replaced in a network, and can detect that a packet is lost by referring to a packet number.

[0016] Moreover, the RTP provides with a system (RTCP) for notifying network state information such as jitter or packet loss rate from a transmitter to a receiver.

[0017] However, how this RTCP information is utilized depends on applications, and is not determined in standards.

[0018] In addition, in the case of an image, a bandwidth corresponding to video transmission cannot be al-

Webgroup CZ a.s. Ex. 1002, Page 949 of 1406

located in a network bandwidth, thus making it necessary to compress and deliver a video signal in an encoding system such as MPEG, as described previously. Although this encoding system is effective in a decreased amount of data, the system becomes very fragile to a packet loss or error entry by supplying data to unstable Internet. This is because a moving picture encoding system transmits only a difference between a current frame and a previous frame. Thus, partial data missing causes a very serious problem. In the case of using the UDP or RTP, data retransmission is not basically carried out, thus making it necessary to counteract this problem.

[0019] There generally exist two modes in picture encoding, that is, one is an inter-frame encoding mode for transmitting a difference between the current frame and the previous frame and an intra-frame encoding mode for carrying out encoding in one frame. In general, intra-frame encoded pictures are provided at a proper timing, and inter-frame encoded pictures are provided between them. An interval between the frames encoded in an intra-frame encoding mode is called a GOP (Group of Picture) interval.

[0020] When an encoded picture is missing during transmission to the decoder, the decoded picture corresponding to the missing encoded picture is destroyed. Thereafter, the intra-encoded pictures following the missing encoded picture are decoded based on the destroyed picture. Thus, all the subsequent decoding pictures are affected by the destroyed picture, and decoding cannot be carried out correctly. Therefore, an intra-frame encoded picture is inserted in the way of a stream of frames to cut off a propagation of missing error and recover adequate decoding.

[0021] In a conventional technology, it can determine that errors occur in a network. However, how to utilize the determination result has been unknown. Also, a system for notifying the network information to the transmitter in an unique format is conceived. However, the system is based on the specification of associated applications and lacks a general-purpose use. The system receives transmission data using an information receiver, and controls a video encoder within a range of the information received from the network via a transmission channel.

[0022] A conventional network condition determination is conceived on assumption of network congestion. However, since Internet is popularized in mobile environment, it is required to consider an error or the like in wireless environment. Current technique does not assume countermeasures against such error.

[0023] Further, in the case of dealing with the error, a case in which a network condition changes, and an error rate is not constant is not considered. If a short GOP interval is set in order to counteract a case in which errors frequently occur, the intra-frame encoding increases resulting in impairing the encoding efficiency. When errors occur frequently qualitatively, it may be required to establish such state in which such errors occur frequently. However, in the case of a network in which an error hardly occurs in a normal state, and an error occurs only at one moment, this setting is very wasteful. Conversely, when a long GOP interval is set, it is troublesome that a great influence occurs when an error occurs.

[0024] Thus, a real time transmission using RTP is noted. As described above, by utilizing the RTP that is a protocol for transferring audio data signal or video data signal in real time, time information and a packet number are added to a packet, whereby the receiver can display a voice or image by using correct time information, can determine a packet or the like whose order is replaced in a network, or can detect that a packet is lost by referring to a packet number.

[0025] Moreover, at the RTP, there is provided a system (RTCP) for notifying network state information such as jitter or packet loss rate from the transmitter or receiver.

[0026] It is an object of the present invention to provide a data transmission apparatus and method capable of adjusting a transmission rate by using the RTP characteristics in accordance with a transmission state of a transmission channel based on notification of network state information such as jitter or packet loss rate, obtained from the receiver in the transmitter or capable of carrying out controls such as changing error resilience, thereby making it possible to efficiently transmit data to the maximum, and fully utilize transmission that requires real time properties.

[0027] According to an aspect of the invention, there is provided a data transmission apparatus that transmits transmission data from a transmitter to a receiver via a transmission channel, comprising: an estimation device configured to estimate a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and a controller configured to change at least one of a bit rate of transmission data and a error resilience level according to the estimated transmission condition.

[0028] According to another aspect of the invention, there is provided a data transmission method comprising: estimating a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and changing at least one of a bit rate of transmission data and an error resilience level according to the estimated transmission condition.

[0029] According to another aspect of the invention, there is provided a data transmission program stored on a computer readable medium, comprising: instruction means for instructing a computer to estimate a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and instruction means for instructing the computer to change at least

Webgroup CZ a.s. Ex. 1002, Page 950 of 1406

one of a bit rate of transmission data and a error resilience level according to the estimated transmission condition.

[0030] This summary of the invention does not necessarily describe all necessary features so that the invention may also be a sub-combination of these described features.

[0031] The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a view showing a basic configuration of a data transmission apparatus according to a first embodiment of the present invention;
FIG. 2 is a view showing another configuration in the present embodiment;
FIG. 3 is a view showing a configuration of a network condition determination device in the present embodiment;
FIG. 4 is a view showing a configuration of a video encoder in the present embodiment;
FIG. 5 is a view showing a configuration of an encoded parameter determining device in the present embodiment;
FIG. 6 is a view showing a basic configuration of a data transmission apparatus in a second embodiment of the present invention;
FIG. 7 is a view showing a configuration of an encoded data switch device in the present embodiment;
FIG. 8 is a view illustrating a timing of encoded data switching at an encoded data switch device in the present embodiment;
FIG. 9 is a view illustrating a timing of switching encoded data with its different frame interval at the encoded data switch device in the present embodiment;
FIG. 10 is a flow chart showing a basic example of the network condition determination method at the network condition determination device in the first embodiment of the present invention;
FIG. 11 is a flow chart showing a basic example when a delay is forced to occur by using the network condition determination method at the network condition determination device in the first embodiment of the present invention;
FIG. 12 is a flow chart showing a basic example considering a time direction change with the network condition determination method at the network condition determination device in the present embodiment;
FIG. 13 is a view showing an exemplary configuration according to a third embodiment of the present invention;
FIG. 14 is a flow chart showing an example of a GOP interval calculation method at a GOP interval calculator in the present embodiment;
FIG. 15 is a flow chart showing another example of a GOP interval calculation method at a GOP interval calculator in the present embodiment; and
FIG. 16 is a flow chart showing still another example of a GOP interval calculation method at a GOP interval calculator in the present embodiment.

[0032] Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

[0033] The present invention utilizes RTP or RTCP that is a protocol for transferring audio data signal or video data signal in real time. The transmitter performs controls such as adjusting a transmission rate or changing error resilience in accordance with a transmission state of a transmission channel based on notification of network state information acquired from the receiver such as jitter (Jitter information) or packet loss rate. In this manner, data transmission can be carried out efficiently to the maximum. Hereinafter, embodiments of the present invention will be described in detail.

(First Embodiment)

[0034] FIG. 1 shows a basic configuration of an image transmission apparatus according to a first embodiment of the present invention. In FIG. 1, a video signal 131 input from an image input device 101 is processed to be encoded. That is, an encoded data transmitter 103 processes encoded data 132 that has been encoded by a video decoder 102 in the form which conforms to a network, and transmits the encoded data to a receiver. A network information receiver 104 receives network information 134 delivered from the receiver, and outputs the received information to a network condition determination device 105. This network condition determination device 105 has a function that determines a network condition from network information 135 output from the network information receiver 104, and notifies the result as network condition information 136 to the video encoder 102.

[0035] The video encoder 102 encodes the video signal 131 using the network condition information 136. This encoding is carried out as follows. That is, in the case of RTP or RTCP, a packet loss rate or Jitter information is provided to the network condition determination device 105. The network condition determination device 105 determines that, if a packet loss rate is not "0" or if a delay time is longer than a predetermined value, any load is applied to a network, and a presumed amount of data cannot be supplied. Then, the network condition determination device 105 is configured so as to carry out processing so as to issue an instruction (network condition information 136) for lowering a bit rate to the video encoder 102, and to lowly set a target bit rate in encoding.

[0036] According to the thus configured apparatus, when the video signal 131 is inputted from the image input device 101, the inputted video signal 131 is encod-

Webgroup CZ a.s. Ex. 1002, Page 951 of 1406

ed by the video encoder 102. Encoded data 132 encoded by the video encoder 102 is inputted to the encoded data transmitter 103.

[0037] The encoded data transmitter 103 processes the encoded data in the form suitable to a network, and receives the processed data to a receiver. The network information receiver 104 receives the network information 134 delivered from the receiver, and outputs the received information to the network condition determination device 105.

[0038] The network condition determination device 105 determines a network condition from the network information 135 outputted from a network information receiver, and notifies the result as the network condition information 136 to the video encoder 102.

[0039] The video encoder 102 encodes the video signal 131 using the thus notified network condition information 136.

[0040] FIG. 10 shows a very simple example of a method for determining a network condition at the network condition determination device 105 by way of showing a flow chart.

[0041] According to this flow chart, at the step S1001, a packet loss rate of network information is checked to see if the rate is "0" or not. As the result of this check, if the packet loss is not "0", an effective bit rate is calculated from the packet loss rate in accordance with the step S1002. This bit rate can be calculated by formula (1) shown below.

$$b' = b \times (1 - r) \quad (1)$$

where "b" denotes a current bit rate, b' denotes a new bit rate, and "r" denotes a packet loss rate.

[0042] Next, at the step S1003, a parameter (encoding parameter) obtained at the step S1002 is notified to the video encoder 102. Here, the above parameter is used to determine a rate control or error resilience level for encode processing at the image encoder 102. This parameter is also used for adjustments such as adjusting and controlling the encode processing speed of the input image signal 131 to this parameter, thereby changing a bit rate, a frame interval, or an error resilience level.

[0043] On the other hand, at the step S1001, when the packet loss rate is "0", no parameter change occurs at the step S1004. This determination method is provided as a mere example. It is possible to employ any other method for obtaining a bit rate based on a case in which the criterion of the step S1001 is determined by thresholds without being set to "0" or others or based on a formula other than the above formula (1).

[0044] Therefore, according to the first embodiment, even when a transmission network bandwidth is unknown or when the bandwidth changes halfway, it is possible to reset a parameter or the like based on the receiver's network information, and then, encode and transmit an image in accordance with the parameter suitable to a current network. In this manner, even in the case of a network congestion, although a bit rate is automatically lowered, and an image quality is lowered, it is possible to communicate an image without an occurrence of a phenomenon that an image is destroyed due to such packet loss. This method is very effective in image transmission in real time.

[0045] The first embodiment can be carried out by modifying it as follows. For example, as shown in FIG. 11, a method other than that shown in FIG. 10 is employed as a method for determining a network condition at the network condition determination device 105. That is, in the flow chart shown in FIG. 10, a parameter is set at only a packet loss rate. In contrast, in the method shown in FIG. 11, even when no packet loss occurs at the step S1104, a delay quantity is checked. As a result of this check, if a delay occurs in excess of a predetermined value, it is determined that a network is congested. When it is determined that a network is congested, a bit rate is calculated, and a new parameter is set by using formula (2) below, for example, at the step S1105.

$$b' = b \times \{(TN-TS)+(d-dth)\}/(TN-TS) \quad (2)$$

where "b" denotes a delay time, b' denotes a new bit rate, TN denotes a current time, TS denotes a start time, "d" denotes a delay time, and "dth" denotes delay time thresholds.

[0046] FIG. 2 shows an example when the network condition determination device 105 is provided with a function for generating the network condition information 136 so as to provide the information to the image encoder 102 by extending the configuration shown in FIG. 1.

[0047] According to a configuration shown in FIG. 2, the network condition determination device 105 is provided with a function for acquiring a current parameter at the current image encoder 102 and a function for generating the network condition information 136 on what parameter should be set next from the thus acquired current parameter and network information 135, thereby providing the parameter to the image encoder 102.

[0048] In the case of this construction, the network condition determination device 105 can recognize a state of a video parameter, i.e., a state of the encode processing currently done at the video encoder 102, thus making it possible for the network condition determination device to calculate and grasp a bit rate or the like. This construction is advantageous in the case of determining a network condition by comparing the network information 135 with parameter information 137. Thus, a system is realized which is capable of changing a parameter so as to set an optimal bit rate in accordance with the network condition, and providing the parameter to the video encoder 102, thereby adjusting the encode processing.

[0049] In this way, according to the present invention,

Webgroup CZ a.s. Ex. 1002, Page 952 of 1406

transmission is adjusted in accordance with a transmission state of a transmission channel or error resilience is changed. The transmission state is adjusted by changing a bit rate or changing a frame interval. With respect to a change in quality of a transmission channel, the error resilience is changed according to the transmission state of the transmission channel (for example, the error resilience is changed by changing an interval of an MPEG4 synchronous signal). Therefore, data transmission can be carried out efficiently to the maximum, thereby enabling data transmission that makes it possible to fully utilize transmission requiring real time processing.

[0050] FIG. 3 shows a configuration when the configuration shown in FIG. 2 is further developed. This network condition determination device 105 comprises a network information storage device 301 that stores past network information and an encoded parameter information storage device 302 that stores encoded parameter information supplied to the current video encoder 102. A network condition determination device 303 recognizes the past network information and the current encoded parameter from these elements, decides an elapse of time in network condition from these elements to determine an optimal parameter assigned to the video encoder 102, and provides the parameter to the video encoder 102.

[0051] With this construction, it is possible to determine a network condition more accurately by referring to an elapse of time relevant to network information. FIG. 12 shows a flow chart of a network condition determination method in the case of using this system. Processing at the network condition determination device 303 will be described in accordance with this flow chart. First, the network condition determination device 303 determines whether or not packet loss is "0" at the step S1201. As a result of this determination, when the packet loss is present, it is determined by the step S1202 whether or not the past packet loss occurs. As a result, when the past packet loss occurs, the loss rate is compared with the current rate. If the current packet loss rate is higher than the past packet loss rate, it can be determined that the past correction has been invalid.

[0052] It is understood from this determination that the bandwidth overflow of transmission data such as network congestion is not troublesome, but a possibility that a noise or the like occurs over a channel resulting in destroying is high. Therefore, the network condition determination device 303 does not change a bit rate at the step S1204, and carries out parameter setting to ensure reliable error correction, and notifies the fact to the video encoder 102 at the step S1205.

[0053] If the current packet loss rate is lower than the past packet loss rate at the step S1203, the network condition determination device 303 determines that the past change works efficiently, and re-calculates a valid bit rate from the packet loss rate at the step S1206. When the past packet loss does not occur at the step S1202, the last loss is determined as a channel noise, and processing goes to the step S1204.

[0054] On the other hand, when no packet loss occurs at the step S1201, the network condition determination device 303 checks a delay quantity at the step S1207. As a result, when the delay quantity exceeds thresholds "Th", a valid bit rate is calculated from the delay quantity at the step S1208, and the calculation result is notified to the video encoder 102 at the step S1205.

[0055] Lastly, when the delay quantity does not exceeds the thresholds "Th", the network condition determination device 303 determines that successful communication is established, and does not change a parameter at the step S1209.

[0056] By causing the network condition determination device 303 to carry out such processing, the network condition determination device 105 can have a function capable of determining whether a packet loss occurs on a transmission channel due to network congestion or whether a noise is generated, and the loss occurs due to the impairment of a channel state such as radio equipment.

[0057] This function is provided as a mere example. For example, when the past packet loss does not occur at the step S1202, a control for lowering a bit rate may be made by determining network congestion instead of determination of noise. If the current packet loss rate is improved more remarkably than the past packet loss rate at the step S1203, similar parameter change may be made after checking how the past change has been made. In this way, in this system, a variety of determination systems can be set according to a network.

[0058] In the foregoing, although there has been shown an example in which the video encoder 102 carries out encode processing based on encoded parameters determined and assigned at the network condition determination device 105, a configuration for the video encoder 102 to determine a parameter can be provided without being limited to the network condition determination device 105. An example is shown in FIG. 4.

[0059] FIG. 4 is a block diagram depicting an inclusive configuration when the video encoder 102 determines an encoded parameter. In the case of this example, the video encoder 102 comprises an encoded parameter determination device 401 and a signal processor 402.

[0060] In the case of this configuration, the network condition determination device 105 is configured to output the network condition information 136 from the network condition determination device 303, and then, provide the information to the video encoder 102.

[0061] In such a configuration, the network condition determination device 105 provides the network condition information 136 delivered from the network condition determination device 303 to the video encoder 102. Then, the video encoder 102 first inputs the network condition information 136 to an encoded parameter determination device 401. Then, the encoded parameter determination device 401 recognizes a network condi-

Webgroup CZ a.s. Ex. 1002, Page 953 of 1406

tion from this network condition information 136, and generates an encoded parameter 431 in the form suitable to the network condition.

[0062] The thus generated encoded parameter 431 is inputted to a signal processor 402. Then, this signal processor 402 encodes the video signal 131 inputted from the video input device 101 by using this encoded parameter 431.

[0063] Encoding information 432 such as the number of encoded bits after encoding is inputted to the encoded parameter determination device 401, and is used for the next encoded parameter determination. Encoded data 132 encoded at the signal processor 402 is output to the encoded data transmitter 103.

[0064] FIG. 5 is a block diagram depicting a configuration including a intra-frame encoding determination device 501 that forcibly sets intra-frame encoding at the encoded parameter determination device 401 shown in FIG. 4. As shown in the figure, the encoded parameter determination device 401 comprises an intra-frame encoding/determination device 501 and an encoded parameter determination device 502.

[0065] In the case of this configuration, the network condition information 136 outputted from the network condition determination device 105 is input to the encoded parameter determination device 502 possessed by the encoded parameter determination device 401. Then, encoded parameter information 531 corresponding to the network condition information 136 is output from the encoded parameter determination device 502.

[0066] The encoded parameter information 531 is input to the intra-frame encoding determination device 501, and it is determined whether inter-frame encoding is carried out as is or intra-frame encoding is forcibly carried out. When it is determined as intra-frame encoding, the encoding parameter information 531 is updated so as to carry out intra-frame encoding, and is output as the encoded.parameter information 431 to the signal processor 402 of the video encoder 102.

[0067] By doing this, even if the past data is not transmitted correctly to a receiver, when the data can be received correctly after parameter change, a correct image can be reproduced.

[0068] It is possible to configure a video encoder capable of determining a network condition, which has functions of the video encoder 102 and network condition determination device 105, thereby making it possible to provide the previously described function in one block.

[0069] The encoded parameter determination device 401 or network condition determination device 105 makes determination concerning the next encoded parameter setting. However, if a picture quality is changed suddenly due to temporary instability of network, an unclear picture may be produced. In order to suppress such a phenomenon, it is possible to incorporate a mechanism in which a change in encoded parameter is suppressed within its predetermined range. In the above described circumstance, this mechanism functions efficiently.

[0070] Although a bit rate or an error resilience parameter may be set as its calculated value, it is possible to employ a method of predetermining some patterns, and then, selecting the closest pattern from among them. Further, instead of the closest pattern, it is possible to make a selection of the closest bit rate which is lower than the calculated bit rate. This makes it possible to prevent the generation of a video image with its unexpected image quality due to a combination of a variety of parameters, and makes it possible to prepare a combination of encoded parameters that have been tested to some extent.

[0071] In the foregoing example, when the packet loss rate is not "0" or when a delay exceeds the thresholds, there has been made a control such that parameters such as bit rate or error resilience are changed, and the changed is reset to that suitable to the current state.

[0072] However, after recovery of a network condition, when no packet loss occurs or when a small delay occurs, it is possible to make a control for increasing a bit rate or decreasing an error resilience parameter.

[0073] The foregoing example will be described below according to a second embodiment.

(Second Embodiment)

[0074] FIG. 6 is a view showing a basic configuration of an image transmission apparatus according to the second embodiment of the present invention. The image transmission apparatus shown in FIG. 6 comprises a plurality of media 601, an encoded data switch device 602, an encoded data selector 603, an encoded data transmitter 103, a network information receiver 104, and a network condition determination device 105.

[0075] The storage media 601 are used to store encoded data 631 on contents that have been encoded in advance. The storage media 601 each store encoded data on the same contents encoded by different encoded parameters, respectively.

[0076] The encoded data switch device 602 selects one of a plurality of storage media 601, and provides encoding data 631 stored in the thus selected storage medium 601 to the encoded data transmitter 103. A selection of the storage media is carried out in accordance with switch information 632 from the encoded data selector 603.

[0077] The network information receiver 104 has a function that receives network information 134 such as packet loss rate or Jitter information delivered from a receiver or a network, and provides the received information as network information 135 to the network condition determination device 105.

[0078] The network condition determination device 105 determines a network condition from the input network information 135, and outputs the result as network condition information 136 to the encoded data selector

Webgroup CZ a.s. Ex. 1002, Page 954 of 1406

603. The encoded data selector 603 has a function for estimating, from this network condition information 136, which of the encoded data on encoding parameters is optimal to the current network, and then, outputting to the encoded data switch device 602 the switch information 632 used for switching in order to select encoded data caused by the estimated optimal encoding parameter as an output.

[0079] The encoded data switch device 602 selects one item of encoded data from among the input encoded data 631, and outputs encoded data 132.

[0080] With such a configuration, the encoded data 631 encoded in advance and store in the storage medium 601 or the like is input to an encoding data switch device 602 when the data is reproduced from the storage medium 601. That is, respective encoded data encoded by the differential encoding parameters are maintained in a plurality of storage media 601. As a result of reproducing these items of data, the encoded data encoded by the different encoding parameters, respectively, is inputted. The encoded data switch device 602 selects one from among these items of data, and outputs it to the encoded data transmitter 103.

[0081] This selection is carried out in accordance with switch information 632 from the encoded data selector 603.

[0082] On the other hand, network information 134 such as packet loss rate or Jitter information from a receiver is received at the network information receiver 104, and then, the received information is delivered to the network condition determination device 105. The network condition determination device 105 determines a network condition from the inputted network information 135, and outputs the result as network condition information 136 to an encoded data selector 603.

[0083] The encoded data selector 603 estimates, from the network condition information 136, which of the encoded data of the encoding parameters is optimal to the current network, and outputs the switch information 632 to the encoded data switch device 602.

[0084] The encoded data switch device 602 selects one item of the encoded data from among the input encoded data 631, and outputs encoded data 132.

[0085] The present embodiment will be described by way of a specific example.

[0086] Now, assume that there exist five storage media 601a to 601e each having stored therein five items of encoded data encoded at 384 kbps, 128 kbps, 64 kbps, 32 kbps, and 16 kbps.

[0087] That is, for example, a storage medium having stored therein encoded data on contents encoded at 384 kbps is defined as a storage medium 601a; a storage medium having stored therein encoded data on contents encoded at 128 kbps is defined as a storage medium 601b; a storage medium having stored therein encoded data on contents encoded at 64 kbps is defined as a storage medium 601c; a storage medium having stored therein encoded data on contents encoded at 32 kbps is defined as a storage medium 601d; and a storage medium having stored therein encoded data on contents encoded at 16 kbps is defined as a storage medium 601e.

[0088] In the case of using a transmission channel having its quality capable of being transmitted at 384 kbps, first, reproduced encoded data is selected by the storage medium 601a that is a storage medium having stored therein encoded data on contents encoded at 384 kbps; transmission is started at 384 kbps, and reception of network information from the receiver starts at the same time.

[0089] Although network information is received at a predetermined interval, if a problem occurs with a network based on the received information, a valid bit rate is calculated at a stage at which a packet loss or delay occurs. The encoded data selector 603 selects encoded data on a bit rate close to the calculated bit rate, and the encoded data switch device 602 switches and transmits the selected data.

[0090] For example, the calculated bit rate is 140 kbps, a value close to this bit rate is 128 kbps. In this case, the above switch device selects and switches encoded data reproduced from the storage medium 601b having stored therein encoded data on contents encoded at 128 kbps. In addition, if the calculated bit rate is 100 kbps, a value close to a bit rate lower than the calculated bit rate is 64 kbps. In this case, the switch device selects and switches encoded data reproduced from the storage medium 601c having stored therein encoded data on contents encoded at 64 kbps.

[0091] In this way, in the present embodiment, contents are prepared after encoded in advance for type of transmission bit rate, and a current optimal transmission rate is obtained based on network information such as packet loss rate or Jitter information from a receiver that is a function possessed by RTP. A storage medium having stored therein encoded data obtained at the bit rate corresponding to this transmission rate is selected by the switch 602, and reproduced encoded data output of the storage medium is transmitted. In this manner, there is no need for a server to carry out encode processing in real time, making it possible to reduce a load on the server. This is very effective in distributing a pre-produced video such as broadcast in particular.

[0092] Now, a modified example of the second embodiment will be described here. FIG. 7 is a block diagram depicting a method for carrying out control for a switch timing of encoded data to be inputted at the encoded data switch device 602.

[0093] Encoded data 631 is inputted to the switching position detecting device 701 and a switch device 702. Switch information 632 is inputted to the switching position detecting device 701. If there occurs a need to execute switching from the current encoded data to the other encoded data according to the switch information 632, the switching position detecting device 701 analyzes encoded data, and detects a switching enable posi-

Webgroup CZ a.s. Ex. 1002, Page 955 of 1406

tion.

[0094] This means that a search is made for a frame encoded by intra-frame encoding (I-Picture).

[0095] When the switching enable position is set, an instruction for switching encoded data is supplied to the switch device 702 by using the switching instruction information 731. FIG. 8 shows an example of this instruction. Assume that encoded data A is currently selected, and there occurs a need to execute switching to encoded data B according to the switch information 632.

[0096] At this stage, assume that a frame is processed at the time of "switching instruction" shown in FIG. 8. In such a case, if encoded data is switched, an unmatched image occurs. This is because a difference from the previous image is encoded in intra-frame encoding (P-Picture). Therefore, if encoded data is switched at the time of P-Picture, an attempt is made to reproduce the next picture (picture P11 of encoded data (B)) by using immediately preceding picture (decoded picture 111 of encoding data (A)). This provides a problem that a correct decode picture cannot be obtained, and a picture is destroyed. Thus, there occurs a need to execute switching at a timing of a picture of intra-frame encoding (I-Picture) undergoing encoding by that frame only. This timing is defined as a timing at a position marked with "execute switching".

[0097] As in FIG. 9, a case in which the number of frames or time position differs depending on encoded data is considered. In this case as well, a switching enable position of encoded data at a switching destination is detected, and switching of encoded data is executed when the switching enable position is set.

[0098] At the switching position detecting device 701 shown in FIG. 7, when a need to execute switching according to the switch information 632 occurs, it is possible to employ a method for temporarily stopping an output 132 to the encoded data transmitter 103, and then, outputting new encoded data to the encoded data transmitter 103 at a stage at which the switching position is set.

[0099] This method is effective when it is necessary to suppress a buffer overflow or the like by switching encoded data. When an underflow is problematic, a stuffing bit is forcibly inserted, thereby making it possible to counteract such an underflow.

(Third Embodiment)

[0100] Now, a third embodiment according to the present invention will be described here.

[0101] The present embodiment describes an exemplary configuration of an encoding parameter determination device 401 of the video encoder 102 shown in FIG. 4 according to the first embodiment when a time interval (GOP interval) between frames encoded in a intra-frame encoded mode is adjusted based on the network condition information 136 outputted from the network state determination device 105. Here, a description will be given by focusing on differences from the first embodiment.

[0102] FIG. 13 shows an exemplary configuration of the encoding parameter determination device 401. This device comprises a GOP interval calculator (GOP interval calculator) 1501 and an encoding parameter determination device 502.

[0103] The network condition information 136 outputted from the network condition determination device 105 (including at least packet loss rate information) is input to an encoding parameter determination device 502. The parameter determination device 502 inputs packet loss rate information 1531 of the network condition information 136 to the GOP interval calculator 1501. The GOP interval calculator 1501 calculates a GOP interval from the packet loss rate information 1531. The GOP interval information 1532 is notified to the encoding parameter determination device 401. The encoding parameter determination device 401 outputs encoding parameter information 431 that contains the inputted GOP interval information 1532. When internally generated parameter information exists, the encoding parameter determination device 401 outputs GOP interval information 1532 and encoding parameter information 431 that contains the internally generated parameter information.

[0104] FIG. 14 shows an example of a method for determining a GOP interval at the GOP interval calculator.

[0105] At the step S1601, it is determined whether or not a packet loss occurs from the network condition information 136. When such a packet loss occurs, the GOP interval is estimated by formula (3) below, for example, at the step S1602.

$$Gop = (TN - TL)/\{(FN - FL) \times r\} \quad (3)$$

where "gop" denotes a GOP interval, "r" denotes a packet loss rate, FN denotes a total number of current frames, FL denotes a total number of frames during past calculation, TN denotes a time, and TL denotes a time during past calculation.

[0106] The GOP interval obtained at the step S1602 is notified to the signal processor 402 at the step S1603, and encoding is carried out based on the notified value.

[0107] On the other hand, when no packet loss has occurred at the step S1601, the default GOP thresholds are read out at the step S1604. At the step S1603, this value is notified to the signal processor 402.

[0108] According to the present embodiment, it is possible to change dynamically the GOP interval to a value suitable to a network. In this manner, when a small number of errors occur, the GOP interval is increased, thereby making it possible to reduce wasteful intra-frame encoded modes in number. In contrast, when a large number of errors occur, the GOP interval is decreased, and a frame in the intra-frame encoded mode appears quickly, thereby making it possible to acceler-

Webgroup CZ a.s. Ex. 1002, Page 956 of 1406

ate recovery. In the present embodiment, it is possible to efficiently select an intra-frame encoded mode.

[0109] FIG. 15 shows another example of a method for determining a GOP interval at the GOP interval calculator in accordance with a flow chart.

[0110] In this example, even when packet loss is fewer than that in the system shown in FIG. 14, the network condition is estimated from the past history of packet loss at the step S1704, and an optimal GOP interval is calculated. This technique makes it possible to estimate whether a network is completely free of an error or an error may occurs by checking the past history instead of resetting the GOP interval to the default value by determining that no packet loss occurs at one moment. In this manner, it is possible to determine the network condition more accurately.

[0111] FIG. 16 shows still another example of a method for determining a GOP interval at the GOP internal calculator in accordance with a flow chart.

[0112] In this example, the GOP interval is determined by a unique calculation system instead of determination based on the presence/absence of a packet loss. This system can be used to determine the GOP interval from the current packet loss rate in accordance with a single formula or to determine the most suitable GOP interval by checking the past history.

[0113] The following formula (4) shows an example of calculation formula for determining the GOP interval.

$$Gop = [(TN - TL)/\{(FN - FL) \times r\}] \times \alpha \qquad (4)$$

where "gop" denotes a GOP interval, "r" denotes a packet loss rate, α denotes a sensitivity coefficient, FB denotes a total number of current frames, FL denotes a total number of frames during past calculation, TN denotes a current time, and TL denotes a time during past calculation.

[0114] In this example, the GOP interval calculated from an actual value is multiplied by a sensitivity coefficient, thereby making it possible to meet a requirement for accelerating recovery by sacrificing efficiency or a requirement when one does not take care even if an effect of error is somewhat extended. For example, if the sensitivity coefficient α is set to be smaller than 1, a GOP interval which is smaller than that calculated from an actually measured value is output. In this manner, although the efficiency is sacrificed, when an error occurs, it is possible to estimate faster recovery.

[0115] The present embodiment is not limited to formulas (3) and (4). For example, in these formulas, a value is calculated by using an increment during past calculation and subsequent, it is possible to calculate the value by taking a margin such as the n preceding increment. In this manner, it is possible to cope with a gradual change hidden in a change in detailed state or to eliminate a temporal change to some extent. Similarly, algorithms are not limited to those shown in the present embodiment.

[0116] The foregoing embodiment has described an exemplary configuration when a time interval (GOP interval) is adjusted, the time interval being between the frames encoded in the intra-frame encoded mode based on the network condition information 136 at the encoding parameter determination device 401 of the video encoder 102 shown in FIG. 4 according to the first embodiment. Alternatively, there can be provided a configuration in which the network condition determination device 105 according to the first embodiment (FIGS. 1, 2, or 3) determines a time interval (GOP interval) encoded in the intra-frame encoded mode based on information from the network information or information from the network information receiver 104 and information from the video encoder 102, and provides the encoded time interval to the image encoder 102.

[0117] As described in the first embodiment, it is possible to configure a video encoder capable of determining a network condition, the video encoder having functions of the video encoder 102 and network condition determination device 105, thereby providing the previously described functions in one block.

[0118] In the foregoing, although a variety of embodiments have been described, in short, the present invention utilizes characteristics of RTP, and comprises a system (RTCP) for notifying network state information such as jitter or packet loss rate from a transmitter or receiver. At the transmitter, a bit rate of transmission data at the transmitter is adjusted according to a transmission state of a transmission channel based on the notification of network state information acquired from the receiver in the transmitter such as jitter or packet loss rate so that control such as change of the error resilience level can be carried out. Therefore, according to the above described present invention, data can be transmitted efficiently to the maximum so as to achieve data transmission that makes it possible to fully utilize transmission requiring real time properties as well.

[0119] The techniques described in the embodiments of the present invention can be distributed to be stored as a computer executable program in a recording medium such as a magnetic disk (such as a flexible disk or a hard disk); an optical disk (such as CD-ROM, CD-R, CD-RW, DVD, or MO), and a recording medium such as a semiconductor memory. Further, the above program can be distributed by means of transmission via a network.

[0120] According to the present invention, it is possible to determine a network condition, and then, optimally set an encoding parameter. In addition, when a packet loss caused by congestion and a loss of a channel error coexist in a network, it is possible to determine the loss, and then, to set a parameter.

[0121] Therefore, according to the present invention, there can be provided a data transmission apparatus and method in which data can be transmitted efficiently to the maximum so as to achieve data transmission that

Webgroup CZ a.s. Ex. 1002, Page 957 of 1406

makes it possible to fully utilize transmission requiring real time properties.

Claims

1. A data transmission apparatus for transmitting transmission data from a transmitter to a receiver via a transmission channel, **characterized by** comprising:

   means (105) for estimating a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and
   means (102) for changing at least one of a bit rate of transmission data and an error resilience level according to the estimated transmission condition.

2. An apparatus according to claim 1, **characterized in that** the transmitter includes means (102) for generating encoded data obtained by encoding a single content at different transmission rates, and means (603) for selecting optimum encoded data having optimum bit rate from the encoded data of the encoded data generating means (102) to adjust a bit rate of the transmission data in the transmitter according to the estimated transmission condition.

3. A data transmission method of transmitting transmission data from a transmitter to a receiver via a transmission channel, **characterized by** comprising:

   generating encoded data obtained by encoding a single content at different transmission rates;
   estimating a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and
   selecting optimum encoded data having an optimum bit rate from the encoded data to adjust a bit rate of the transmission data in the transmitter according to the estimated transmission condition.

4. A data transmission method **characterized by** comprising:

   estimating a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and
   changing at least one of a bit rate of transmission data and an error resilience level according to the estimated transmission condition.

5. A data transmitting apparatus that transmits transmission data from a transmitter to a receiver via a transmission channel, **characterized by** comprising:

   means (102) for generating plural encoded data obtained by encoding a single content at different bit rates, in the transmitter;
   means (105) for estimating a condition of the transmission channel based on Jitter information or packet loss rate; and
   means (603) for selecting encoded data having an optimum transmission rate from the plural encoded data according to the estimated transmission condition.

6. A method of transmitting transmission data from a transmitter to a receiver via a transmission channel, the method **characterized by** comprising:

   storing plural encoded data obtained by encoding a content at different bit rates;
   estimating a condition of the transmission channel based on Jitter information or packet loss rate;
   selecting encoded data having optimum transmission rate from the plural encoded data to adjust a bit rate of the transmission data in the transmitter.

7. A data transmission program stored on a computer readable medium, the program **characterized by** comprising:

   instruction means for instructing a computer to estimate a transmission condition of the transmission channel in the transmitter based on at least Jitter information or a packet loss rate obtained from the receiver; and
   instruction means for instructing the computer to change at least one of a bit rate of transmission data and a error resilience level according to the estimated transmission condition.

8. A data transmission apparatus, **characterized by** comprising:

   receiver means (104) for receiving network information regarding a condition of a network;
   determination means (105) for determining a network condition based on the network information from the receiver means;
   encoder means (102) for encoding a video data signal to generate encoded video data and control a bit rate or an error resilience level of the encoded video data according to the network condition information; and
   transmitter means (103) for transmitting the en-

Webgroup CZ a.s. Ex. 1002, Page 958 of 1406

coded video data to the network.

9. An apparatus according to claim 6, **characterized in that** the encoder means (102) is supplied with an encoding parameter as the network condition information and generates encoded data whose bit rate is adjusted according to the encoding parameter,

the determination means (105) includes first storage means (302) for storing encoding parameter information obtained by the encoder means, second storage means (301) storing the network information input by the network information receiver, and determination means (303) for determine the encoding parameter by deciding the network condition based on network information input by the network information receiver, past encoding parameter information from the first storage means and past network information from the second storage means.

10. An apparatus according to claim 8, **characterized in that** the encoder means (102) includes parameter determination means (401) for determining the encoding parameter from the network condition information input from the receiver means, the encoder means (102) encoding the video data signal to generate the encoded video data whose bit rate is adjusted in correspondence with the encoding parameter determined by the determination means (401).

11. An apparatus according to claim 10, **characterized by** including encoding determination means (501) determine whether a next frame is to be encoded forcibly in an intra-frame encoding mode, when the parameter determination means (401) determines the encoding parameter using the network condition information.

12. An apparatus according to claim 8 or 9, **characterized in that** the determination means (105) includes computation means for computing a GPO interval from the network information input from the receiver means (104) to generate network condition information including GOP interval information indicating the GOP interval obtained by the computation means, and the encoder means (102) encodes the video data signal according to the GOP interval information included in the network condition information.

13. An apparatus according to claim 8 or 10, **characterized in that** the encoder means (102) includes GOP interval computation means for computing a GOP interval based on the network information input from the receiver means (104) and encodes the video data signal according to the GOP interval information indicating the GOP interval computed by the GOP interval computation means.

14. An apparatus according to claim 12 or 13, **characterized in that** the determination means (105) determines at least a packet loss rate as the network condition, and the GOP interval computation means computes the GOP interval based on at least the packet loss rate.

15. An apparatus according to claim 8, **characterized by** including switching means (602) for switching among plural encoded data encoded at different transmission rates, respectively, to select encoded data having a transmission rate corresponding to switching information, and selector means (603) for selecting a transmission rate of encoded data to be transmitted from the transmitter based on the network condition information outputted from the determination means (105) and output the selected transmission rate as the switching information to the switching means.

16. An apparatus according to claim 15, **characterized in that** the switching means (602) includes a switching position detector for detecting a switching position at which one of the encoded data can be switched to the other, and when an encoded data switching signal is generated by the switching information output from the selector means (603), the switching position detector detects the switching position, to switch the encoded data at the switching position.

Webgroup CZ a.s. Ex. 1002, Page 959 of 1406

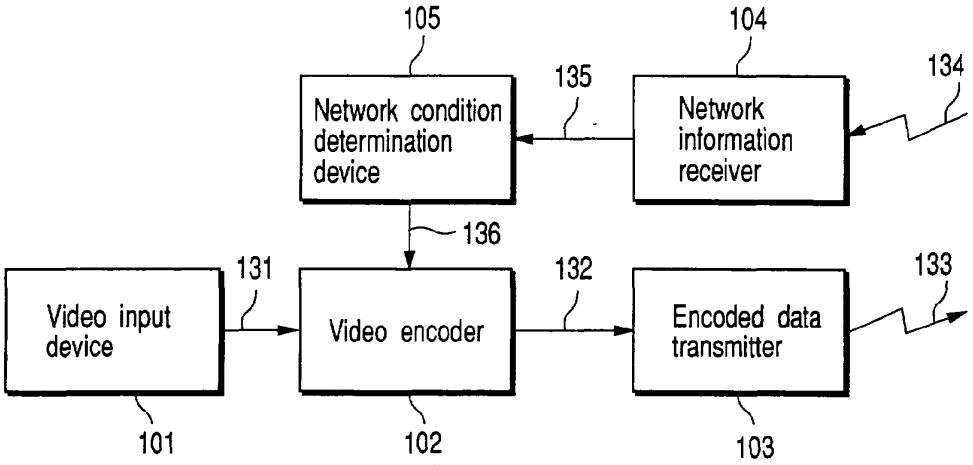


FIG. 1

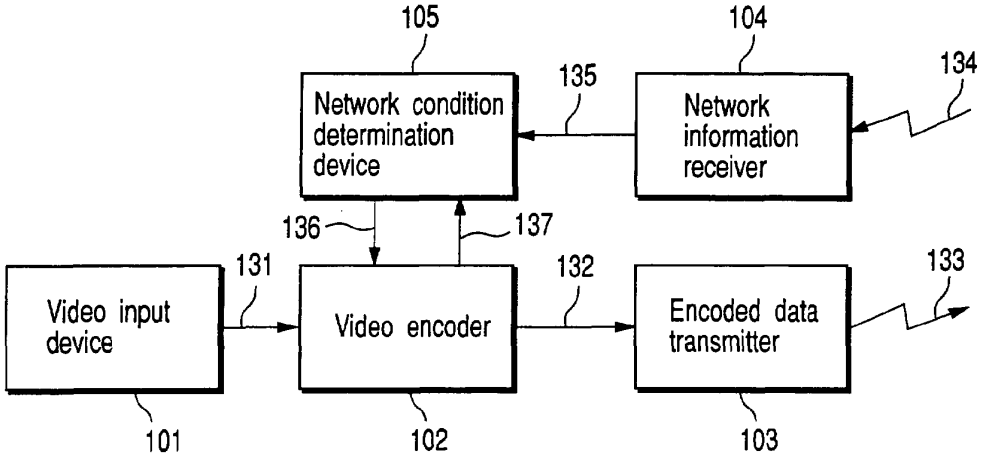


FIG. 2

Webgroup CZ a.s. Ex. 1002, Page 960 of 1406

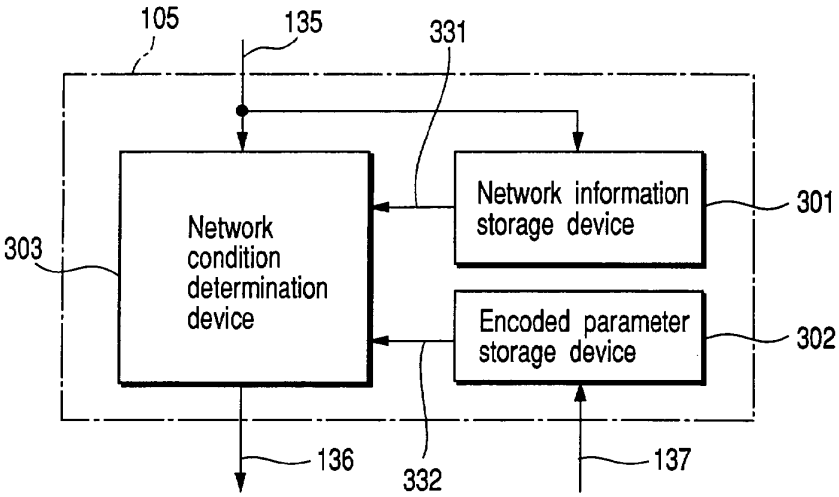


FIG. 3

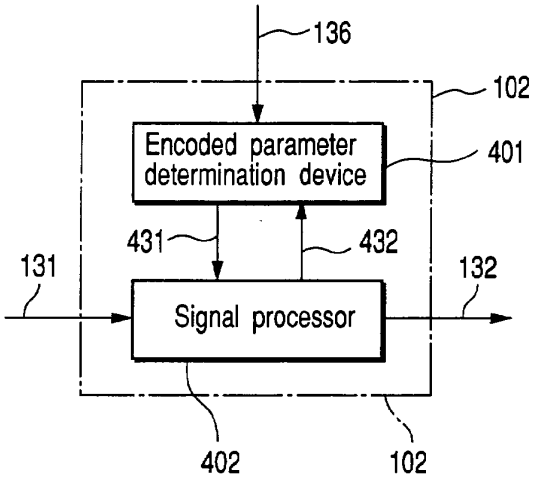


FIG. 4

Webgroup CZ a.s. Ex. 1002, Page 961 of 1406

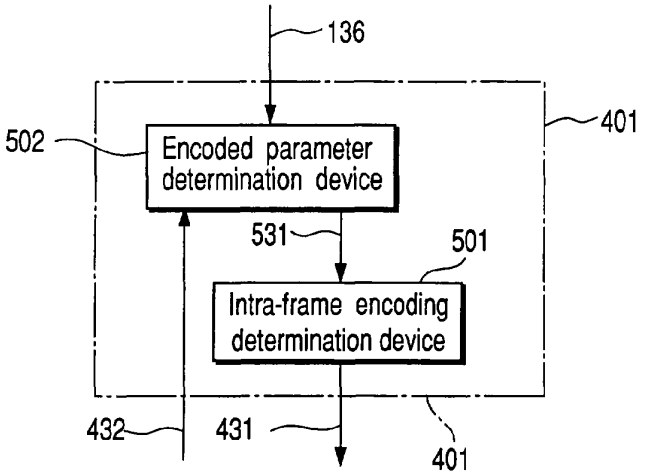


FIG. 5

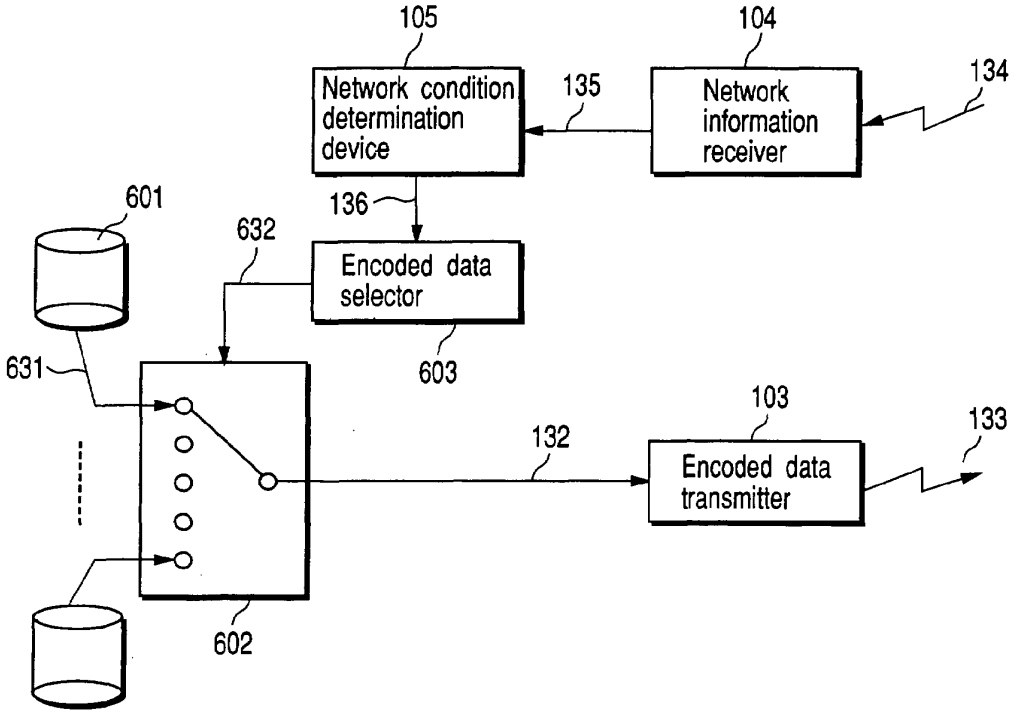


FIG. 6

Webgroup CZ a.s. Ex. 1002, Page 962 of 1406

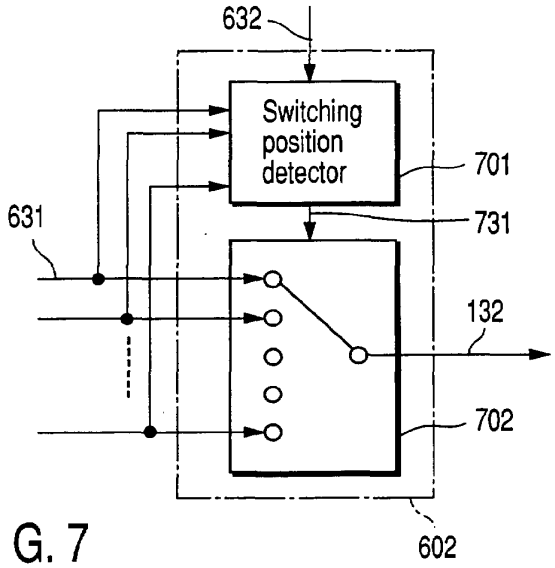


FIG. 7

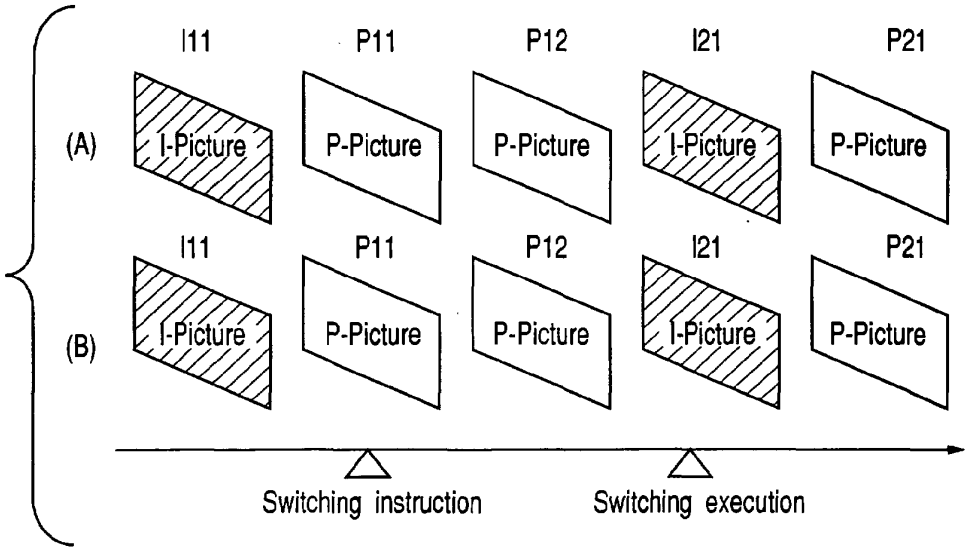


FIG. 8

Webgroup CZ a.s. Ex. 1002, Page 963 of 1406

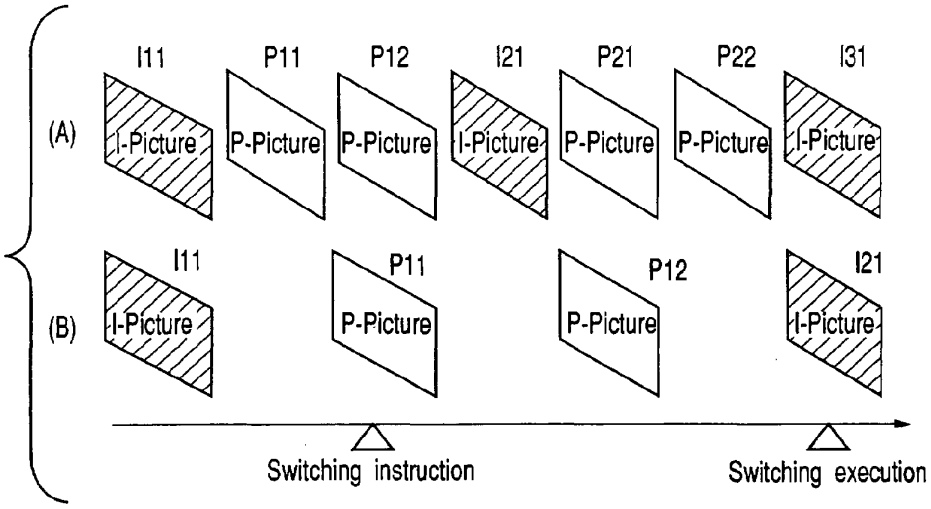


FIG. 9

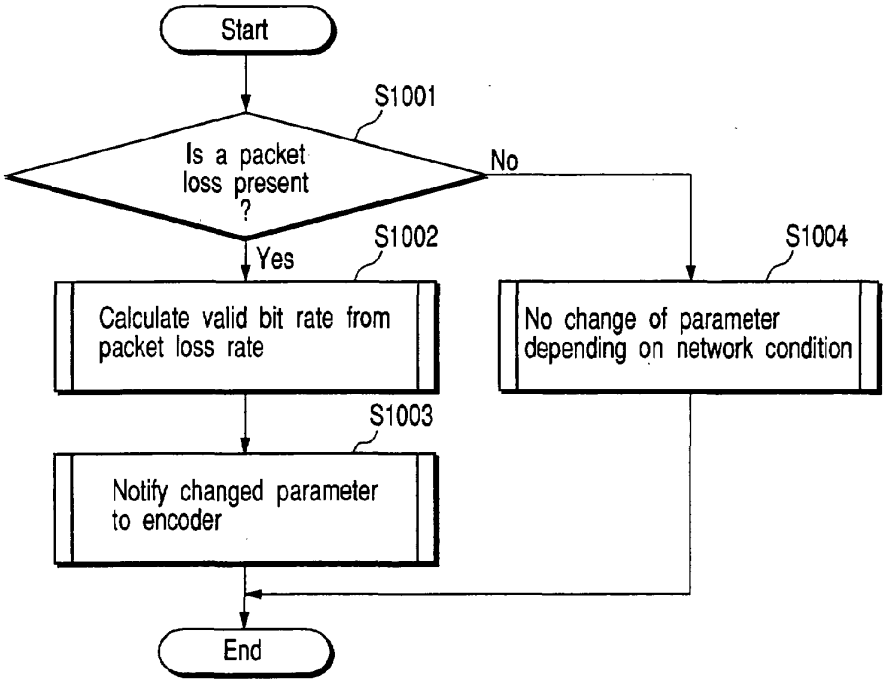


FIG. 10

Webgroup CZ a.s. Ex. 1002, Page 964 of 1406

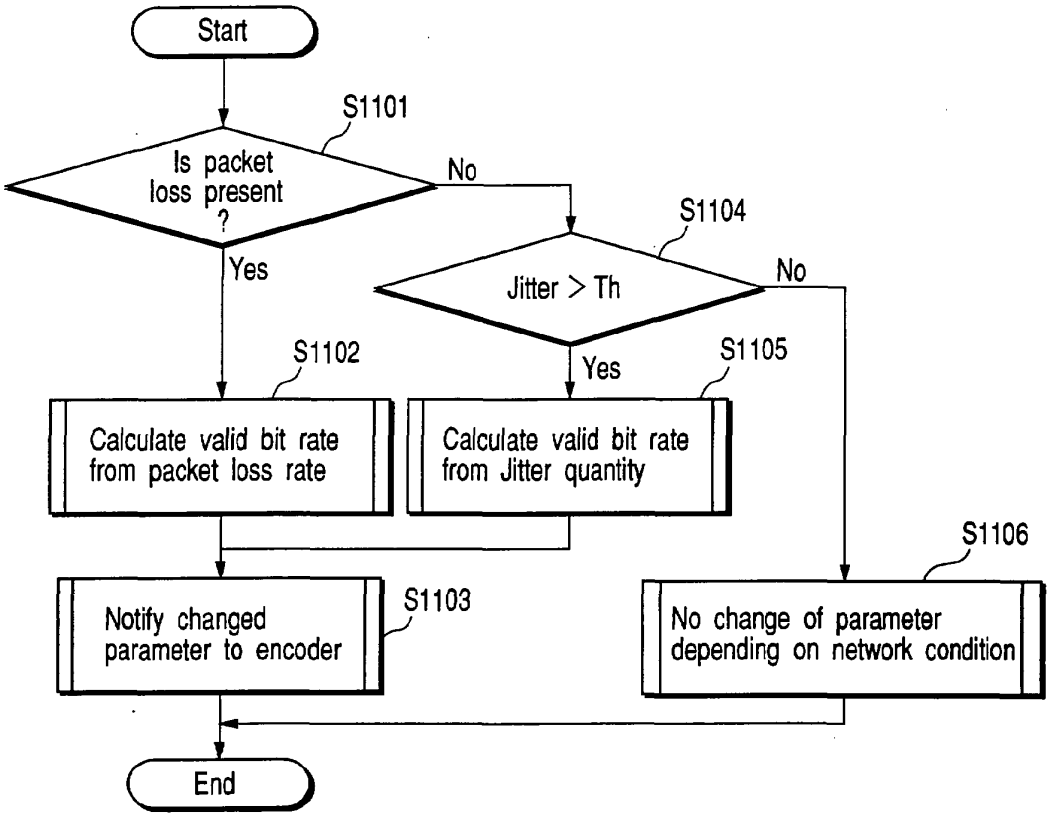


FIG. 11

Webgroup CZ a.s. Ex. 1002, Page 965 of 1406

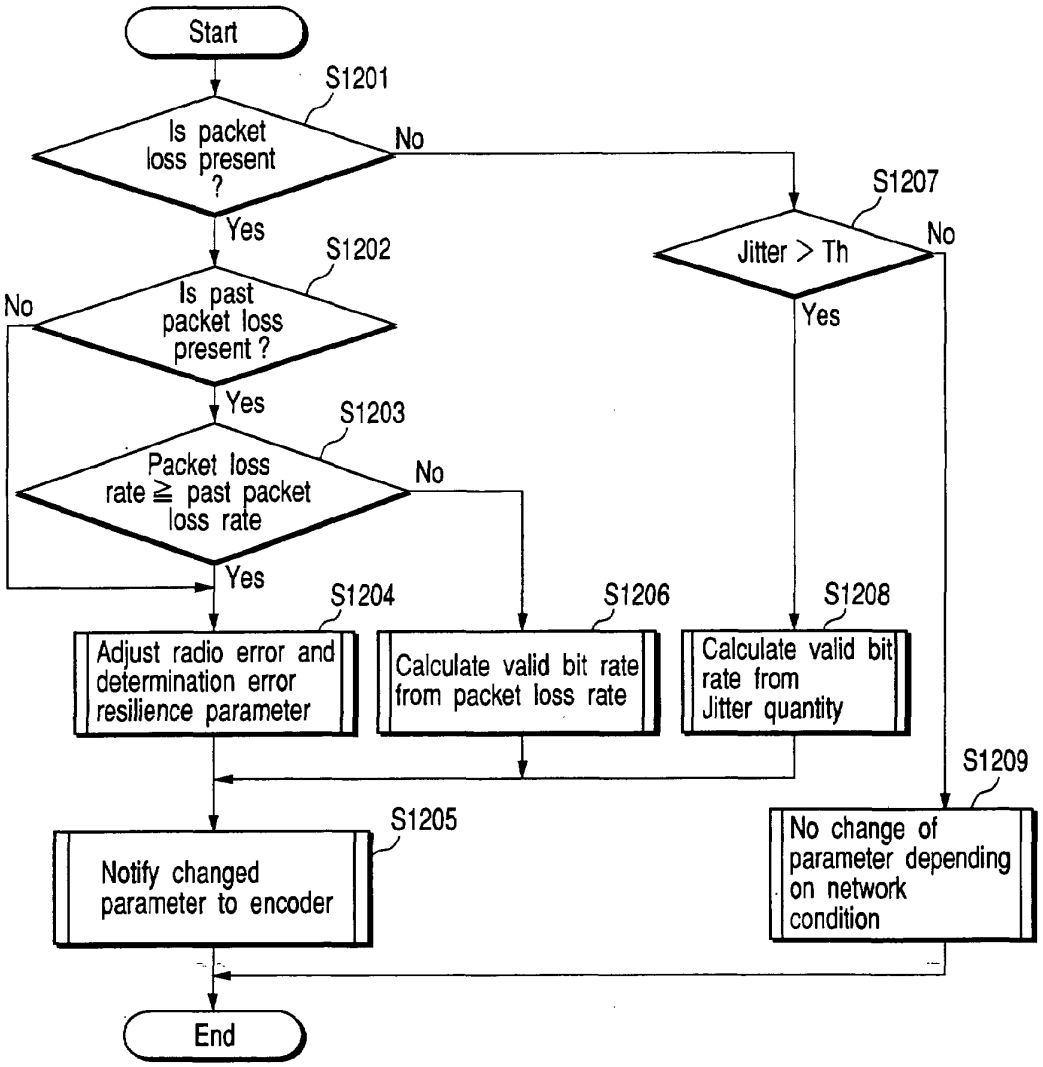

Start
S1201
Is packet loss present ?
No
Yes
S1202
Is past packet loss present ?
No
Yes
S1203
Packet loss rate ≧ past packet loss rate
No
Yes
S1204
Adjust radio error and determination error resilience parameter
S1206
Calculate valid bit rate from packet loss rate
S1207
Jitter > Th
No
Yes
S1208
Calculate valid bit rate from Jitter quantity
S1209
No change of parameter depending on network condition
S1205
Notify changed parameter to encoder
End

FIG. 12

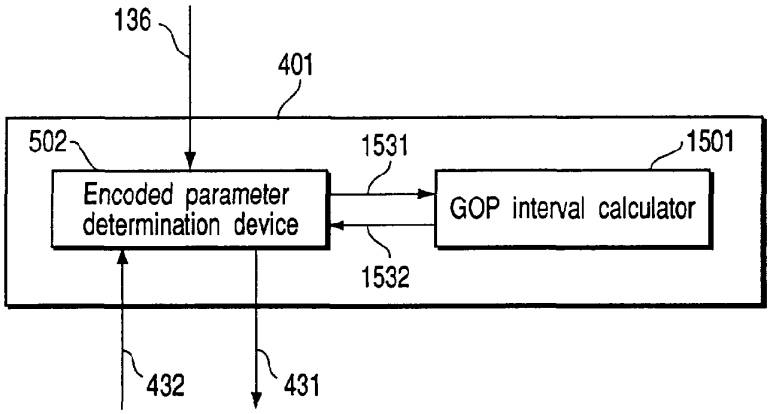


FIG. 13

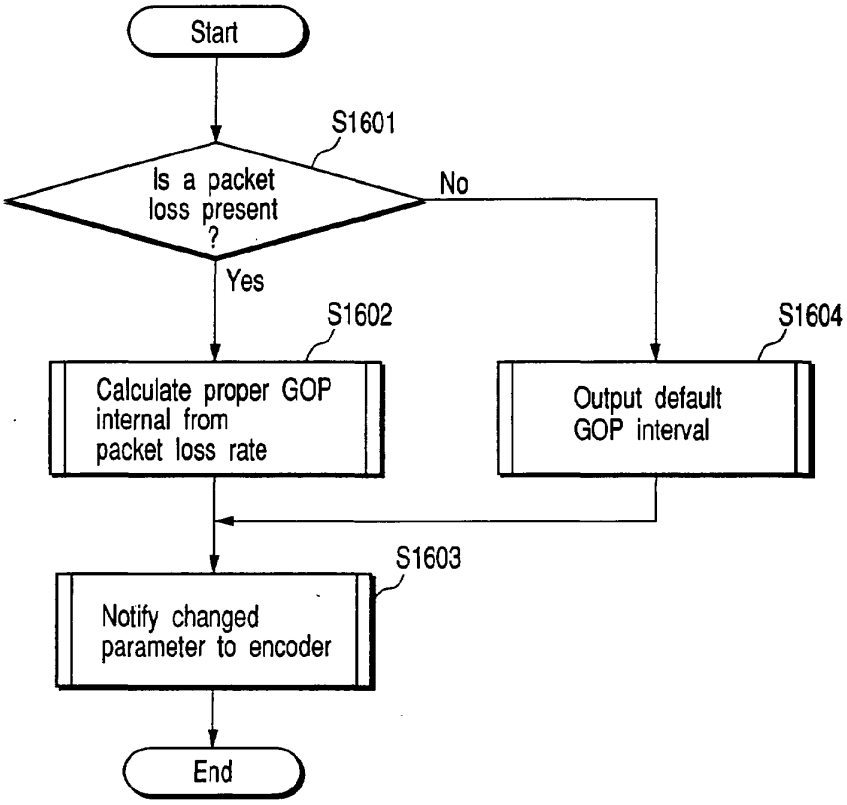


FIG. 14

Webgroup CZ a.s. Ex. 1002, Page 967 of 1406

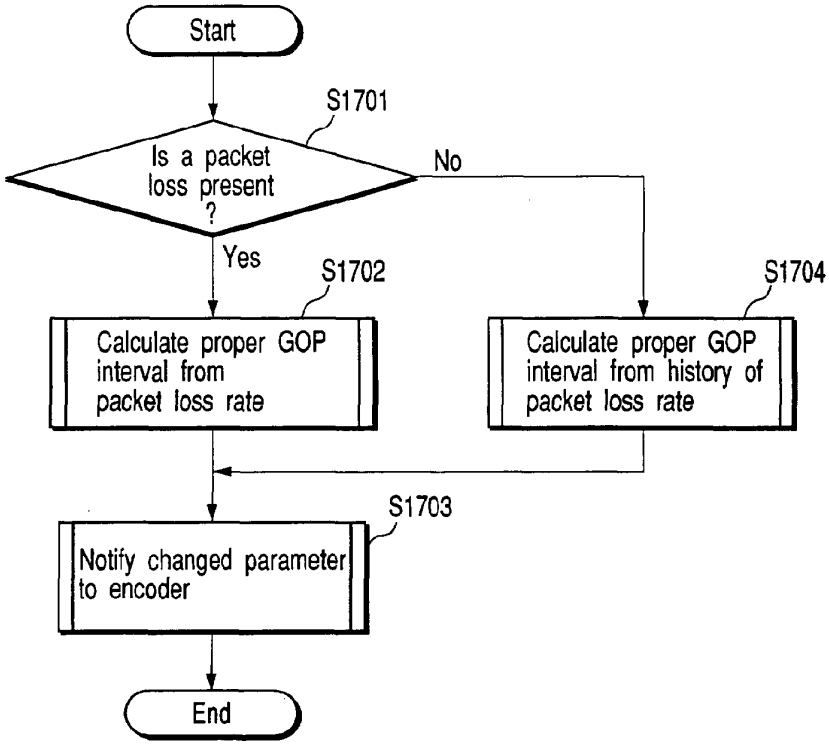


FIG. 15

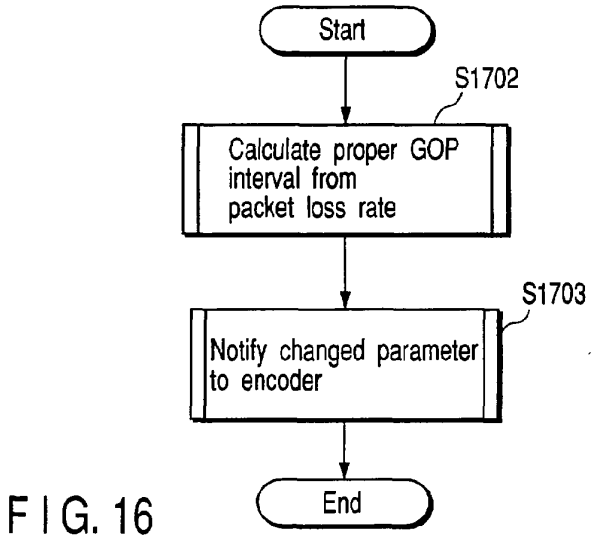


FIG. 16

Webgroup CZ a.s. Ex. 1002, Page 968 of 1406

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(71) Applicant: **Oplayo Oy**
00180 Helsinki (FI)

(72) Inventor: **Ala-Honkola, Pekka**
00180 Helsinki (FI)

(74) Representative: **Savela, Antti-Jussi**
Patent Agency Compatent Ltd.
Hämeentie 29, 4th. Fl.
00500 Helsinki (FI)

(54) Adaptive media stream

(57) This invention relates to media streams transmitted in a network, such as the Internet. The idea is to change the source of the content of a media stream when an available transmission speed rate changes. Each source contains essentially the same information (such as video and voice), but the suitability of each source for transmission has been adjusted to a certain speed rate.

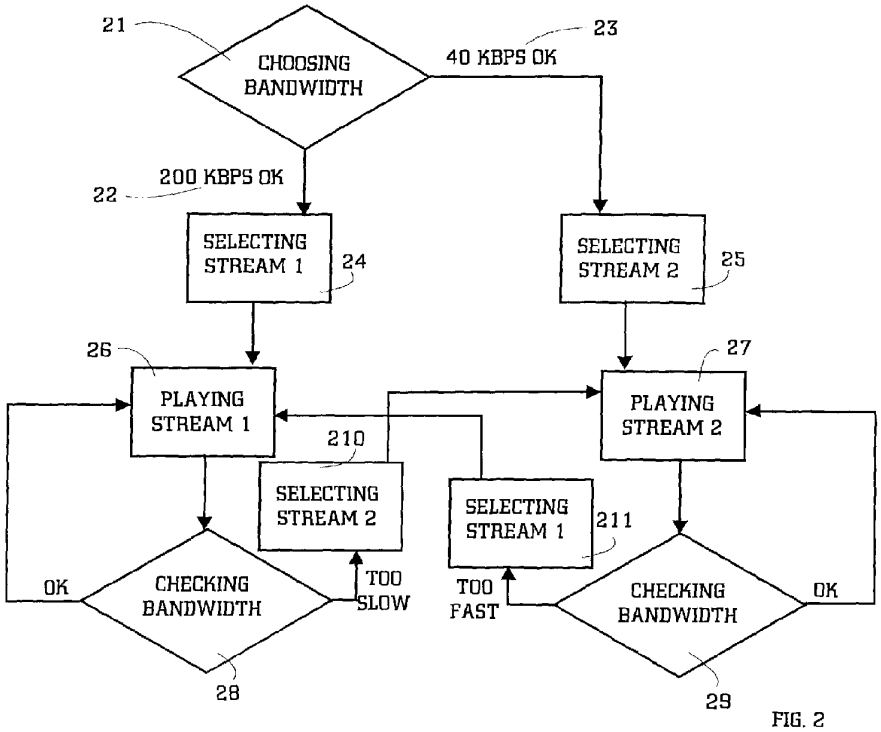


FIG. 2

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EP 1 298 931 A2

Description

FIELD OF THE INVENTION

[0001] This invention relates to media streams transmitted in a network, such as the Internet. Especially, the invention relates to media streams concerning video pictures and voice.

BACKGROUND OF THE INVENTION

[0002] When media streams that contain continuous data, for example video pictures and voice, are transmitted in a network, such as the Internet, the speeds of the media streams have to be adjusted with the speed of the transmission connection available at the time. Often, in the case of video pictures, the adjustment is made by changing the visual quality of the pictures. The speed of a transmission connection in the Internet depends strongly on a user's Internet terminal. Some terminals support technically higher speed rates than others (usually older terminals). Thus, speed adjusted media streams must be offered for a variety of terminals.

[0003] Transmission speed may also vary with time. For example, when congestion happens in the network, the transmission speed may decrease considerably. After the congestion, the transmission speed returns to the normal speed rate.

[0004] Nowadays, most of the content of the Internet is in WWW servers, which use the HTTP protocol for transmitting desired contents to users. Originally, the HTTP protocol was not designed for continuous media streams (video, voice). The problem of the known solutions is that when a media stream has to be adjusted for a changed transmission condition, i.e. to be an adaptive media stream, a special software or protocol must be used, instead of the HTTP protocol. Real Server® (RealNetworks Inc, Seattle, Washington), Quicktime® Server (Apple Computers, Cupertino California), and Windows Media Server® (Microsoft, Redmond, Washington) are commercial server software, which support adaptive media streams. These software packages use special protocols, such as RTP (Real-Time Transport Protocol) and RTSP (Real Time Streaming Protocol), which are designed for the adaptive media streams.

[0005] However, using these software packages usually requires a user to invest and maintain parallel devices and software in addition to the WWW server that is used to serve other Internet content, such as web pages. User communities such as corporations require support staff which must be educated to use these systems. For a service provider this means in practice that a special media stream server must be maintained. The goal of this invention is to eliminate these drawbacks. This is achieved in a way described in the claims.

SUMMARY OF THE INVENTION

[0006] The following definitions should be kept in mind when reading these specifications:

Connection: A transport layer virtual circuit established between two programs for the purpose of communication. A connection can have varying transmission speed rates.

HTTP transport: An application layer transmission of data from a file on a server computer to a user terminal using HTTP 1.1 protocol. One HTTP 1.1 connection can consist of one or several HTTP 1.1 transports.

Stream: A continuous transmission of data over for example HTTP transport

[0007] An important aspect of the invention is to change the source of an adaptive media stream when an available connection speed rate changes. Each source contains essentially the same information (such as video and voice), but the suitability of each source for transmission has been adjusted to a certain connection speed rate. The coding of the source information can be different among the sources, which affects the speed rate. The picture information can be black-and-white instead of a color picture. The picture size can be smaller or larger. The video can be with or without voice. When the source is changed, also a new HTTP transmission for the new source is started for a new stream containing the information of the new source. In other words, the adaptive media stream, i.e. the adaptive stream, comprises at least one media stream for transmitting information.

[0008] In an arrangement according to the invention a source file is formed. The source file contains a plurality of sources intended for different media streams, according to such parameters as bandwidth, computing capability of the receiving terminal, etc. At the beginning of the transmission the optimal transmission speed rate at the time is chosen according to an information transfer condition. The source in the source file, which corresponds to the available speed rate, is selected to be the source of the adaptive media stream. When the available transmission speed rate changes, either to be faster or slower, a command for changing the source of the adaptive media stream, is sent from the user's terminal to the service provider's server, i.e. the source server, wherein the file of the service is. Preferably commands are sent using an HTTP protocol. When the available transmission speed rate changes again, a new command for changing the source is sent from the user's terminal to the source server. The commands are sent when it is possible to use a higher speed rate or when a lower speed rate must be used.

[0009] In one aspect, the invention thus provides a method for providing an adaptive media stream between a sending terminal and a user's terminal wherein

Webgroup CZ a.s. Ex. 1002, Page 970 of 1406

the adaptive media stream comprises at least one media stream and the method comprises the steps of choosing a transmission speed rate for the media stream, selecting a suitable data source for the media stream among sources containing essentially the same information content, each source intended for a certain information transfer condition and playing the media stream. During such playing, checking the suitability of the actual transmission speed rate, and continuing playing the media stream if the transmission speed is still suitable or selecting a new data source, which is suitable at the moment as a response for the selection of the new data source, playing a new media stream. Those selection actions continue until the played stream stops.

[0010] Optionally, the step of choosing comprises the phase of reading a header field of a file, which contains at least two data sources, the header indicating the starting points of the sources and to which transmission speed rate each source is indented. Yet another option calls for the selecting step to include the phase of starting to read from the starting point of the selected source.

[0011] Other aspect of the invention provide for the step of monitoring to include the phase of monitoring a filling degree of a buffer for incoming data in the user's terminal, e.g. if the buffer is becoming empty or full, then selecting to continue to play the present media stream or to start playing another media stream. The information of the selection of the new data source may transmitted from the user's terminal to the sending terminal using a GET method of an HTTP protocol with an optional RANGE field. When a new stream is played, an optional phases of terminating the old media stream after starting to play the new media stream and creating the new media stream before playing the new media stream is also contemplated.

[0012] If a new stream is selected, according to another aspect of the invention, the step of reading timing marks in said adaptive media stream for defining the right point to start playing the new media stream is also performed. Further, the step of selecting the initial speed may comprise the phase of reading a header field of files, where each contains one data source, the header indicating the starting points of the source and to which transmission speed rate the source is indented.

[0013] An arrangement for providing an adaptive media stream between a sending terminal and a user's terminal, is also contemplated, wherein the adaptive media stream comprises at least one media stream and the arrangement comprises:

a) Means in the client terminal for choosing a transmission speed rate for the media stream,

b) A data structure in the sending terminal comprising at least two data sources containing essentially the same information, each source intended for a certain transmission speed rate,

c) Means in the client terminal and the sending terminal for selecting a suitable data source from among the sources for the media stream,

d) Means in the user's terminal for checking the suitability of the transmission speed rate when the media stream is played,

e) Means in the user's terminal for reselecting a suitable data source from among the sources for a new media stream.

[0014] An arrangement as described above may further comprise means for playing the data structure in a way that the playing is started from the right point of the data structure. Preferably, means a) comprises means for reading a message from the user's terminal, which defines alternative transmission speed rates. Further preferably, each source comprises timing marks, which indicate the corresponding point in the other sources. More preferably, the arrangement further comprises a GET method of an HTTP protocol with an optional RANGE field for transmitting the information of the reselection of the suitable data source from the user's terminal to the sending terminal. In another preferable embodiment, means d) comprises means for monitoring a filling degree of a buffer for incoming data in the user's terminal. It also preferable that the data structure is a file containing the data sources. Alternatively, the data structure may be a number of files, each of them containing one data source.

[0015] Means c) may further comprise means for reading a header of the data structure, which indicates the starting points of the sources and to which transmission speed rate each source is intended. Means c) may further comprise means for reading headers of the files, which indicate the starting point of the source and to which transmission speed rate the source is intended.

[0016] In yet another aspect, the invention teaches a method for storing adaptive media stream data comprising the steps of storing a plurality of media streams, each representing a substantially similar information content, and each adapted for a different set of information transfer conditions; and providing a plurality of pointers into a first of said media streams, said pointers associated with a source location in one of said media streams and pointing to at least one target location in a second of said media streams; wherein the information content of said target location is substantially a continuation of the information content prior to said source location.

[0017] Preferably, said plurality of media streams is contained in a single file. Said pointers are preferably embedded within said adaptive media stream data, and comprise target locations pointer comprises a byte offset into said single file. Alternatively, said target location pointer comprises an offset into said second source stream, within said single file. Another alternative teaches that said target locations pointers comprise a pointer to another file containing said second media stream or a portion thereof. Optionally in this case, said target location pointer further comprises a byte offset into said

Webgroup CZ a.s. Ex. 1002, Page 971 of 1406

other file.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In the following the invention is described in more detail by means of Figs. **1 - 3** in the attached drawings where.

FIG. **1** illustrates an example of the structure of a file according to the invention,
FIG. **2** illustrates an example of a flow chart describing the function of the inventive arrangement,
FIG. **3** illustrates an example of an arrangement according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] FIG. **1** describes an example of a file structure according to the invention. The file is in the service provider's server (source server) from where users can stream it. For example the file contains a video in two different formats. At the beginning of the file there exists a header **1**, which contains starting bytes for two different media sources - the sources for the media stream. Source 1, called stream 1 contains video data in a resolution of 320*240, for a speed rate 200 kbps (kilobit per second) **2.** The starting byte **4** for that video data is byte 2000 in the file. Source 2, called stream 2 contains video data in a resolution of 160*120 optimized for a speed rate 40 kbps **3.** The starting byte of that video data **5** in the file is at byte 800000. If the network and a user's terminal support the transmission speed rate 200 kbps then stream 1 is sent to the user - otherwise stream 2 is sent. In this embodiment, all data feeds are assumed to support communication at a speed of at least 40 kbps. It should be noted that stream 1 and 2 are sources i.e. the parts of the file structures in this example, and a media stream is a continuous transmission of data of a source over a transmission protocol. The transmission protocol used can be any protocol, in this text the HTTP protocol is used.

[0020] Stream 1 is sent, i.e. streamed, to the user. Stream 1 (and the media stream for it as well) contains timing marks **6, 7, 8, 9.** The timing marks are embedded in stream 1 at a various locations, and correlate the information in the two separate resolution streams. Thus the timing marks of stream 1 in the example of Fig. 1 indicate the byte of the file where the stream is running at the time and the corresponding byte **6A, 7A, 8A, 9A,** in stream 2. If for some reason, the network can not transmit stream 1 with 200 kbps, or the user's terminal can not receive at this speed rate, the transmission of the video is changed to stream 2. For example, when the need to change the speed rate to a lower one is noticed and the most recently received (or alternatively the next) timing mark is, let's say, the mark **7** indicating time 1000 ms, it tells the corresponding byte 805000 in stream 2 to where the source of the transmission of the video transfers **11.**

[0021] Similarly, stream 2 (and the media stream for it) contains timing marks **10**, **11**, **12**, **13**, which point to the location of corresponding information in stream 1, as shown by the corresponding byte **10A, 11A**, **12A**, **13A**, in stream 1. When the capability of transmitting 200 kbps is noticed during the transmission at 40 kbps rate, the transmission of the video is changed to stream 1. For example, when the availability of the higher speed rate is noticed and the next timing mark is the mark **13** indicating time 3000 ms, the corresponding byte 77000, located in stream 1, points to the location of corresponding information in stream 1 so the source of transmission is shifted to stream 1, using data stored in location **9** onwards.

[0022] FIG. **2** shows an example of a flow chart, which illustrates a function and method of the invention. FIG. **3** shows an example of the inventive arrangement. When a user visits a home page of a service provider, he/she may find something he wants to order, such as a video show. The video player client running in the user terminal sends **34** a request message from the terminal **33** to the service provider's server **31** through the network **32**, such as the Internet, to get the show using a GET method, which is one of the methods defined in the HTTP1.1 protocol. Let the request be:

GET http://www.serviceprovider.com/video/music/song1.video. **HTTP/1.1**

[0023] Often, the connection speed rate depends on the available (and optional) connection and processing speeds of the terminal. At the beginning, the first stream which is sent works like a test stream. The test stream, i.e. the first stream preferably forms the first part of the file structure, which preferably contains data for the lowest bandwidth. Thus the first stream over the HTTP transport also contains a list of alternative speed rates. The player in the client terminal chooses **21** one of the supported speed rate from the list. (It should be noted that the server can be informed of the capability of a terminal or the available bandwidth using other techniques and the specific method of learning the link capabilities is a matter of technical choice to one skilled in the art.) In this example, the user's terminal supports speed rates of 200 kbps and 40 kbps. Let's assume that the desired file **36** is the file in FIG. **1**. If the speed rate of 200 kbps **22** is available, stream 1 is selected **24**. Otherwise, the speed rate of 40 kbps **23** is chosen and stream 2 is selected **25.** (Notice that the higher speed rate means the higher bandwidth.)

[0024] In the selection of the speed rate of 200 kbps the server starts to play **26** stream 1 beginning at byte (2000) of the file. The data and the timing marks are sent **35** to the user's terminal during the play. The terminal checks **28** frequently that the currently available bandwidth is sufficient for the selected stream. If the bandwidth is sufficient, playing stream 1 is continued. If the bandwidth becomes unavailable for stream 1, stream 2 is selected **210** and stream 2 starts to play **27**, **311** be-

Webgroup CZ a.s. Ex. 1002, Page 972 of 1406

ginning at the byte of the file defined by the latest timing mark. The bandwidth of stream 2 is checked **29** similarly as the bandwidth of stream 1, and when the bandwidth is again available for the speed rate of 200 kbps, stream 1 is selected **211**.

[0025] In the selection of the speed rate of 40 kbps the server starts to play **25** stream 2 from the right byte (800000) of the file. The data and the timing marks are sent **35** to the user's terminal during the play. The terminal checks **29** frequently that the bandwidth is okay for the selected stream. If the bandwidth is still restricted to 40 kbps, playing stream 2 is continued. If the bandwidth rise to a level sufficient to support 200 kbps transmission, stream 1 is selected **211** and stream 1 starts to play **26**, and is sent **311** to the terminal **33** beginning at the byte of the file defined by the latest timing mark. The bandwidth of stream 1 is checked **28** similarly as the bandwidth of stream 2, and when the bandwidth is again too slow for the speed rate of 200 kbps, stream 2 is selected **210**.

[0026] The checking of the bandwidth of the streams can be made, for example, measuring a filling degree of a buffer for incoming data connection in the user's terminal. When the buffer is becoming empty, the required bandwidth for current stream is too high compared to what is available through the network connection, and the speed rate should be dropped. When the buffer is becoming full, bandwidth for current stream is lower than what is available through the network connection, and the speed rate can be raised. After the measurement, the suitable stream source is selected **210, 211** and a GET command with an additional field RANGE is sent **310** from the user's terminal to the server for changing the stream. For example, let the GET command be GET http://www.serviceprovider.com/video/music/song3video RANGE: bytes= 805000- when the transmission speed rate changes from 200 kbps to 40 kbps.

[0027] It is worth noting that preferably, when a stream is changed, a new HTTP transport (and naturally a new media stream) is started and the old media stream is terminated after the new media stream starts playing. From the view of the user the desired file, such as a video show, seems to continue without any break because the new stream starts playing from the byte indicated by the timing mark, thus the information continuity is maintained, despite the media stream switch. So, when the source is changed, also a new HTTP transport is created for the new stream, i.e. media stream, instance and for the new source. Thus the adaptive media stream, i. e. the adaptive stream, is made up of one media stream or several consecutive media streams. Since the consecutive media streams carry essentially the same data, a user gets a visual impression of continuous shows. In other words, the adaptive media stream comprises at least one media stream for transmitting information. The HTTP 1.1 protocol provides a feature called Persistent Connections. Persistent Connection means that several requests (such as GET), can be sent via one TCP connection. Thus one connection may carry several consecutive streams. However, it should be noted that several TCP connections may be needed or used for transmitting consecutive streams.

[0028] Furthermore, it may be said that the adaptive media stream comprises several (or one if the speed rate remains the same during the whole transmission) instances (separate streams) of the same object (the adaptive media stream containing information such as video). Naturally, there are more ways to model the adaptive media stream, but common for these models are that transmission of information of the adaptive stream, (the stream of a continuous data, such as video over one or several connections) happens in one or several consecutive media streams over a transport protocol, each media stream adapted for certain conditions, and certain links or pointers periodically connect or cross connect the media streams in essentially content coherent fashion. Thus varying transmission conditions may dictate how many suitable media streams are sent forming together the adaptive stream.

[0029] For creating the inventive arrangement an initial selection module **39** (i.e. means) for choosing an original transmission speed rate and selecting a suitable source in a service provider's server is needed. In a user's terminal another estimation module **37** (i.e. means for checking transmission rate) is needed, for checking the suitability of the transmission speed rate as reselection module **38** (i.e. means) for reselecting a suitable source are needed.

[0030] Although, the processing and network connection speed of a user's terminal is mostly the decisive element when selecting a suitable transmission speed rate, it may happen that the network itself becomes congested. In congestion, the available speed rate decreases and the transmission speed rate must be lowered. On the other hand, if the network allows a higher speed, the transmission speed rate may be increased.

[0031] Using the inventive arrangement, an adaptive media stream can be served from with a common HTTP server. Therefore, there is no need for the use of a special media stream server, or parallel devices and software. Remarkable cost savings are achieved, since usually service providers and users support the HTTP protocol. Also the reliability of the system increases because of fewer sources of faults.

[0032] It is clear that inventive arrangement can be implemented in many ways. For example, the time period between two timing marks can be different than in the example of this text. It can be any suitable period depending on the features of a solution, such as 2 or 4 seconds. The format of the inventive file can be any suitable format as well, such as MPEG or another.

[0033] The inventive file may comprise more than two different streams (containing the same content), from which the most suitable stream is selected at any given time. Therefore, timing marks must contain a number of references for the corresponding byte in the other data

Webgroup CZ a.s. Ex. 1002, Page 973 of 1406

sources.

[0034] All the sources do not have to be in the same file, but each source can be a separate file. However, the use of this kind of structure is not as efficient when attempting to use as little processing power as possible compared to the use of one file structure. In the structure of several files, timing marks must indicate the right file with the corresponding byte.

[0035] Although, a sending terminal have been described to be a server in the examples above, it is clear that the sending terminal can be another terminal capable of sending information.

[0036] Similarly other mechanisms are known and suitable to measure and select the most appropriate source. Such methods may be server based or user terminal based, or even utilize intermediate network nodes to estimate network congestion and bandwidth, and similar measurements that are indicative of total node to node capacity, as well as specific node capabilities, and the selection of sources (and media streams) may be carried out in various ways that will provide the best end-user experience according to varying conditions.

[0037] According to the above-mentioned matters, it is evident that the invention is not restricted to the solutions described in this text, but it can be modified for various solutions, in the scope of the inventive idea.

Claims

1. A method for providing an adaptive media stream between a sending terminal and a user's terminal **characterized in that** the adaptive media stream comprises at least one media stream and the method comprises the steps of:

   a) choosing a transmission speed rate for the media stream,
   b) selecting a suitable data source for the media stream among sources containing essentially the same information, each source intended for a certain transmission speed rate,
   c) playing the media stream,
   d) checking the suitability of the transmission speed rate,
   e) either continuing playing the media stream if the transmission speed is still suitable or,
   f) selecting a new data source, which is suitable at the moment,
   g) as a response for the selection of the new data source, playing a new media stream,
   h) repeating steps d) to g) until the stream, which is played, stops.

2. A method according to claim 1 **characterized in that** step b) comprises the phase of reading a header field of a file, which contains at least two data sources, the header indicating the starting points of the sources and to which transmission speed rate each source is intended.

3. A method according to claim 2 **characterized in that** step c) comprises the phase of starting to read from the starting point of the selected source.

4. A method according to claim 1 or 3 **characterized in that** step d) comprises the phase of monitoring a filling degree of a buffer for incoming data in the user's terminal.

5. A method according to claim 4 **characterized in that** if the buffer is becoming empty or full, then step f) is chosen, else step e) is chosen.

6. A method according to claim 1 or 5 **characterized in that** the information of the selection of the new data source is transmitted from the user's terminal to the sending terminal using a GET method of an HTTP protocol with an optional RANGE field.

7. A method according to claim 1 **characterized in that** step g) comprises phases of terminating the old media stream after starting to play the new media stream and creating the new media stream before playing the new media stream.

8. A method according to claim 1 or 7, **characterized in that** step g) further comprises the phase of reading timing marks in the data source for defining the right point to start playing the new media stream.

9. A method according to claim 1 **characterized in that** step b) comprises the phase of reading a header field of files, where each contains one data source, the header indicating the starting points of the source and to which transmission speed rate the source is intended.

10. An arrangement for providing an adaptive media stream between a sending terminal and a user's terminal, **characterized in that** the adaptive media stream comprises at least one media stream and the arrangement comprises:

    a) means in the sending terminal for choosing a transmission speed rate for the media stream,
    b) a data structure in the sending terminal comprising at least two data sources containing essentially the same information, each source intended for a certain transmission speed rate,
    c) means in the sending terminal for selecting a suitable data source from among the sources for the media stream,
    d) means in the user's terminal for checking the suitability of the transmission speed rate when the media stream is played,

Webgroup CZ a.s. Ex. 1002, Page 974 of 1406

e) means in the user's terminal for reselecting a suitable data source from among the sources for a new media stream.

11. An arrangement according to claim 10, **characterized in that** the arrangement further comprises means for playing the data structure in a way that the playing is started from the right point of the data structure.

12. An arrangement according to claim 11, **characterized in that** means a) comprises means for reading a message from the user's terminal, which defines alternative transmission speed rates.

13. An arrangement according to claim 11, **characterized in that** each source comprises timing marks, which indicate the corresponding point in the other sources.

14. An arrangement according to claim 13, **characterized in that** the arrangement further comprises a GET method of an HTTP protocol with an optional RANGE field for transmitting the information of the reselection of the suitable data source from the user's terminal to the sending terminal.

15. An arrangement according to claim 11, **characterized in that** means d) comprises means for monitoring a filling degree of a buffer for incoming data in the user's terminal.

16. An arrangement according to claim 11, **characterized in that** the data structure is a file containing the data sources.

17. An arrangement according to claim 16, **characterized in that** means c) comprises means for reading a header of the data structure, which indicates the starting points of the sources and to which transmission speed rate each source is intended.

18. An arrangement according to claim 11, **characterized in that** the data structure is a number of files, each of them containing one data source.

19. An arrangement according to claim 18, **characterized in that** means c) comprises means for reading headers of the files, which indicate the starting point of the source and to which transmission speed rate the source is intended.

Webgroup CZ a.s. Ex. 1002, Page 975 of 1406

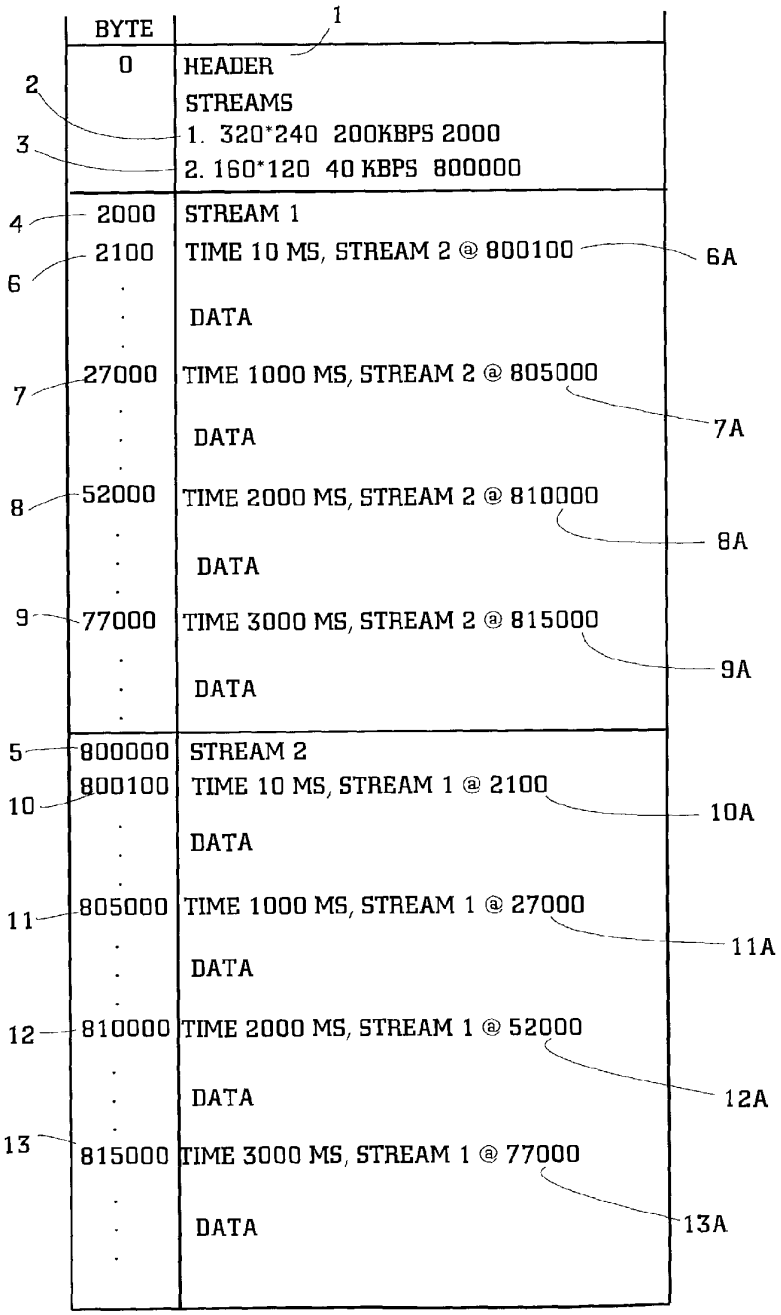


FIG. 1

Webgroup CZ a.s. Ex. 1002, Page 976 of 1406

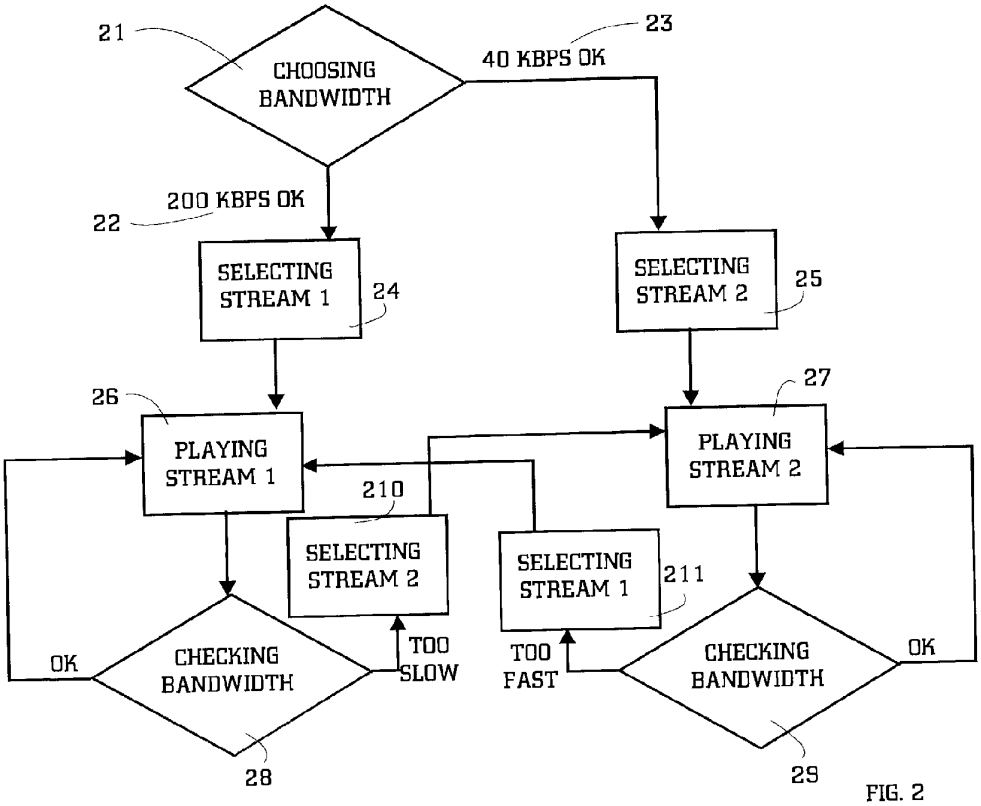

21
CHOOSING BANDWIDTH
23
40 KBPS OK
22
200 KBPS OK
SELECTING STREAM 1
24
SELECTING STREAM 2
25
26
PLAYING STREAM 1
27
PLAYING STREAM 2
210
SELECTING STREAM 2
SELECTING STREAM 1
211
OK
CHECKING BANDWIDTH
TOO SLOW
TOO FAST
CHECKING BANDWIDTH
OK
28
29

FIG. 2

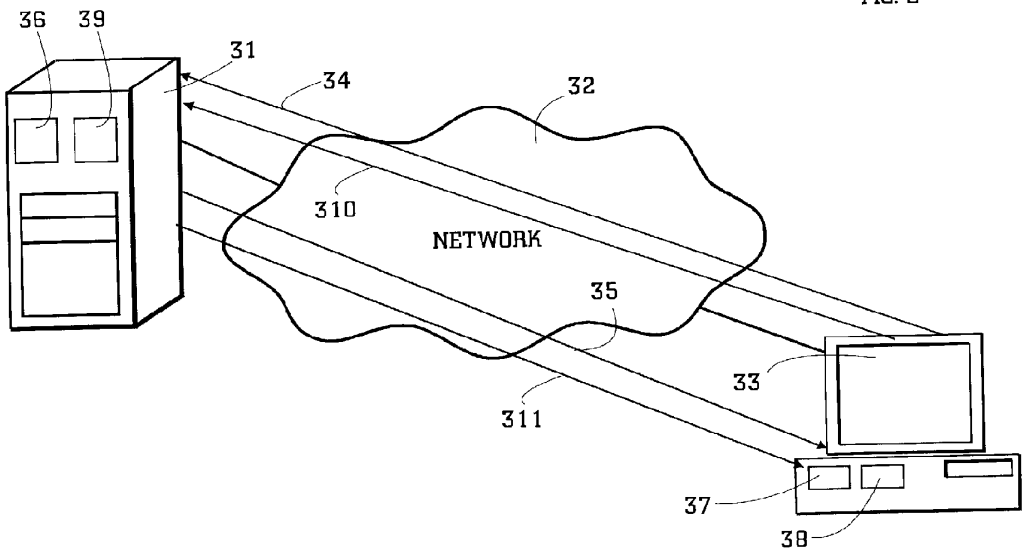

36
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31
34
32
310
NETWORK
35
33
311
37
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FIG. 3

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(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Kadoma-city, Osaka 571-8501 (JP)

(72) Inventors:
- **Rey, José Luis**
  64287 Darmstadt (DE)
- **Burmeister, Carsten**
  22081 Hamburg (DE)
- **Hakenberg, Rolf**
  64295 Darmstadt (DE)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) A method of transmitting data streams with data segments of variable length

(57) A method of transmitting data streams between a sending host and a receiving host using a transport protocol comprising the steps of making available data streams at the sending host in the form of mono-rate or multi-rate content streams having the same content but different encoding rates, establishing a connection between the sending host and the receiving host, transmitting data streams with a selected encoded rate to the receiving host, and separating the data streams into data segments of variable length at the sending host as required during transmission.

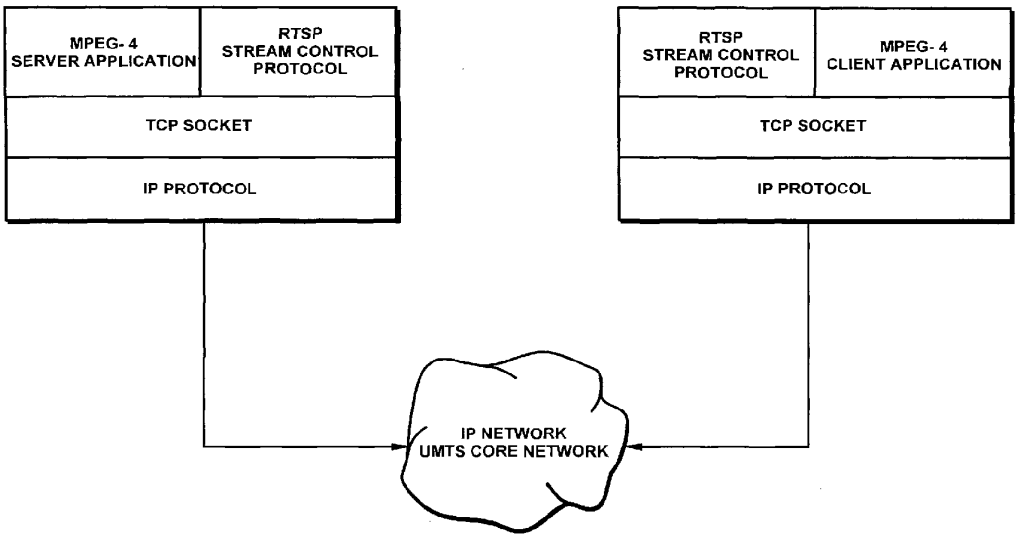


Fig. 1

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EP 1 395 014 A1

Description

[0001] The present invention relates to a method of transmitting data streams between a sending host and a receiving host using a transport protocol such as TCP.

[0002] In network communications between a sending host and a receiving host, the transmission of data packets is mostly done on a best-effort basis. In the communication link, the available bandwidth and the current link conditions vary and hence, the end hosts must be provided with mechanisms to probe and adjust themselves to the current link conditions.

[0003] With the development of 3rd generation networks, so-called streaming applications are gaining importance. Streaming applications are understood as a continuous stream of data, e.g. video or audio data which is typically sensitive to time delays. In order that the user will be able to receive multimedia data streams on a portable receiver, for example a mobile phone, several requirements on the transport mechanism will be imposed in order that the delivered data meets with the resulting time constraints. These constraints are difficult to meet in a best-effort environment, which is subject to bandwidth variations and delays.

[0004] To cope with the problem of bandwidth adaption, it is common praxis to make several data streams with different encoding rates but same content available at the sending host. According to the available bandwidth, it is then switched between the data streams in order to adjust the rate to the available bandwidth. In other words, multi-rate content streams at the sending host are transmitted and switching operations between streams are performed depending on the available bandwidth. The current stream is forwarded to the receiving host in one piece and consequently, for every switching operation, the ongoing connection must be torn down and a new one must be set up. As a result, this operation is inefficient and decreases the data throughput.

[0005] Alternatively, it is possible to transmit only one stream of data to the receiving host and to discard data packets based on priority and time constraints. However, this leads to a loss of data and is therefore not an optimal solution.

[0006] The object subject to the present invention is to minimize the latency of the switching operation and to ensure fast recovery from an incorrect switching decision.

[0007] This object is solved according to the present invention with a method as set forth in claim 1. Preferred embodiments of the method are subject to various dependent claims.

[0008] The method of the present invention supposes the existence of multi-rate content data streams at the sending host. With the method of the present invention, it is possible to quickly switch between data streams that are variably segmented at the application layer as required during transmission. Instead of using data streams of fixed segment length, the data segments given to the socket are made smaller before, during and after the switching. For each content several video streams encoded with different rates are stored at the video server. Under normal sending conditions, i.e. the transmission has reached some equilibrium where the bandwidth is enough and the losses are not dominating, the video content is passed to the sending TCP socket in segments of the same size (irregardless of the stream encoding rate, the segment size is a function of the link, not of the encoding rate). Only when the server is notified (or knows by other means) that a stream switch might be needed, then it reduces the size of these segments.

[0009] Further, with the method of the present invention, it is neither necessary to modify the originally encoded data at the sending host or to modify the transport protocol nor to introduce additional control messages, making the method easy to implement.

[0010] Preferably, the switching is performed between data streams of different rate and the variable segmentation of the data streams is performed around the switching instant. Hence, a quick stream switching from the old to the new data stream can be performed. Further, preferably, the segmentation during, before or after the switching instance is made finer, such that the switching operation is more resilient to an incorrect decision and enables a quicker, further switching operation.

[0011] Advantageously, the step of switching between streams involves a feedback message (e.g. an RTSP command) i.e. communication between hosts when a switching operation is needed and when to make the necessary preparations therefor, for example, to start with finer segmentation.

[0012] It is furthermore of advantage if the feedback message includes at least one of the parameters, which comprise the length of data segment, an identifier of the data to be sent or a stream control command which makes the operation smoother and less susceptible to data losses.

[0013] Preferably, the length of the data segments is gradually increased after a switching instant to reduce interface communication, i.e. between application and TCP socket.

[0014] The present invention will be more fully understood from the following detailed description with reference to the accompanying drawings which show:

Figure 1: the basic architecture of a sending host and a receiving host connected by a communications network in which the method subject to the present invention can be performed,

Figure 2: a block diagram of a server architecture as the sending host in which the method of the present invention is performed, and

Webgroup CZ a.s. Ex. 1002, Page 979 of 1406

Figure 3: a block diagram of a client architecture.

[0015] Figure 1 illustrates the basic architecture of a communications network for connecting a video server as a sending host to a video client acting as a receiving host. The communications network is, for example, a UMTS core network, an external network, such as the internet or an internal intranet over which the server and the client communicate by means of a transport protocol. As transport protocol TCP is selected as an example, but it is clear to a skilled person that any other transport protocol for transmitting data can be employed.

[0016] In a more general way, it will now be explained how TCP handles the exchange of data between the server and the client.

[0017] First of all, the video server needs to transfer its data to the protocol and tell it to send same to the client. To progressively read and send data, the protocol uses a kind of buffer with added functionalities, a so-called TCP socket. Generally, sockets are unequivocally identified by the IP addresses of the correspondents, the protocols and ports which are used. Once a connection between two sockets is established, the communication can be controlled by use of interface calls, which, for example may comprise "create a socket", "bind a socket to a transport address", "accept" or "close a connection", "send", "receive" or "write" data between the sender and the receiver.

[0018] Wide-spread socket implementations are UNIX BSD 4.2 and Windows Winsock 2.0, where equivalent interface calls are implemented.

[0019] Each interface call has parameters, e.g. for the "send" call, parameters of relevance are the socket descriptor, the identifier of the data to be sent and the length of the data stream. Once a data stream is passed in one call, no single bit of this data stream can be modified. The only way to abort transfer of this data stream is to break down the connection.

[0020] Nevertheless, in order to close the connection, the application must explicitly issue a "close" call. Interface calls can be queued as, for example, in FTP. When asked for a file, the FTP server usually issues two interface calls for this transmission, namely a "send" call indicating the socket, the identifier of the data stream and the length thereof and a "close" call identifying the socket. The two interface calls are put into the queue and when the "send" call is completed, the connection is irreversibly broken down because the "close" call was next in the queue.

[0021] Alternatively, for example, in case of TELNET, the connection is established and the socket is set to wait for incoming data, i.e. commands typed on the keyboard.

[0022] Of course, the application can be configured such that the server only issues a send call and waits for the client to close. However, this is uncommon.

[0023] Additionally, it is assumed that the TCP protocol provides a means for asynchronously signaling certain information about events in the socket. Often in the specification, the information will be an error message. In other cases, there will be information relating to the completion of processing a SEND or RECEIVE or another interface call.

[0024] Referring again to Figure 1, the video server provides, e.g. an MPEG 4 compressed data stream, i. e. a given video content, which is made available to the TCP socket in the form of mono-rate or multi-rate streams. Multi-rate streams are defined for the purpose of this and the following description, as one or several data streams with the same video content at different encoding rates. The MPEG data streams are forwarded to the TCP socket. Subsequently, by means of an IP protocol, data is transmitted to the video client. A stream control protocol, e.g. RTSP, should be used to perform such operating as PLAY, PAUSE or STOP the transmission.

[0025] With reference to Figure 2, which shows the basic architecture of a video server 200, at the MPEG server application 210, video content is made available in a buffer 211 at different coding rates. A switch 212, which receives stream control RTSP commands from RTSP block 220, such as "Play", "Pause", "Tear down" or "Change rate", selects one of the data streams which is forwarded to the TCP socket 230 in form of an MPEG file.

[0026] It is clear to a skilled person that other stream control protocols than RTSP could be used at the server and the client. The stream control protocol typically instructs to perform play, forwarding, rewinding, pause or stop functions. Additionally, if multi-rate content is available, switch to a higher or lower encoding rate can be instructed.

[0027] Once a server has received a request for a file containing a chosen content encoded at a desired rate, the server application forwards each of the segments, in which the file was previously segmented, one after another to the TCP socket by means of consecutive interface calls, e.g. consecutive SEND calls. Unlike in current FTP applications, the connection is not torn down after each data transmission process is completed. The data connection remains open, so that there is no need to build up a new connection every time a segment is transmitted. Following this, the TCP socket forms with these segments packet data units (PDUs) for transmission to the client, as it finds most appropriate

[0028] Upon establishing a connection, the TCP socket selects a segment size for the data streams which the server finds most appropriate for the link under consideration of the channel bandwidth and starts transmitting.

[0029] Initially, the size of the segments is made small before, during and after a switching operation in order to avoid a large waiting time before a further switch operation can be performed in case the previous switch decision was incorrect. Subsequently, the size of the data segments can be increased gradually throughout the connection time.

Webgroup CZ a.s. Ex. 1002, Page 980 of 1406

[0030] Eventually, when there is a change in the available link bandwidth, the video client shall indicate a possible switch operation by means of, for example, an RTSP message and the server will start doing finer segmentation. Hence, the server switches between data streams of different encoding rates. This is done based on initial information and subsequently controlled by feedback from the client. Alternatively, this could be determined by the server, which would, however, impose processing requirements on the server. Also a combination of control mechanisms at the server and the client is possible. How the server or the client exactly makes the decision to perform a switching operation or indicates a possible anticipated switch is out of the scope of the present invention.

[0031] The basic architecture of a TCP streaming client 300 is illustrated in Figure 3. The client 330 typically consists of a TCP socket 310, an application layer buffer 320 and a buffer manager 330 for the application layer buffer.

[0032] The client 300 processes the data segments of variable length as they come. In response thereto, it sends ACKs and performs flow control in order to prevent an overflow of the TCP socket 310 while extracting the maximum bit rate possible from the link. To do this, the TCP socket indicates to the server, with each ACK, how much data it can receive until the socket is full using a window field in the header of the TCP protocol. If needed, the TCP client signals a zero-window telling the server to enter a "Persist" mode wherein no data is sent until the client allows to do so while the connection is maintained. The Persist mode and the signaling of a window field are standard functionalities of the TCP protocol. When the TCP circuit has capacity for more data, it signals this to the server. Streaming control commands are signalled to the server by means of RTSP commands.

[0033] The application layer buffer 320, also called "play-out buffer" receives data from the socket and transmits same to the MPEG client application 340. The manager 330 for the application layer buffer 320 receives a frame request from the MPEG client application and issues a socket request upon considering the state of the application layer buffer. The buffer manager 320 therefore insures that the bit rate with which the TCP socket 310 can deliver the new data to the application layer buffer 320 matches the bit rate at which the application layer buffer is emptied to the MPEG client application 340. The exact control mechanism of the buffer manager is out of the scope of the present invention.

[0034] Finally, from the MPEG client application, the data is transferred to a display 350 for visualization for the user.

Claims

1. A method of transmitting data streams between a sending host and a receiving host using a transport protocol comprising the steps of:

   making available data streams at the sending host in form of mono-rate or multi-rate content streams having same content but different encoding rates,

   establishing a connection between the sending host and the receiving host for the duration of transmission,

   transmitting data streams of the same content with a selected encoding rate to the receiving host, and

   separating the data streams in data segments of variable length at the sending host as required during the established connection.

2. The method according to claim 1, further comprising the steps of switching between data streams of different rate and performing the variable segmentation of the data streams around the switching instant.

3. The method according to claim 1 or 2, wherein the data streams are finer segmented during, before or after the switching instant.

4. The method according to claim 2, wherein the step of switching between streams involves a feedback message.

5. The method according to claim 4, wherein the feedback message includes signalling at least one of the parameters which comprise data segment length, an identifier of the data to be sent or a stream control command.

6. The method according to one of claims 1-5, wherein the receiving host communicates to the sending host when a stream switching is needed.

7. The method according to one of claims 1-6, wherein the sending host determines the timing of the switching instant dependent on the available bandwidth of the communication link.

8. The method according to one of claims 1-7, wherein the length of the data segments is gradually increased after a switching instant.

9. The method according to one of claims 1-8, wherein the received data streams at the receiving host are temporarily stored in an internal buffer.

10. The method according to one of claims 1-9, wherein the receiving host issues stream control commands

Webgroup CZ a.s. Ex. 1002, Page 981 of 1406

to the sending host depending on the state of the internal buffer.

Webgroup CZ a.s. Ex. 1002, Page 982 of 1406

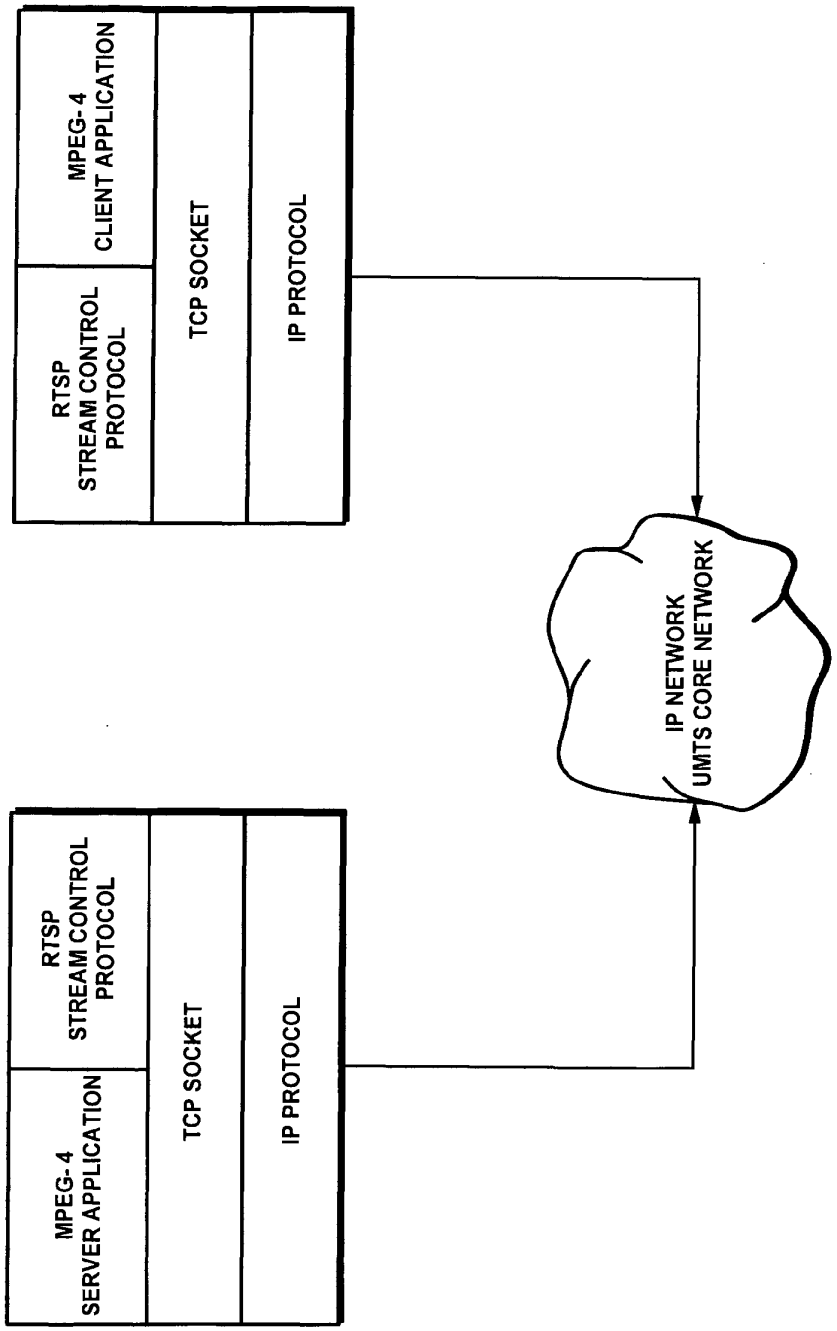


Fig. 1

Webgroup CZ a.s. Ex. 1002, Page 983 of 1406

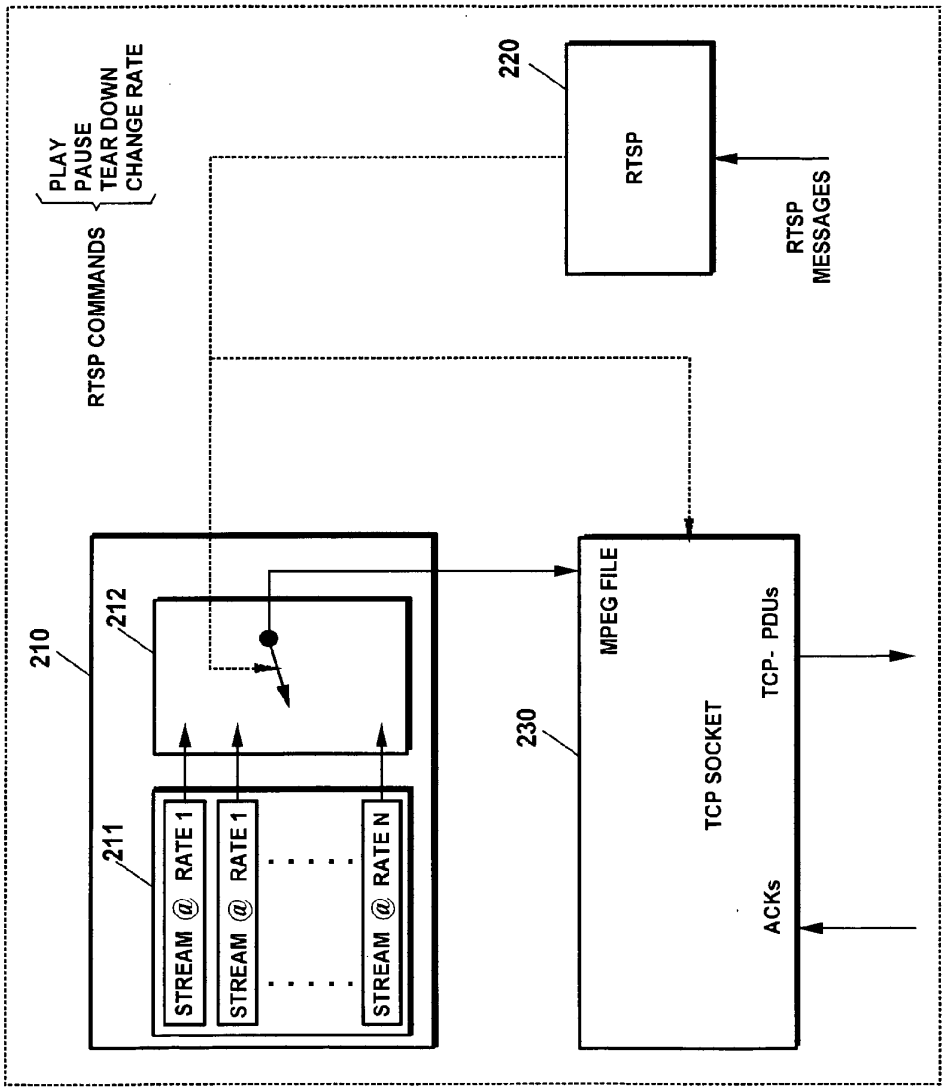


Fig. 2

Webgroup CZ a.s. Ex. 1002, Page 984 of 1406

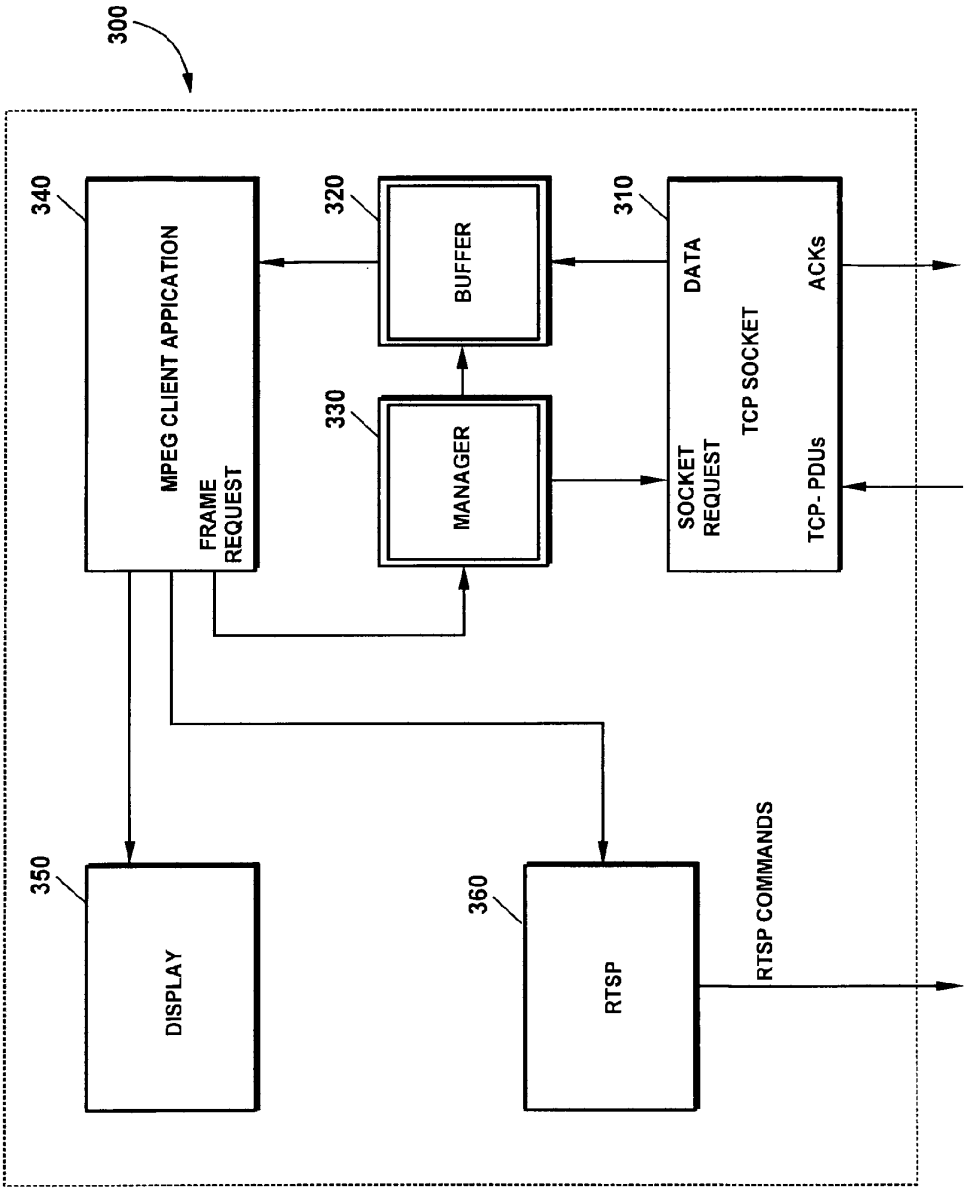


Fig. 3

Webgroup CZ a.s. Ex. 1002, Page 985 of 1406

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 01 9052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	CONKLIN G J ET AL: "VIDEO CODING FOR STREAMING MEDIA DELIVERY ON THE INTERNET" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE INC. NEW YORK, US, vol. 11, no. 3, March 2001 (2001-03), pages 269-281, XP001093477 ISSN: 1051-8215 * page 271, left-hand column, line 35 - line 44; figures 1,2 * * page 270, left-hand column, line 11 - line 20 * ---	1-10	H04L29/06 H04L29/08
Y	EP 0 786 885 A (NOKIA TELECOMMUNICATIONS OY) 30 July 1997 (1997-07-30) * abstract * * page 2, column 2, line 14 - line 34 * ---	1-10	
X	WO 02 054284 A (LEISTAD GEIRR I ;DANKWORTH HARALD (NO); FAST SEARCH & TRANSFER ASA) 11 July 2002 (2002-07-11) * page 2, line 31 - page 3, line 7 * * page 4, line 6 - page 5, line 6; figure 1 * * page 9, line 18 - page 10, line 15 * * page 11, line 3 - line 28; figure 3 * --- -/--	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	7 January 2003	Michael, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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Webgroup CZ a.s. Ex. 1002, Page 986 of 1406

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EUROPEAN SEARCH REPORT

Application Number
EP 02 01 9052

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	HUI J Y ET AL: "CLIENT-SERVER SYNCHRONIZATION AND BUFFERING FOR VARIABLE RATE MULTIMEDIA RETRIEVALS" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 14, no. 1, 1996, pages 226-237, XP000548824 ISSN: 0733-8716 * page 228, left-hand column, line 15 - line 33 * * page 228, right-hand column, line 14 - line 32 * ---	10	
A	JONGWON KIM ET AL: "TCP-friendly Internet video streaming employing variable frame rate encoding and interpolation" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, vol. 10, no. 7, October 2000 (2000-10), pages 1164-1177, XP002226167 ISSN: 1051-8215 * page 1164, right-hand column, line 25 - line 40; figure 1 * ---	7	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	WO 02 052859 A (DURRANT SIMON ;LAKE JULIAN (GB); MULROY PAT (GB); PA CONSULTING SE) 4 July 2002 (2002-07-04) * page 3, line 12 - line 30 * -----	7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	7 January 2003	Michael, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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Webgroup CZ a.s. Ex. 1002, Page 987 of 1406

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 01 9052

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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07-01-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0786885 A	30-07-1997	FI 960382 A	27-07-1997
		EP 0786885 A2	30-07-1997
		US 5914960 A	22-06-1999
WO 02054284 A	11-07-2002	NO 20010056 A	05-07-2002
		WO 02054284 A1	11-07-2002
WO 02052859 A	04-07-2002	WO 02052859 A1	04-07-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Webgroup CZ a.s. Ex. 1002, Page 988 of 1406

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(71) Applicant: **Microsoft Corporation**
Redmond WA 98052 (US)

(72) Inventors:
- **Klemets, Anders E.,**
  c/o Microsoft Corporation
  Redmond, WA 98052 (US)
- **Huang, Cheng,**
  c/o Microsoft Corporation
  Redmond, WA 98052 (US)
- **Chou, Philip A.,**
  c/o Microsoft Corporation
  Redmond, WA 98052 (US)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) A system and process for controlling the coding bit rate of streaming media data

(57) A system and process for controlling the coding bit rate of streaming media data is presented. This coding bit rate control involves dynamically adjusting the coding bit rate to control client buffer duration to prevent the buffer from underflowing, while keeping the average coding bit rate close to the average transmission bit rate of the network (an thus maximizing the quality of the data playback). Using the theory of optimal linear quadratic control, the client buffer duration is kept as close as possible to a target level while still keeping the coding bit rate (and hence the quality) as constant as possible. In addition, a leaky bucket model is incorporated into the control loop so that the changes in buffer duration due to natural variation in the instantaneous coding bit rate are not mistaken for changes in buffer duration due to network congestion.

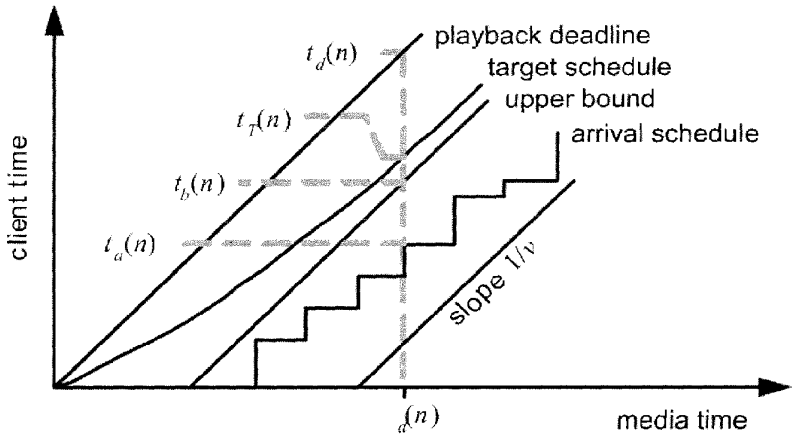


FIG. 5

EP 1 670 256 A2

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND

Technical Field:

[0001] The invention is related to controlling the coding bit rate of streaming media, and more particularly to a system and process for controlling the coding bit rate of streaming media data that provides fast startup, continuous playback, and maximal quality and smoothness over the entire streaming session.

Background Art:

[0002] Perhaps the major technical problem in streaming media on demand over the Internet is the need to adapt to changing network conditions. As competing communication processes begin and end, the available bandwidth, packet loss and packet delay all fluctuate. Network outages lasting many seconds can and do occur. Resource reservation and quality of service support can help, but even they cannot guarantee that network resources will be stable. If the network path contains a wireless link, for example, its capacity may be occasionally reduced by interference. Thus it is necessary for commercial-grade streaming media systems to be robust to hostile network conditions. Moreover, such robustness cannot be achieved solely by aggressive (nonreactive) transmission. Even constant bit rate transmission with re-transmissions for every packet loss cannot achieve a throughput higher than the channel capacity. Some degree of adaptivity to the network is therefore required.

[0003] End users expect that a good streaming media system will exhibit the following behavior: content played back on demand will start with low delay; once started, it will play back continuously (without stalling) unless interrupted by the user; and it will play back with the highest possible quality given the average communication bandwidth available. To meet these expectations in the face of changing network conditions, buffering of the content at the client before decoding and playback is required.

[0004] Buffering at the client serves several distinct but simultaneous purposes. First, it allows the client to compensate for short-term variations in packet transmission delay (i.e., "jitter"). Second, it gives the client time to perform packet loss recovery if needed. Third, it allows the client to continue playing back the content during lapses in network bandwidth. And finally, it allows the content to be coded with variable bit rate, which can dramatically improve overall quality. Note that even so-called constant bit rate (CBR) coded content is actually coded with variable bit rate within the constraints of a decoding buffer of a given size. The larger the decoding buffer size, the better the quality. The required decoding buffering is part of the larger client buffer.

[0005] The size of the client buffer can be expressed as the number of seconds of content in the buffer, called the buffer *duration.* The buffer duration tends to increase as content enters the buffer and tends to decrease as content leaves the buffer. Content leaves the buffer when it is played out, at a rate of v seconds of content per second of real time, where v is the *playback speed* (typically 1 for normal playback, but possibly more than 1 for high speed playback or less than 1 for low speed playback). Content enters the buffer when it arrives at the client over the network, at a rate of r_a/r_c seconds of content per second of real time, where r_a is the *arrival rate,* or average number of bits that arrive at the client per second of real time, and r_c is the *coding bit rate,* or the average number of bits needed to encode one second of content. Thus the buffer duration can be increased by increasing r_a, decreasing r_c, and/or decreasing v (and vice versa for decreasing the buffer duration). Although the buffer duration can be momentarily controlled by changing r_a or changing v, these quantities are generally not possible to control freely for long periods of time. The arrival rate r_a on average is determined by the network capacity, while the playback speed v on average is determined by user preference. Thus if the network capacity drops dramatically for a sustained period, reducing the coding bit rate r_c is the only appropriate way to prevent a *rebuffering event* in which playback stops (v=0) while the buffer refills.

[0006] Thus, adaptivity to changing network conditions requires not only a buffer, but also some means to adjust the coding bit rate r_c of the content. This can be done by stream switching in combination with multi bit rate (MBR) coding or coarse grained or fine grained scalable coding. Today's commercial streaming media systems [1] rely on MBR coding as well as *thinning,* which is a form of coarse grained scalability. In MBR coding, semantically identical content is encoded into alternative bit streams at different coding bit rates and stored in the same media file at the server, allowing the content to be streamed at different levels of quality corresponding to the coding bit rates r_c, possibly using bit stream switching [2]. In coarse grained scalable coding (such as MPEG-2/4 temporal or SNR scalability) the content is encoded into several sub-streams or *layers,* so that the coding bit rate r_c can be changed in large deltas by adding or dropping (at possibly restricted times) one layer of content at a time. Thinning is a special case of coarse grained scalability in which dependent video frames (P and B frames) are dropped before independent video frames (I frames), which are in turn are dropped before audio frames. Future commercial systems may support fine grained scalability (FGS) as well. Fine grained scalable coding (such as 3D SPIHT [6], MPEG-4 FGS [7], or EAC [8]) allows the coding bit rate r_c to change

Webgroup CZ a.s. Ex. 1002, Page 990 of 1406

at any time in deltas sometimes as small as one byte per presentation. FGS coding offers great flexibility in adapting to variable network conditions, and can demonstrably improve quality under such conditions.

[0007] Some examples of existing technology that adjusts the coding bit rate r_c of the content in an attempt to adapt to changing network conditions includes de Cuetos and Ross [9], which decouples the transmission rate and the coding bit rate. They assume that the transmission rate is determined by the network transport protocol (TCP or TFRC). Based on this, they develop a heuristic real time algorithm for adaptive coding bit rate control and compare its performance to an optimal offline coding bit rate control policy if the transmission rate is given prior to streaming. The work of Rejaie, Handley and Estrin [4] proposes a scheme for transmitting layered video in the context of unicast congestion control, which basically includes two mechanisms. One mechanism is a coarse-grained mechanism for adding and dropping layers (changing the overall coding bit rate and quality). The other is a fine-grained interlayer bandwidth allocation mechanism to manage the receiver buffer (not changing the overall coding bit rate or quality). A potential issue with this approach is that it changes the coding bit rate by adding or dropping one (presumably coarse) layer at a time. If the layers are fine-grained, as in the case of FGS coded media, then adding or dropping one (fine-grained) layer at a time typically cannot provide a prompt enough change in coding bit rate. Moreover, since the adding and dropping mechanism is rather empirical, the mechanism may simply not be suitable for FGS media. The work of Q. Zhang, Zhu and Y-Q. Zhang [5] proposes a resource allocation scheme to adapt the coding bit rate to estimated network bandwidth. The novelty of their approach is that they consider minimizing the distortion (or equivalently maximizing the quality) of all applications, such as file-transfers and web browsing in addition to audio/video streaming. However, their optimization process does not include the smoothness of individual streams and might lead to potential quality fluctuations.

[0008] However, even with buffering and the ability to adjust the coding bit rate, existing technologies for streaming media on demand over the Internet suffer from two problems:

1. Playback often stalls during network congestion. That is, during playback of high bit rate content, if the network bit rate drops below the content bit rate, the client buffer runs out of content and playback stops while the client rebuffers (known as a "rebuffering" event).
2. Start-up delay is often too long (about 5 seconds).

There are existing solutions to both of these problems, but they do not always work well. One solution to the first problem is to stream the content encoded at a coding bit rate that is low relative to the average bit rate transmitted over the network (the *transmission bit rate*). This will enable the buffer to build up over time. With such a large reserve of unplayed information on the client, temporary network congestion will not affect playback. However, this solution has two problems. First, the coding bit rate of the content is not as high as the average transmission bit rate of the network and hence the quality is lower than it could be. Second, the buffer can grow nearly as large as the streamed file itself. This may demand too many resources on the client device.

[0009] Another solution to the first problem is to try to maintain the client buffer at a constant level (typically about 10 seconds), while switching between different coding bit rates for the same content, trying to match the transmission bit rate of the network. However, rebuffering events are still commonly observed in practice, because choosing the right time to switch streams is difficult. One reason that it is difficult is that there are natural variations in the instantaneous coding bit rate of the content, even in so-called constant bit rate encodings, which can confuse the client buffer management algorithm.

[0010] The second problem above (long start-up delay) also has multiple solutions. One solution is to fill up the client buffer quickly, with a quick initial transmission rate burst. With the client buffer full, playback can safely begin. However, this solution has several problems. First, it is only applicable when there is sufficient "headroom" in the network to increase the transmission bit rate for a few seconds. Thus it is usually not applicable for modem connections, for example. Second, it stresses the network, causing other applications in the network to back off. It has been shown that during the burst period, there can be as much as 80% packet loss, causing all TCP connections sharing the same bottleneck to back off. Third, by implication, if there is headroom in the network for bursting, then the streaming application may not be using the full bandwidth available to it during the remainder of the file, meaning that quality is lower than it should be.

[0011] Another solution to the second problem is to play back the content slower than real time, allowing playback to begin while the client buffer builds up. This is an innovative solution, but has the obvious temporal distortion.

[0012] A final solution to the second problem is to lower temporarily the coding bit rate of the content below the transmission bit rate of the network, allowing playback to begin while the client buffer builds up. This is a solution proposed by Chou et al. in [13].

[0013] The system and process of the present invention resolve the problems of the existing techniques and provide fast startup, continuous playback, and maximal quality and smoothness over the entire streaming session.

[0014] It is noted that in the preceding paragraphs, as well as in the remainder of this specification, the description refers to various individual publications identified by a numeric designator contained within a pair of brackets. For example, such a reference may be identified by reciting, "reference [1]" or simply "[1]". A listing of references including

Webgroup CZ a.s. Ex. 1002, Page 991 of 1406

the publications corresponding to each designator can be found at the end of the Detailed Description section.

SUMMARY

[0015] The present invention is directed toward a system and process for controlling a coding bit rate of streaming media data being transmitted to a client from a server over a computer network. In general, this coding bit rate control involves dynamically adjusting the coding bit rate of the streaming media data to control the client buffer duration. The purpose of this is to prevent the client buffer from underflowing, while keeping the average coding bit rate close to the average transmission bit rate of the network (an thus maximizing the quality of the playback of the data). The problem of coding bit rate control is formulated as a standard problem in linear quadratic optimal control, in which the client buffer duration is controlled as closely as possible to a target level. The smoothness of the average coding bit rate over consecutive frames is also considered when deciding whether to change the coding bit rate as part of the optimal control process. This yields a higher and more stable quality as network conditions change. In addition, the natural variation in the instantaneous coding bit rate that occurs for a given average coding bit rate is explicitly take into consideration. This is accomplished by incorporating the leaky bucket model into the control loop so that the changes in buffer duration due to natural variation in the instantaneous coding bit rate are not mistaken for changes in buffer duration due to network congestion. It is noted that in the present system and process, it is not the actual fullness of the client buffer that is controlled, but an upper bound on the time of arrival of bits into the client buffer, to a target level. The upper bound is based on the leaky bucket model of the coding bit rate.

[0016] Preventing the client buffer from underflowing, while keeping the average coding bit rate close to the average transmission bit rate of the network, meets two of the aforementioned user expectations. Namely, if the buffer never underflows, it allows for continuous playback. In addition, keeping the average coding bit rate close to the average transmission bit rate of the network means the data is played back with the highest possible quality given the average communication bandwidth available. This leaves the remaining issue of startup delay. This issue is resolved in the present system and process by controlling the size of the client buffer over time. More particularly, the aforementioned client buffer target level is adjusted to start small, and then grow slowly over time. If the buffer is initially small, it allows for shorter startup delay. In addition, as the buffer is eventually allowed to grow large, it enhances the robustness of the system as well as creating high, nearly constant quality. Thus, client buffer management is a key element affecting the performance of streaming media systems.

[0017] More particularly, the present system and process involves a server generating a streaming media data stream that exhibits one of a number of coding bit rates supported by the server. Initially, the server chooses the coding bit rate during a startup period. However, after the startup period, the client provides coding bit rate requests to the server. In response, the server transmits the streaming media data at the most appropriate supported coding bit rate closest to the rate requested by the client. The coding bit rates requested by the client are those estimated to provide a high quality playback of the streaming media data while still keeping a decoder buffer of the client used to receive streaming media data from the server filled to a desired duration level.

[0018] The client computes the coding bit rate that will provide the desired results on an ongoing basis using the aforementioned linear quadratic optimal control technique. This coding bit rate computation involves determining on a frame-by-frame basis a coding bit rate that reduces a difference between an estimated latest anticipated arrival time of the frame under consideration and a prescribed target arrival time, while at the same time reducing the change in the coding bit rate to a prescribed degree. In one embodiment involving the aforementioned leaky bucket model, the coding bit rate computations are based on parameters indicative of the state of the encoder buffer of the server. These parameters are computed by the server and provided to the client along with the streaming media data.

[0019] More particularly, the server first computes a set of parameters defining an initial state of the encoder buffer as it would exist if a data stream corresponding to a supported coding bit rate where streamed therefrom. A separate set of parameters is computed for each of the supported coding bit rates, and are provided to the client in a preamble to the streaming media data. These parameters include the coding bit rate associated with the data stream, the size of the encoder buffer employed with the coding bit rate of the data stream, and a value indicative of the initial encoder buffer fullness exhibited at the coding bit rate of the data stream. It is noted that the size of the encoder buffer employed with each supported coding bit rate varies and is chosen so as to be the minimum size buffer that will still contain the data stream at any point in the streaming process given the coding bit rate and the initial encoder buffer fullness.

[0020] In addition to the initial encoder buffer parameters, the server also computes an upper bound gap for each frame of the streaming media data generated for each coding bit rate supported by the server. This upper bound gap is defined as the number of data bits that the server's encoder buffer can contain over the bits currently contained therein after a just-generated frame is fully input into the buffer. More particularly, the upper bound gap for each frame is computed as the difference between the encoder buffer size and the last computed value for an encoder buffer fullness after insertion of the just-generated frame. The encoder buffer fullness value after insertion of the just-generated frame is computed as the sum of the last computed value of the encoder buffer fullness value prior to insertion of the just-

Webgroup CZ a.s. Ex. 1002, Page 992 of 1406

generated frame and the size of that just-generated frame. The encoder buffer fullness value prior to insertion of the just-generated frame is computed as either zero, or the difference between the value computed for the encoder buffer fullness after the insertion of the frame generated immediately before the just-generated frame and the coding bit rate associated with that prior frame divided by the instantaneous frame rate associated with said prior frame, whichever is larger. The instantaneous frame rate is equal to the reciprocal of, the time the next frame is scheduled to be encoded less the time the just-generated frame was encoded. In one embodiment, the server provides the upper bound gap computed for the first frame of a sequence of frames generated after a change in the coding rate to the client along with an indication of the coding bit rate associated with the sequence of frames as part of the data associated with the first frame of the sequence. In another embodiment, the server provides the gap value with every frame generated.

[0021] The client employs the encoder buffer parameters and the upper bound gap values to determine on a frame-by-frame basis the coding bit rate that will reduce a difference between the estimated latest anticipated arrival time of a frame under consideration and a prescribed target arrival time of that frame, in order to keep the client buffer at approximately the desired duration level. In cases where the upper bound gap is only provided with the first frame after a change in the coding bit rate, the client estimates the upper bound gap for the frames that do not include a gap value. It is also noted that given the aforementioned initial encoder buffer conditions, it is possible for the client to estimate the upper bound gap values for every frame received. Thus, an alternate embodiment where the server is not configured to compute and provide the gap values on an ongoing basis, the client computer can still compute them on its own.

[0022] When a frame with a new average coding bit rate arrives at the client there is a shift in the upper bound gap. This shift can be on the order of seconds and hence, rather than being negligible, can be confusing to the controller. One solution to this is to introduce a simultaneous shift in the control target schedule. To this end, the server also computes a shift value for each frame representing the first frame after a coding bit rate change. This shift value represents the difference between the upper bound gap that would be associated with the frame generated immediately before this first frame had it been encoded at the new coding bit rate and the upper bound gap actually associated with the frame as encoded at the previous coding bit rate. The shift value is provided to the client along with the first frame after a change in the coding bit rate. The client shifts the currently scheduled target arrival time associated with the just received "first" frame by the shift value provided, and the currently scheduled target arrival times for future frames are shifted such that they collectively approach, over a period of time, and eventually coincide with, the previous target arrival times for those frames. In this way the adverse effects of an upper bound gap shift when the coding bit rate is changed are mitigated and the target arrival time values are eventually brought back in line.

[0023] In regard to the target arrival time for each frame, these are chosen so as to make the amount of time between the target time of a frame and its playback time large enough, after the startup period, that network jitter, delays and throughput changes which may cause the actual arrival time of the frame to be after its target arrival time do not result in the frame arriving after its scheduled playback time. During the startup period, the target arrival times are chosen so as to make the target arrival time closer to the playback time to assist in reducing startup delay. In one embodiment this is accomplished by setting the target arrival time for each frame using a logarithmic target schedule. In another embodiment this is accomplished by setting the target arrival time for each frame using a two-piece linear target schedule where the difference between the target arrival time and the playback time for a frame arriving during the startup period increases linearly to a prescribed amount of time that is large enough to account for the network jitter, delays and throughput changes and after which the difference remains substantially constant.

[0024] It is noted that the startup delay can be further minimized by beginning playback of the first frame of the streaming media data when the client's decoder buffer has the minimum amount of data therein that is needed to ensure an underflow condition does not occur at the initial coding bit rate. Still further, the initial coding bit rate can be set to a level that is less than the anticipated arrival rate of the streaming media data at the client since the minimum amount of data needed to ensure an underflow condition does not occur, decreases as the arrival rate increases relative to the coding bit rate. Thus, in the startup period before the client request changes in the coding bit rate, the server provides the streaming media data at the initial coding bit rate. In one embodiment, the initial coding bit rate is set to approximately one-half the anticipated arrival rate, where the anticipated arrival rate is estimated to be the anticipated transmission rate from the server at the current bandwidth available on the network. It is noted that the startup period can be defined as the period of time prior to the first instance of an estimated latest arrival time of a frame under consideration computed for the initial coding bit rate being earlier than a target arrival time for that frame.

[0025] In regard to the client identifying the coding bit rate for each frame that also reduces the change in the coding bit rate to a prescribed degree, it is noted that the prescribed degree can vary depending on whether the coding bit rate increased. If it did increase, then the prescribed degree to which any future change in the coding bit rate is minimized is made greater in comparison to the prescribed degree in cases where the last change in the coding bit rate decreased the rate. Still further, it is also desirable to minimize quality variations due to large or frequent changes to the coding bit rate. In order to stabilize the code bit rate changes, the following actions can be taken. First, in the case where the client identifies a new coding bit rate that represents an increase, a new coding bit rate would be requested from the server only if the new rate does not exceed the current moving average arrival rate of the frames. In another embodiment, the

Webgroup CZ a.s. Ex. 1002, Page 993 of 1406

new coding bit rate representing an increase would only be requested from the server, even if it exceeds the current moving average arrival rate of the frames, if the current client buffer duration exceeds the desired duration level by an amount that it is estimated will not be expended at the higher coding bit rate prior to the passing of a prescribed period of time (e.g., 60 seconds). However, in a case where the client identifies a new coding bit rate that represents a decrease, a new coding bit rate would be requested from the server even if it represents a significant departure from the immediately previous coding bit rate. This is because there is little risk in the client buffer underflowing when the coding rate is decreased.

[0026] In regard to the aforementioned moving average arrival rate of the frames, a new procedure for computing this rate is employed with the present system and process. More particularly, the moving average arrival rate is computed on a packet-by-packet basis, by calculating the product of the moving average arrival rate computed for the immediately preceding packet to a currently received packet and a fractional weighting factor, added to the product of the instantaneous arrival rate of the currently received packet and one minus the fractional weighting factor. In this computation, the fractional weighting factor is not a constant as in the past, but instead is based on the inter-arrival gaps between received packets. More particularly, the fractional weighting factor $\beta(k)$ for a currently received packet k is computed as $\frac{e^{-\alpha[t(k)-t(k-1)]} - e^{-\alpha[t(k)-t(0)]}}{1 - e^{-\alpha[t(k)-t(0)]}}$ where α is the reciprocal of a prescribed time constant, $t(k)$ is the actual arrival time of the current packet, $t(k\text{-}1)$ is the actual arrival time of the packet received immediately prior to the current packet, and $t(0)$ is the arrival time of the first packet of the streaming media data. In this case, the instantaneous arrival rate $r_a(k)$ of the current packet k is computed as $\frac{b(k)}{t_a(k) - t_a(k-1)}$, where $b(k)$ is the size of the current packet. If $b(k)$ is expressed in bits and $t_a(k)$ - $t_a(k$ - 1) is expressed in seconds, then the moving average arrival rate represents the arrival rate of the streaming media data bit bits per second. It is noted that a similar procedure can be employed for any arbitrary units of rate of the streaming media.

[0027] As mentioned previously, the server generates data streams that exhibit one of a number of coding bit rates supported by the server, and transmits data streams at the most appropriate supported coding bit rate closest to the rate requested by the client. The number of available coding bit rates will depend on how the data is encoded. For example, if a fine grain scalable coding scheme is used theoretically there could be a large number of rates available (although for practical reasons the number is more likely to be lower, e.g., 50). However, if a coarse grain scalable coding scheme or a multiple bit rate coding scheme is employed, there could be a more limited number of coding bit rates available from the server. Thus, in some cases an optimum coding bit rate identified by the client may not be available from the server. In addition, even if there is a matching coding bit rate available, the upper bound gap may be such that switching to that rate would risk a client buffer underflow. Given this, the present system and process includes techniques for determining the most appropriate coding bit rate, from the available rates, in view of the optimum coding bit rate identified by the client. It is noted that the available rates could be provided to the client from the server in a preamble to the streaming media data. In such a case, the client itself would perform the analysis and request the resulting supported coding bit rate from the server. However, in an alternate embodiment, the client would request the optimum coding bit rate it identified, and the server would perform the analysis to determine which supported rate is most appropriate. The server would then provide a data stream exhibiting the selected coding bit rate. In either case, the analysis involves finding a supported coding bit rate that is equal to, or if none are equal, the closest smaller rate to, the optimum coding bit rate identified by the client. Whenever the supported coding bit rate found is lower than the coding bit rate associated with the last generated frame of the streaming media data, all future frames (or those beginning with a frame specified by the client) are generated at that supported rate. However, when the supported coding bit rate found is higher than the coding bit rate associated with the last generated frame, it is determined if a difference between the upper bound gap associated with the last generated frame had it been encoded at the supported coding bit rate found and the upper bound gap associated with that frame encoded at the current coding bit rate, is less than or equal to a maximum allowable difference value. If the difference is less than the maximum allowable difference value, the affected future frames are generated at the supported rate found. But, if the difference is not less than the maximum allowable difference value, the next lower supported coding bit rate is found and the foregoing actions are repeated to ultimately identify the appropriate rate.

[0028] The maximum allowable difference value is computed by the client, and if the server is doing the analysis, the client provides the value along with the request for data at the new coding bit rate. The client chooses the maximum allowable difference value such that the latest anticipated arrival time associated with a frame provided by the server immediately prior to a frame under consideration by the client, had it been coded at the requested coding bit rate, is no more than a prescribed fraction of the way from that frame's target arrival time to its playback deadline (e.g., 1/3 of the way).

[0029] In addition to the just described benefits, other advantages of the present invention will become apparent from

Webgroup CZ a.s. Ex. 1002, Page 994 of 1406

the detailed description which follows hereinafter when taken in conjunction with the drawing Fig.s which accompany it.

DESCRIPTION OF THE DRAWINGS

[0030] The specific features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. 1 is a diagram depicting a general purpose computing device constituting an exemplary system for implementing the present invention.

FIG. 2 is block diagram of a simplified streaming media communication pipeline.

FIG. 3 is a graph showing schedules at which bits in the coded bit stream pass points A, B, C and D in the communication pipeline of Fig. 2 in terms of bits vs. media time.

FIG. 4 is a graph showing a buffer tube containing a coding schedule in terms of bits vs. media time.

FIG. 5 is a graph showing an arrival schedule and its upper bound in client time vs. media time, where the upper bound is controlled to a target schedule that is increasingly in advance of the playback deadline to provide greater robustness over time.

FIG. 6 is a graph showing a target arrival schedule design.

FIGS. 7(a)-(b) are graphs showing two different target arrival schedules. Fig. 7(a) shows a logarithmic schedule and Fig. 7(b) shows a two-piece linear schedule.

FIG. 8 is a graph showing buffer tubes for various transmission rates.

FIG. 9 is a graph illustrating exponential averaging.

FIG. 10 is a graph showing buffer tube changes and control target adjustments.

FIGS. 11A-C show a flow chart diagramming an embodiment of the coding bit rate control process according to the present invention.

FIG. 12 is a timeline illustrating the conservative limit used in the conservative coding bit rate up-switching procedure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] In the following description of the preferred embodiments of the present invention, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

I. The Computing Environment

[0032] Before providing a description of the preferred embodiments of the present invention, a brief, general description of a suitable computing environment in which portions of the invention may be implemented will be described. Fig. 1 illustrates an example of a suitable computing system environment 100. The computing system environment 100 is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the invention. Neither should the computing environment 100 be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment 100.

[0033] The invention is operational with numerous other general purpose or special purpose computing system environments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use with the invention include, but are not limited to, personal computers, server computers, hand-held or laptop devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

Webgroup CZ a.s. Ex. 1002, Page 995 of 1406

[0034] The invention may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

[0035] With reference to Fig. 1, an exemplary system for implementing the invention includes a general purpose computing device in the form of a computer 110. Components of computer 110 may include, but are not limited to, a processing unit 120, a system memory 130, and a system bus 121 that couples various system components including the system memory to the processing unit 120. The system bus 121 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus.

[0036] Computer 110 typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer 110 and includes both volatile and nonvolatile media, removable and non-removable media. By way of example, and not limitation, computer readable media may comprise computer storage media and communication media. Computer storage media includes both volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by computer 110. Communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of the any of the above should also be included within the scope of computer readable media.

[0037] The system memory 130 includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) 131 and random access memory (RAM) 132. A basic input/output system 133 (BIOS), containing the basic routines that help to transfer information between elements within computer 110, such as during start-up, is typically stored in ROM 131. RAM 132 typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit 120. By way of example, and not limitation, Fig. 1 illustrates operating system 134, application programs 135, other program modules 136, and program data 137.

[0038] The computer 110 may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, Fig. 1 illustrates a hard disk drive 141 that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive 151 that reads from or writes to a removable, nonvolatile magnetic disk 152, and an optical disk drive 155 that reads from or writes to a removable, nonvolatile optical disk 156 such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive 141 is typically connected to the system bus 121 through a non-removable memory interface such as interface 140, and magnetic disk drive 151 and optical disk drive 155 are typically connected to the system bus 121 by a removable memory interface, such as interface 150.

[0039] The drives and their associated computer storage media discussed above and illustrated in Fig. 1, provide storage of computer readable instructions, data structures, program modules and other data for the computer 110. In Fig. 1, for example, hard disk drive 141 is illustrated as storing operating system 144, application programs 145, other program modules 146, and program data 147. Note that these components can either be the same as or different from operating system 134, application programs 135, other program modules 136, and program data 137. Operating system 144, application programs 145, other program modules 146, and program data 147 are given different numbers here to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer 110 through input devices such as a keyboard 162 and pointing device 161, commonly referred to as a mouse, trackball or touch pad. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 120 through a user input interface 160 that is coupled to the system bus 121, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). A monitor 191 or other type of display device is also connected to the

Webgroup CZ a.s. Ex. 1002, Page 996 of 1406

system bus 121 via an interface, such as a video interface 190. In addition to the monitor, computers may also include other peripheral output devices such as speakers 197 and printer 196, which may be connected through an output peripheral interface 195. A camera 192 (such as a digital/electronic still or video camera, or film/photographic scanner) capable of capturing a sequence of images 193 can also be included as an input device to the personal computer 110. Further, while just one camera is depicted, multiple cameras could be included as input devices to the personal computer 110. The images 193 from the one or more cameras are input into the computer 110 via an appropriate camera interface 194. This interface 194 is connected to the system bus 121, thereby allowing the images to be routed to and stored in the RAM 132, or one of the other data storage devices associated with the computer 110. However, it is noted that image data can be input into the computer 110 from any of the aforementioned computer-readable media as well, without requiring the use of the camera 192.

[0040] The computer 110 may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer 180. The remote computer 180 may be a personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the computer 110, although only a memory storage device 181 has been illustrated in Fig. 1. The logical connections depicted in Fig. 1 include a local area network (LAN) 171 and a wide area network (WAN) 173, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

[0041] When used in a LAN networking environment, the computer 110 is connected to the LAN 171 through a network interface or adapter 170. When used in a WAN networking environment, the computer 110 typically includes a modem 172 or other means for establishing communications over the WAN 173, such as the Internet. The modem 172, which may be internal or external, may be connected to the system bus 121 via the user input interface 160, or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer 110, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, Fig. 1 illustrates remote application programs 185 as residing on memory device 181. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

[0042] The exemplary operating environment having now been discussed, the remaining parts of this description section will be devoted to a description of the program modules embodying the invention.

II. Problem Formulation

A. Temporal Coordinate Systems

[0043] It will pay to distinguish between the temporal coordinate systems, or clocks, used to express time. Herein, *media time* refers to the clock running on the device used to capture and timestamp the original content, while *client time* refers to the clock running on the client used to play back the content. It is assumed that media time is real time (i.e., one second of media time elapses in one second of real time) at the time of media capture, while client time is real time at the time of media playback. The symbol τ is used to express media time and the symbol t to express client time, with subscripts and other arguments to indicate corresponding events. For example, $\tau_d(0),\tau_d(1),\tau_d(2),...$ is used to express the playback deadlines of frames 0,1,2,... in media time, while $t_d(0),t_d(1),t_d(2),..$ is used to express the playback deadlines of frames 0,1,2,... at the client. Content may be played back at a rate v times real time. Thus the conversion from media time to client time can be expressed as

$$t = t_0 + \frac{\tau - \tau_0}{v}, \qquad (1)$$

where t_0 and τ_0 represent the time of a common initial event, such as the playback of frame 0 (or the playback of the first frame after a seek or rebuffering event) in media and client coordinate systems, respectively.

B. Leaky Bucket Model

[0044] For the moment imagine a scenario in which both the encoder 200 and the decoder 202 run in real time over an isochronous communication channel of a network 204. In this case, to match the instantaneous coding bit rate to the instantaneous channel rate, an *encoder buffer* 206 is required between the encoder 200 and the network 204 and a *decoder buffer* 208 is required between the network 204 and the decoder 202 , as illustrated in Fig. 2. A *schedule* is the sequence of times at which successive bits in the coded bit stream pass a given point in the communication pipeline.

Webgroup CZ a.s. Ex. 1002, Page 997 of 1406

The graph in Fig. 3 illustrates the schedules of bits passing the points A, B, C, and D in Fig. 2. Schedule A is the schedule at which captured frames are instantaneously encoded and put into the encoder buffer. This schedule is a staircase in which the nth step rises by $b(n)$ bits at time $\tau(n)$, where $\tau(n)$ is the time at which frame n is encoded, and $b(n)$ is the number of bits in the resulting encoding. Schedules B and C are the schedules at which bits respectively enter and leave the communication channel. The slope of these schedules is R bits per second, where R is the communication rate of the channel. Schedule D is the schedule at which frames are removed from the decoder buffer and instantaneously decoded for presentation. Note that Schedule D is simply a shift of Schedule A. Note also that Schedule B is a lower bound to Schedule A, while Schedule C is an upper bound to Schedule D. Indeed, the gap between Schedules A and B represents, at any point in time, the size in bits of the encoder buffer, while the gap between Schedules C and D likewise represents the size of the decoder buffer. The encoder and decoder buffer sizes are complementary. Thus the coding schedule (either A or D) can be contained within a *buffer tube,* as illustrated in the graph of Fig. 4, having slope R , height B , and initial offset F^d from the top of the tube (or equivalently initial offset $F^e = B - F^d$ from the bottom of the tube). It can be seen that $D = F^d/R$ is the *startup delay* between the time that the first bit arrives at the receiver and the first frame is decoded. Thus it is of interest to minimize F^d for a given R.

[0045] A *leaky bucket* is a metaphor for the encoder buffer. The encoder dumps $b(n)$ bits into the leaky bucket at time $\tau(n)$, and the bits leak out at rate R. In general it is possible for the leak rate R to be high enough so that the bucket occasionally empties. Thus the encoder buffer fullness $F^e(n)$ immediately before frame n is added to the bucket and the encoder buffer fullness $B^e(n)$ immediately after frame n is added to the bucket evolve from an initial encoder buffer fullness $F^e(0) = F^e$ according to the dynamical system

$$B^e(n) = F^e(n) + b(n), \tag{2}$$

$$F^e(n+1) = \max\{0, B^e(n) - R/f(n)\}, \tag{3}$$

where

$$f(n) = \frac{1}{\tau(n+1) - \tau(n)} \tag{4}$$

is the instantaneous frame rate, for n=0,1,2,... If R is sufficiently low, then the bucket will never run dry (underflow), but if R is too low the bucket will eventually overflow. The largest R such that the buffer will never run dry is taken to be the average coding bit rate r_c of the bit stream. This is made more precise in the following two paragraphs.

[0046] A leaky bucket with size B, rate R, and initial fullness F^e is said to *contain* a stream having a schedule characterized by the steps $\{(b(n),\tau(n))\}$ if $B^e(n) \le B$ for all n. The minimum bucket size needed to contain the stream given leak rate R and initial fullness F^e is defined as

$$B^e_{\min}(R, F^e) = \min_n B^e(n), \tag{5}$$

while the corresponding initial decoder buffer fullness is defined as

$$F^d_{\min}(R, F^e) = B^e_{\min}(R, F^e) - F^e. \tag{6}$$

The minimum of each of these over F^e is denoted as

Webgroup CZ a.s. Ex. 1002, Page 998 of 1406

$$B^e_{\min}(R) = \min_{F^e} B^e_{\min}(R, F^e), \tag{7}$$

$$F^d_{\min}(R) = \min_{F^e} F^d_{\min}(R, F^e). \tag{8}$$

It is shown in [10, Proposition 2] that remarkably; these are each minimized by the same value of F^e, which is hence equal to

$$F^e_{\min}(R) = B^e_{\min}(R) - F^d_{\min}(R). \tag{9}$$

Thus the bit stream with schedule $\{(b(n),\tau(n))\}$, for each bit rate R there is a unique leaky bucket that contains the stream and that has the minimum buffer size B as well as the minimum startup delay $D = F^d/R$. These parameters can be computed with the above equations.

[0047] For sufficiently low leak rates R, the leaky bucket does not underflow, when beginning with initial fullness $F^e = F^e_{\min}(R)$. Tthe maximum such rate R may be used as the average coding bit rate r_c of a bit stream with coding schedule $\{(b(n),\tau(n))\}$.

[0048] Leak rates R greater than r_c can also be employed. It is shown in [10] that both $B^e_{\min}(R)$ and $F^d_{\min}(R)$ are decreasing, piecewise linear, and convex in R. Hence if the transmission rate R is greater than the average coding bit rate r_c, the startup delay $D = F^d_{\min}(R)/R$ can be reduced compared to $D = F^d_{\min}(r_c)/R$. This fact will be used in Section IV-A.

[0049] A leaky bucket with leak rate $R=r_c$, size $B = B^e_{\min}(r_c)$ and initial decoder buffer fullness $F^d = F^d_{\min}(r_c)$ thus corresponds to a straight buffer tube bounding the coding schedule as in Fig. 4. Each stream in the media file has a coding schedule; thus each stream corresponds to a straight buffer tube with slope equal to the average coding bit rate r_c of the stream. The size B of the buffer tube and its offset F^e (or F^d) relative to the coding schedule can be either computed by the above formula for a variable bit rate (VBR) stream (such as a constant-quality sub-stream of a scalable stream), or obtained from the size B and initial state F^e of the actual encoder buffer used to encode the stream if it is a constant bit rate (CBR) stream.

[0050] In the following the gap $g(n)$ at frame n between the buffer tube *upper bound* and the coding schedule is considered, as depicted in Fig. 4. Note that the decoder buffer fullness $F^d(n) = B - F^e(n)$ can also be expressed

$$F^d(n) = b(n) + g(n) = g(n-1) + \frac{r_c(n)}{f(n)}, \tag{10}$$

where $r_c(n)$ is the coding bit rate of the buffer tube, now taking into account that different frames may lie in different buffer tubes with different coding bit rates as coding bit rate control is applied and streams are switched.

C. Rate Control Model

[0051] Assume for the moment that bits arrive at the client at a constant rate r_a. Then frame n (having size $b(n)$) arrives at the client $b(n)/r_a$ seconds after frame n-1. Indeed, the index of a bit is proportional to its arrival time. Dividing the vertical scale of the schedules in Fig. 4 by r_a, the schedules are obtained in terms of client time, rather than bits, as shown in the graph of Fig. 5. The coding schedule divided by r_a becomes the *arrival schedule,* which provides for each n the time $t_a(n)$ of arrival of frame n at the client. The buffer tube upper bound (in bits) divided by r_a becomes the buffer tube upper bound (in time), which provides for each n the time $t_b(n)$ by which frame n is guaranteed to arrive. In the

Webgroup CZ a.s. Ex. 1002, Page 999 of 1406

same plot the *playback deadline* is shown, which is the time $t_d(n)$ at which frame n is scheduled to be played (after instantaneous decoding). Thus the gap between a frame's arrival time and its playback deadline is the client buffer duration at the time of the frame arrival. This must be non-negative to allow continuous playback.

[0052] In reality the arrival rate is not constant. If $t_a(n\text{-}1)$ and $t_a(n)$ are the arrival times of frames n and n-1 respectively, then

$$r_a(n) = \frac{b(n)}{t_a(n) - t_a(n-1)} \tag{11}$$

can be defined as the *instantaneous arrival rate* at frame n. In practice the average arrival rate at frame n is estimated by a moving average $\tilde{r}_a(n)$ of previous values of $r_a(n)$, as detailed in Section IV-C. Hence using Eq. (11) the arrival time of frame n can be expressed in terms of the arrival time of frame n-1 as

$$t_a(n) = t_a(n-1) + \frac{b(n)}{r_a(n)} \tag{12}$$

$$= t_a(n-1) + \frac{b(n)}{\tilde{r}_a(n)} + v(n), \tag{13}$$

where the $v(n)$ term is an error term that captures the effect of using the slowly moving average $\tilde{r}_a(n)$. From Eq. (10), however, it can be seen that

$$b(n) = \frac{r_c(n)}{f(n)} + g(n-1) - g(n), \tag{14}$$

whence (substituting Eq. (14) into Eq. (13)) yields

$$t_a(n) = t_a(n-1) + \frac{r_c(n)}{f(n)\tilde{r}_a(n)} + \frac{g(n-1)}{\tilde{r}_a(n)} - \frac{g(n)}{\tilde{r}_a(n)} + v(n). \tag{15}$$

Now defining the buffer tube upper bound (in time) of frame n as

$$t_b(n) = t_a(n) + \frac{g(n)}{\tilde{r}_a(n)}, \tag{16}$$

so that

Webgroup CZ a.s. Ex. 1002, Page 1000 of 1406

$$t_b(n) - t_b(n-1) = t_a(n) - t_a(n-1) + \frac{g(n)}{\tilde{r}_a(n)} - \frac{g(n-1)}{\tilde{r}_a(n-1)}, \quad (17)$$

the following update equation is obtained:

$$t_b(n) = t_b(n-1) + \frac{r_c(n)}{f(n)\tilde{r}_a(n)} + w(n-1), \quad (18)$$

where

$$w(n-1) = \frac{g(n-1)}{\tilde{r}_a(n)} - \frac{g(n-1)}{\tilde{r}_a(n-1)} + v(n). \quad (19)$$

is again an error term that captures variations around a locally constant arrival rate.

[0053] Using Eq. (16), the client can compute $t_b(n\text{-}1)$ from the measured arrival time $t_a(n - 1)$, the estimated arrival rate $\tilde{r}_a(n - 1)$, and $g(n - 1)$ (which can be transmitted to the client along with the data in frame n-1 or computed at the client as described in Section V-E). Then using Eq. (18), the client can control the coding bit rate $r_c(n)$ so that $t_b(n)$ reaches a desired value, assuming the frame rate and arrival rate remain roughly constant. From this perspective, Eq. (18) can be regarded as the state transition equation of a feedback control system and it is thus possible to use a control-theoretic approach to regulate the coding bit rate.

D. Control Objective

[0054] With the state transition equation defined in Eq. (18), uninterrupted playback can be achieved by regulating the coding bit rate so that the client buffer does not underflow. To introduce a margin of safety that increases over time, a *target schedule* is introduced, as illustrated in Fig. 5, whose distance from the playback deadline grows slowly over time. By regulating the coding bit rate, it is attempted to control the buffer tube upper bound so that it tracks the target schedule. If the buffer tube upper bound is close to the target schedule, then the arrival times of all frames will certainly be earlier than their playback deadlines and thus uninterrupted playback will be ensured. Note that controlling the actual arrival times (rather than their upper bounds) to the target would result in an approximately constant number of bits per frame, which would in turn result in very poor quality overall. By taking the leaky bucket model into account, it is possible to establish a control that allows the instantaneous coding bit rate to fluctuate naturally according to the encoding complexity of the content, within previously established bounds for a given average coding bit rate.

[0055] Although controlling the upper bound to the target schedule is our primary goal, it is also desirable to minimize quality variations due to large or frequent changes to the coding bit rate. This can be achieved by introducing into the cost function a penalty for relative coding bit rate differences.

[0056] Letting $t_T(n)$ denote the target for frame n, the following cost function is used to reflect both of concerns:

$$I = \sum_{n=0}^{N} \left((t_b(n) - t_T(n))^2 + \sigma \left(\frac{r_c(n+1) - r_c(n)}{\tilde{r}_a(n)} \right)^2 \right), \quad (20)$$

where the first term penalizes the deviation of the buffer tube upper bound from the target schedule and the second term penalizes the relative coding bit rate difference between successive frames. N is the control window size and σ is a Lagrange multiplier or weighting parameter to balance the two terms.

Webgroup CZ a.s. Ex. 1002, Page 1001 of 1406

III. Optimal Control Solution

[0057] Before presenting the optimal control solution, the design rational of the target schedule will be described.

A. Target Schedule Design

[0058] Fig. 6 is a graph showing an illustrative target schedule. The gap between the playback deadline and the target schedule is the desired client buffer duration (in client time). If the gap is small at the beginning of streaming, then it allows a small startup delay, while if the gap grows slowly over time, it gradually increases the receiver's ability to counter jitter, delays, and throughput changes.

[0059] The slope of the target schedule relates the average coding bit rate to the average arrival rate. Let $t_T(n)$ be the target for frame n. As illustrated in Fig. 6, the slope of the target schedule at frame n is

$$s(n) = \frac{t_T(n+1) - t_T(n)}{\tau(n+1) - \tau(n)}. \qquad (21)$$

If the upper bound $t_b(n)$ aligns perfectly with the target schedule (i.e., $t_b(n) = t_T(n)$) and the arrival rate r_a is constant (i.e., the $w(n\text{-}1)$ term vanishes), from Eq. (18),

$$s(n) = \frac{t_b(n+1) - t_b(n)}{\tau(n+1) - \tau(n)} = \frac{r_c(n)}{r_a}. \qquad (22)$$

Thus initially, when the slope was low, i.e., less than $1/v$, r_a/r_c is greater than v and more than v seconds of content are received per second of client time, causing the client buffer (which is playing out only v seconds of content per second of client time) to grow. Over time, as the slope approaches $1/v$, r_a/r_c approaches v and the buffer remains relatively constant (except for changes due to variations in the instantaneous coding bit rate), since content is received and played back at the same speed v. Next two target schedule functions are presented that illustrate the general design idea.

1) Logarithmic Target Schedule

[0060] One way to choose the target schedule t_T is to have the client buffer duration grow logarithmically over time. Specifically, if t_d is the playback deadline, then for each t_d greater than some start time t_{d0},

$$t_T = t_d - \frac{b}{a}\ln(a(t_d - t_{d0}) + 1). \qquad (23)$$

Since by Eq. (1), $t_d = t_{d0} + (\tau_d - \tau_{d0})/v$ this yields

$$s = \frac{dt_T}{d\tau_d} = \frac{dt_T dt_d}{dt_d d\tau_d} = \frac{1}{v} - \frac{b}{a(\tau_d - \tau_{d0}) + v}, \qquad (24)$$

and hence the initial slope at frame 0 (when $t_d = t_{d0}$) is $s(0) = (1\text{-}b)/v$. Setting b=0.5 implies that initially r_c/r_a=0.5/v, causing the client buffer to grow initially at two times real time. Further setting a=0.15 implies that the client buffer duration will be 7.68 seconds after 1 minute, 15.04 seconds after 10 minutes, and 22.68 seconds after 100 minutes, regardless of v.

Webgroup CZ a.s. Ex. 1002, Page 1002 of 1406

2) Two-piece Linear Target Schedule

[0061] Another way to choose the target schedule t_T is to have the client buffer duration grow linearly at rate b seconds of media time per second of client time until the buffer duration reaches a seconds of media time, after which it remains constant. Specifically, for each t_d greater than some start time t_{d0},

$$t_T = \begin{cases} t_d - b(t_d - t_{d0}) & t_d \le t_{d0} + a/b \\ t_d - a & t_d \ge t_{d0} + a/b \end{cases} \quad (25)$$

The initial slope is again $s(0)=(1-b)/v$. Setting b=0.5 implies that initially r_c/r_a = 05/v , causing the client buffer to grow initially at two times real time. Further setting a = 10 implies that the client buffer duration will reach 10 seconds of media time after 20 seconds of client time, regardless of v.

[0062] Figs. 7(a) and (b) show graphs of the above two target schedules. As one can see, if a client buffer duration of 10 seconds is considered to be a safe level against jitter, delay and network fluctuations, then the two-piece linear target schedule reaches the safe level in 20 seconds, much faster than the logarithmic target schedule. On the other hand, the slope of the two-piece linear target schedule remains lower for longer (hence the coding bit rate and quality are lower for longer) and furthermore experiences an abrupt change at 20 seconds when its slope changes from 0.5/v to 1/v. Consequently, the coding bit rate will not change as smoothly as with the logarithmic target schedule, although it will not be as abrupt as the schedule itself because of the smoothness objective in the controller design.

B. Optimal Controller Design

[0063] Recall from Eq. (18) the fundamental state transition equation, which describes the evolution of the buffer tube upper bound $t_b(n)$ in terms of the coding bit rate $r_c(n)$:

$$t_b(n+1) = t_b(n) + \frac{r_c(n+1)}{f\,\tilde{r}_a} + w(n). \quad (26)$$

Here it is now assumed that the frame rate f and the average arrival rate $\tilde{r}_a$ are relatively constant. Deviations from this assumption are captured by $w(n)$.

[0064] It is desired to control the upper bound by adjusting the coding bit rate. As each frame arrives at the client, a feedback loop can send a message to the server to adjust the coding bit rate. Note, however, that by the time frame n arrives completely at the client, frame n + 1 has already started streaming from the server. Thus the coding bit rate r_c (n + 1) for frame n + 1 must already be determined by time $t_a(n)$. Indeed, at time $t_a(n)$, frame n+2 is the earliest frame for which the controller can determine the coding bit rate. Hence at time $t_a(n)$, the controller's job must be to choose r_c (n + 2). This one-frame delay in the feedback loop must be explicitly accounted for.

[0065] For simplicity, the target schedule is linearized around the time that frame n arrives. The linearization is equivalent to using a line tangent to the original target schedule at a particular point as an approximate target schedule. Thus,

$$t_T(n+1) - 2t_T(n) + t_T(n-1) = 0. \quad (27)$$

Rather than directly control the evolution of the upper bound, which grows without bound, for the purposes of stability an error space formulation is used. Defining the error as

$$e(n) = t_b(n) - t_T(n), \quad (28)$$

Webgroup CZ a.s. Ex. 1002, Page 1003 of 1406

results in

$$e(n+1)-e(n) = (t_b(n+1)-t_T(n+1))-(t_b(n)-t_T(n)) \quad (29)$$

$$= (t_b(n+1)-t_b(n))-(t_T(n+1)-t_T(n)) \quad (30)$$

$$= \frac{r_c(n+1)}{f\tilde{r}_a}-(t_T(n+1)-t_T(n))+w(n), \quad (31)$$

from which in turn

$$\begin{aligned}(e(n+1)-e(n))-(e(n)-e(n-1)) &= [r_c(n+1)-r_c(n)]/f\tilde{r}_a \\ &-(t_T(n+1)-2t_T(n)+t_T(n-1)) \\ &+(w(n)-w(n-1))\end{aligned} \quad (32)$$

$$= \frac{r_c(n+1)-r_c(n)}{f\tilde{r}_a}+(w(n)-w(n-1)) \quad (33)$$

The control input is then defined as

$$u(n) = \frac{r_c(n+2)-\hat{r}_c(n+1)}{\tilde{r}_a}, \quad (34)$$

where $\hat{r}_c(n+1)$ is a possibly quantized version of $r_c(n+1)$ (as defined in Section IV-D) and the disturbance is defined as

$$d(n) = \frac{\hat{r}_c(n)-r_c(n)}{f\tilde{r}_a}+w(n)-w(n-1). \quad (35)$$

Then Eq. (33) can be rewritten

$$e(n+1) = 2e(n)-e(n-1)+\frac{u(n-1)}{f}+d(n). \quad (36)$$

Therefore , defining the error vector

Webgroup CZ a.s. Ex. 1002, Page 1004 of 1406

$$\mathbf{e}(n) = \begin{bmatrix} e(n) \\ e(n-1) \\ u(n-1) \end{bmatrix} = \begin{bmatrix} t_b(n) \\ t_b(n-1) \\ \dfrac{r_c(n+1)}{\tilde{r}_a} \end{bmatrix} - \begin{bmatrix} t_T(n) \\ t_T(n-1) \\ \dfrac{\hat{r}_c(n)}{\tilde{r}_a} \end{bmatrix} \qquad (37)$$

the error space representation of the system can be expressed as

$$\mathbf{e}(n+1) = \begin{bmatrix} 2 & -1 & \dfrac{1}{f} \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \mathbf{e}(n) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(n) + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} d(n), \qquad (38)$$

or $e(n+1) = \Phi e(n) + \Gamma u(n) + \Gamma_d d(n)$ for appropriate matrices Φ, Γ and Γ_d.

[0066] Assuming the disturbance *d(n)* is a pure white noise, and assuming *perfect state measurement* (i.e., all components of *e*(*n*) can be measured without using an estimator), the disturbance *d*(*n*) does *not* affect the controller design. Thus a linear controller represented by

$$u(n) = -G\mathbf{e}(n) \qquad (39)$$

can be used where G is a *feedback gain.* By the time frame *n* is completely received, all elements of **e**(*n*) are available at the client and *u*(*n*) can thus be computed. The ideal coding bit rate for frame *n* + 2 can then be computed as

$$r_c(n+2) = \hat{r}_c(n+1) - G\mathbf{e}(n)\tilde{r}_a. \qquad (40)$$

Finding the optimal linear controller amounts to finding the feedback gain G^* that minimizes the quadratic cost function defined in Section II-D. Before continuing with the design, the system *controllability matrix C*,

$$C = \begin{bmatrix} \Gamma & \Phi\Gamma & \Phi^2\Gamma \end{bmatrix} = \begin{bmatrix} 0 & \dfrac{1}{f} & \dfrac{2}{f} \\ 0 & 0 & \dfrac{1}{f} \\ 1 & 0 & 0 \end{bmatrix} \qquad (41)$$

will be checked first which has full rank for any frame rate *f*. Thus, the system is *completely controllable* and the state e(*n*) can be regulated to any desirable value. Now recall that the cost function defined in Section II-D is

Webgroup CZ a.s. Ex. 1002, Page 1005 of 1406

$$I = \sum_{n=0}^{N} \left\{ (t_b(n) - t_T(n))^2 + \sigma \left(\frac{r_c(n+1) - r_c(n)}{\tilde{r}_a} \right)^2 \right\} \quad (42)$$

$$= \sum_{n=0}^{N} \{ e(n)^T Q e(n) + u(n-1)^T R u(n-1) \}, \quad (43)$$

where $Q = C^T C$ (with C = [1 0 0]) and R = σ. Then, the original control problem of tracking the target schedule while smoothing the coding bit rate fluctuations (i.e., minimizing the cost function *I*) is converted to a standard regulator problem in the error space. Letting $N \to \infty$, the infinite horizon optimal control problem can be solved by applying the results in [11, Section 3.3] to obtain an optimal regulator in two steps: 1) solving, to get S, the *discrete algebraic Riccati equation* (DARE)

$$S = \Phi^T \{ S - S\Gamma[\Gamma^T S\Gamma + R]^{-1} \Gamma S \} \Phi + Q, \quad (44)$$

and 2) computing the optimal feedback gain

$$G^* = [\Gamma^T S\Gamma + R]^{-1} \Gamma^T S\Phi. \quad (45)$$

The existence and uniqueness of S (and in turn of G^*) is guaranteed when *Q* is nonnegative definite and R is positive definite, which is straightforward to verify in this case.

C. Frame Rate

[0067] In the previous section, it was assumed that the frame rate is constant. This assumption is reasonable when streaming a single medium, such as video without audio. Variable frame rate video is usually achieved by skipping frames, which can be accommodated by setting $b(n) = 0$. However, usually video and audio are streamed together, and their merged coding schedule may have no fixed frame rate. Even if there is a fixed frame rate *f*, it may be desirable to operate the controller at a rate lower than *f*, to reduce the feedback rate, for example.

[0068] To address these issues, in practice the notion of a *virtual frame rate* is used. A virtual frame rate *f* is chosen, for example *f* =1 frame per second (fps); media time is partitioned into intervals of size 1/*f*; and all of the (audio and video) frames arriving within each interval are modeled as a *virtual frame* whose decoding and playback deadline is the end of the interval.

[0069] This approach has several advantages. First, it allows offline design of a universal feedback gain, which is independent of the actual frame rate of the stream or streams. Second, it allows the rate of feedback from the client to the server to be reduced. And finally, since the interval between virtual frames is typically safely larger than a round trip time (RTT), a one-frame delay in the error space model (as described in the previous section) is sufficient to model the feedback delay. Otherwise it would be necessary to model the feedback delay with approximately *RTT*/*f* additional state variables to represent the network delay using a shift register of length *RTT*/*f*.

[0070] In the remainder of this description a virtual frame rate *f* = 1 fps is employed, and is referred to simply as the frame rate. Likewise, a virtual frame is referred to simply as a frame.

[0071] It is noted that with the present controller design rationale, the deviation of the buffer tube upper bound from the control target can be reduced by decreasing the σ value. A smaller value of σ value implies a relative larger penalty on the deviation term in the cost function and thus forces the upper bound to track the target more closely. This, however, happens at the cost of sacrificing coding bit rate smoothness, since the corresponding term in the cost function will be weighted less. It has been found with σ = 500 that while the buffer tube upper bound deviates only slightly from the control target, the coding bit rate has undesirable oscillations. On the other hand, a large σ value will certainly yield smoother coding bit rates, but might also incur client buffer underflow since the buffer tube upper bound is allowed to

Webgroup CZ a.s. Ex. 1002, Page 1006 of 1406

deviate significantly away from the control target. Therefore, a good choice of σ should take into account this trade-off. In tested embodiments of the present system and process, σ = 4000 was chosen when the coding bit rate switches up and σ = 2000 when it switches down. Note that a slightly more aggressive strategy is allowed in the latter case to further reduce the chance of client buffer underflow.

IV. Practical Issues with Streaming

A. Fast Startup

[0072] As discussed in previous sections, the startup delay is the length of the period from the time that content first begins to arrive at the client to the time that playback begins. During this period, content accumulates in the receiver buffer to counter packet jitter, retransmission delay, variations in network bandwidth, and variations in instantaneous coding bit rate. It is conceivable that a longer startup delay would increase the chances of being able to maintain continuous playback in a dynamic network environment. On the other hand, users expect the startup delay to be as small as possible. Thus, it is desirable to investigate techniques that can reduce the startup delay while retaining robustness. One possible approach is to transmit the content at a faster than normal rate at the beginning of streaming. This *bursting* technique will certainly build up the buffer duration in a small amount of time. It, however, puts extra pressure on the network by demanding a higher than normal initial bandwidth, which may not even be available.

[0073] The present system and process employs an alternative *fast startup* technique, which takes advantage of the properties of adaptive media. As discussed in previous sections, by choosing an initial coding bit rate r_c equal to half the arrival rate r_a (divided if necessary by the playback speed v), the client buffer duration can grow at two times real time during playback. Growing the client buffer during playback enables the startup delay to be low, because playback can begin while the buffer duration is still low. Beginning playback while the buffer duration is low is not particularly risky over the short term, because the probability of deep congestion occurring in any short interval is low. However, the probability of deep congestion occurring in a long interval is high, so it is important for the buffer duration to be high over the long term. Without the ability to grow the buffer duration during playback, startup would have to be delayed until the buffer duration was sufficiently high to guarantee continuous playback over the long term.

[0074] Moreover, if the transmission rate is twice the coding bit rate, the startup delay can be further reduced by taking advantage of properties of the leaky bucket model [10]. As detailed in Section II-B, the startup delay for a given bit stream is $D = F^d_{\min}(R)/R$ when the stream is transmitted at rate R. This is ordinarily equal to $F^d_{\min}(r_c)/r_c$ when transmitting the stream at its coding bit rate. However, when transmitting the stream at a rate $r_a > r_c$ ($r_c = 0.5r_a/v$), then the startup delay drops to $F^d_{\min}(r_a)/r_a$. Thus the startup delay D decreases both because the numerator decreases and because the denominator increases.

[0075] The graph in Fig. 8 illustrates the decrease in the initial decoder buffer fullness $F^d_{\min}(R)$ as R changes from r_c to r_a. In particular, it depicts the coding schedule for a given bit stream, as well as upper and lower bounds, denoted Tube I and Tube II, corresponding to two leaky buckets with leak rates r_c and r_a respectively, both containing the coding schedule. Tube II is smaller than Tube I, since the minimum size $B_{\min}(R)$ of a leaky bucket containing a given stream is decreasing in the leak rate R [10]. Likewise, the initial decoder buffer fullness $F_{\min}(R)$ is decreasing in R [10]. Hence the playback deadline for frame 0 can begin as early as client time $t_{0\_II} = F^d_{\min}(r_a)/r_a$, instead of $t_{0\_I} = F^d_{\min}(r_c)/r_a$. From there, the playback deadline advances at $1/v$ seconds of client time per second of media time.

B. Controller Initialization

[0076] As illustrated in Fig. 8, the target schedule starts at the same time as the playback deadline and grows according to a predefined function. The controller attempts to control the upper bound of Tube I to the target schedule. Initially the upper bound of Tube I is above the target schedule (and is indeed above the playback deadline, though it is known that this is safe). Hence, when the playback starts, the controller would try to close the gap by decreasing the coding bit rate. This, however, would not be desirable because the current coding bit rate is already lower than the arrival rate to allow the client buffer to grow. Further reduction of the coding bit rate would not be proper. To avoid this effect, the controller is initialized when the upper bound of Tube I exceeds the target schedule i.e., at point B in Fig. 8. Point B can be found analytically, but in practice there is no need to explicitly solve for it. The controller can be initialized as soon as the upper bound of Tube I exceeds the target.

Webgroup CZ a.s. Ex. 1002, Page 1007 of 1406

C. Exponential Averaging of the Arrival Rate

[0077] Using the average arrival rate (instead of the instantaneous arrival rate) helps to reduce coding bit rate oscillations. This section details a new exponential averaging algorithm for the arrival rate.

[0078] Let $\tilde{r}_a(k)$ and $r(k)$ be the average arrival rate and the instantaneous arrival rate, respectively, when packet k is received. Note that unlike the controlling operation, the rate averaging operation may be performed after the arrival of every *packet*, rather than after the arrival of every *frame*. Hence the discrete packet index k is used rather than the frame index n . Instead of using the widely adopted exponentially weighted moving average (EWMA)

$$\tilde{r}_a(k) = \beta(k)\tilde{r}_a(k-1) + (1-\beta(k))r_a(k) \qquad (46)$$

with constant $\beta(k) = \beta$, the exponential averaging is performed more carefully. In the present algorithm, the factor $\beta(k)$ is not constant, but varies according to the packets' inter-arrival gaps. This new algorithm has several advantages over the EWMA algorithm with constant $\beta(k)$. First, the estimate of the average arrival rate $\tilde{r}_a(k)$ goes to zero naturally as the gap since the last packet goes to infinity, rather than being bounded below by $\beta\tilde{r}_a(k\text{-}1)$. Second, the estimate of the average arrival rate $\tilde{r}_a(k)$ does not go to infinity as the gap since the last packet goes to zero. This is especially important, since packets often arrive in bursts, causing extremely high instantaneous arrival rates. And finally, the estimate of the average arrival rate $\tilde{r}_a(k)$ does not over-weight the initial condition, as if it represented the infinite past. This is especially important in the early stages of estimation.

[0079] As in Eq. (11), the instantaneous arrival rate after packet k is defined as

$$r_a(k) = \frac{b(k)}{t_a(k) - t_a(k-1)}, \qquad (47)$$

where here $b(k)$ denotes the size of packet k and $t_a(k)$ denotes the arrival time of packet k. The discrete time function $r_a(k)$ is extended to the piecewise constant continuous time function $r_a(t)$ by

$$r_a(t) = r_a(k) \quad \text{for all } t \in (t_a(k-1), t_a(k)), \qquad (48)$$

as illustrated in the graph in Fig. 9. Then the function $r_a(t)$ is filtered by the exponential impulse response $\alpha e^{-\alpha t}$, $t \geq 0$, for some time constant $1/\alpha$:

$$\tilde{r}_a(k) = \frac{\int_{t(0)}^{t(k)} r_a(t')\alpha e^{-\alpha(t(k)-t')}dt'}{\int_{t(0)}^{t(k)} \alpha e^{-\alpha(t(k)-t')}dt'}. \qquad (49)$$

(Here and in the remainder of this sub-section the subscript is suppressed from the arrival time $t_a(k)$.) Note that $\int_t^{\infty} \alpha e^{-\alpha t'}dt' = e^{-\alpha t}$, the denominator integral can be expressed as $1 - e^{-\alpha(t(k)-t(0))}$. Now, the range of the numerator integral is split into ranges (t(0), t(k-1)] and (t(k-1),t(k)] to obtain a recursive expression for $\tilde{r}_a(k)$ in terms of $\tilde{r}_a(k\text{-}1)$ and $r_a(k)$,

Webgroup CZ a.s. Ex. 1002, Page 1008 of 1406

$$\tilde{r}_a(k) = \frac{1-e^{-\alpha[t(k-1)-t(0)]}}{1-e^{-\alpha[t(k)-t(0)]}} e^{-\alpha[t(k)-t(k-1)]} \tilde{r}_a(k-1) + \frac{1-e^{-\alpha[t(k)-t(k-1)]}}{1-e^{-\alpha[t(k)-t(0)]}} r_a(k) \tag{50}$$

$$= \beta(k)\tilde{r}_a(k-1) + (1-\beta(k))r_a(k), \tag{51}$$

where

$$\beta(k) = \frac{e^{-\alpha[t(k)-t(k-1)]} - e^{-\alpha[t(k)-t(0)]}}{1-e^{-\alpha[t(k)-t(0)]}}. \tag{52}$$

Note that $\beta(k)$ is numerically stable as k goes to infinity. However, as the gap $\delta = t(k) - t(k\text{-}1)$ goes to zero, $1 - \beta(k)$ goes to zero while $r_a(k)$ goes to infinity. Their product, however, is well behaved. Indeed,

$$\tilde{r}_a(k) = \frac{1-e^{-\alpha[t(k-1)-t(0)]}}{1-e^{-\alpha[\delta+t(k-1)-t(0)]}} e^{-\alpha\delta} \tilde{r}_a(k-1) + \frac{1-e^{-\alpha\delta}}{1-e^{-\alpha[t(k)-t(0)]}} \frac{b(k)}{\delta} \tag{53}$$

$$\rightarrow \tilde{r}_a(k-1) + \frac{\alpha b(k)}{1-e^{-\alpha[t(k)-t(0)]}} \tag{54}$$

as $\delta \rightarrow 0$, using l'Hôpital's rule. Thus Eq. (54) is the update rule in the case when $t(k) = t(k\text{-}1)$.

D. Choosing a Stream Given a Coding bit rate

[0080] When the client requests a coding bit rate $r_c(n)$, the server complies by choosing a stream (or sub-stream of a scalable stream) having coding bit rate $\hat{r}_c(n)$ approximately equal to $r_c(n)$. There are several reasons that $\hat{r}_c(n)$ may differ from $r_c(n)$. The first reason is that there are only a finite number of streams (or sub-streams) in the media file, even if fine grain scalable coding is used. Thus there may be no stream in the media file with average coding bit rate exactly equal to $r_c(n)$. The second reason is that, even if there is a stream in the media file with average coding bit rate exactly equal to $r_c(n)$, the buffer tube for the stream may be too large to allow switching to the stream without risk of client buffer underflow. In fact, whenever the stream switches, there is generally a discontinuity in the upper bound, which may be either positive or negative. A positive shift in the upper bound is illustrated in the graph in Fig. 10, which, if large, could cause the client buffer to underflow either immediately or eventually.

[0081] Thus the server must choose a stream that causes the upper bound to shift up no more than some amount $\Delta^{max}g(n\text{-}1)$ supplied to it by the client. The client supplies $\Delta^{max}g(n\text{-}1)$ to the server in its feedback along with $r_c(n)$, shortly after client time $t_a(n\text{-}2)$ (after frame n-1 has already begun streaming). Upon receiving the feedback, the server selects a stream with coding bit rate $\hat{r}_c(n)$ as high as possible such that $\hat{r}_c(n) \le r_c(n)$ and, if $\hat{r}_c(n) > \hat{r}_c(n\text{-}1)$ (i.e., if it is a switch up in rate), then $g^{new}(n\text{-}1) - g^{old}(n\text{-}1) \le \Delta^{max}g(n\text{-}1)$, where $g^{new}(n\text{-}1)$ and $g^{old}(n\text{-}1)$ are illustrated in Fig. 10. The constraint given by $\Delta^{max}g(n\text{-}1)$ is not applied if it is a switch down in rate.

[0082] The client chooses $\Delta^{max}g(n - 1)$ to limit (its prediction of) what the upper bound would be at time $t_a(n - 1)$ if the new coding bit rate were in effect, namely,

Webgroup CZ a.s. Ex. 1002, Page 1009 of 1406

$$t_b^{new}(n-1) \approx \frac{t_b(n-2)+\hat{r}_c(n-1)}{f\tilde{r}_a}+\frac{\Delta g(n-1)}{\tilde{r}_a} \qquad (55)$$

$$\leq t_T(n-1)+p[t_d(n-1)-t_T(n-1)]. \qquad (56)$$

That is, the client chooses $\Delta^{max}g(n\text{-}1)$ to limit $t_b^{new}(n-1)$ so that it would be no more than fraction p of the way from the target $t_T(n\text{-}1)$ to the playback deadline $t_d(n\text{-}1)$. In tested embodiments of the present system and process, p=1/3 was chosen.

[0083] It is noted that in an alternate embodiment, the information as to what coding bit rates the server supports can be provided to the client ahead of time and the client can be responsible for performing the foregoing analysis. In this case, the client would only request coding bit rates that are supported by the server, and there would be no need to provide the $\Delta^{max}g(n\text{-}1)$ to the server with the request.

E. Control Target Adjustment

[0084] When a frame with a new average coding bit rate $\hat{r}_c(n)$ arrives at the client at time $t_a(n)$, there is a shift in the upper bound. This shift can be on the order of seconds and hence, rather than being negligible, can be confusing to the controller. If the shift is upward, for example, the controller will immediately try to reduce the coding bit rate $r_c(n+2)$. If the shift is downward, on the other hand, the controller will immediately try to increase the coding bit rate $r_c(n+2)$. Either way is probably not good; the intention is that $\hat{r}_c(n)$ will be maintained unless there is a disturbance in the arrival rate. One solution is to introduce a simultaneous shift in the control target schedule equal to $\Delta g(n-1)/\tilde{r}_a$; where $\Delta g(n-1) = g^{new}(n-1) - g^{old}(n\text{-}1)$ is the actual shift in the upper bound (in bits) at frame n-1 computed at the server, as illustrated in Fig. 10. The server can send this value to the client along with frame n. If there is no stream change, this value is simply zero.

[0085] If the control target schedule is adjusted whenever the coding bit rate changes, it will no longer follow the designed target schedule. The adjusted target schedule will be referred to as the *control target* schedule to distinguish it from the *designed target* schedule (or simply the *target schedule).*

[0086] The control target schedule, of course, should have a tendency to approach the designed target schedule. The basic idea is to decrease the slope of the control target schedule when it is above the designed target schedule and to increase the slope when it is below.

[0087] For the logarithmic target schedule $t_T = t_d - \frac{b}{a}\ln(at_d+1)$ (where $t_d = t_{d0} + (\tau_d - \tau_{d0})/v$), according to Eq. (24) the slope at media time τ_d is

$$s = \frac{dt_T}{d\tau_d} = \frac{1}{v} - \frac{b}{a(\tau_d-\tau_{d0})+v}. \qquad (57)$$

If d is defined as the distance between the playback deadline and the target schedule, namely

$$d = \frac{b}{a}\ln\left(a\left(\frac{\tau_d-\tau_{d0}}{v}\right)+1\right), \qquad (58)$$

then the slope may be expressed as a function of d

Webgroup CZ a.s. Ex. 1002, Page 1010 of 1406

$$s = \frac{1}{\nu} - \frac{b}{\nu e^{(a/b)d}}. \qquad (59)$$

Hence whenever d is the distance between the playback deadline and the control target, the slope of the control target is set to s in Eq. (59). Specifically, if $t_T^{\wedge}(n)$ is the control target at frame n after the shift, then $t_T^{\wedge}(n\text{-}1)$ is reset to be $t_T^{\wedge}(n)\text{-}s/f$. Then $t_T^{\wedge}(n)$ and $t_T^{\wedge}(n\text{-}1)$ is used in place of $t_T(n)$ and $t_T(n\text{-}1)$ to compute the error vector $e(n)$ in Eq. (37). The resulting error vector is then used to compute the ideal coding bit rate in Eq. (40).

[0088] For the two-piece linear target schedule, the slope is easy to compute by using a predefined time period over which the control target schedule is expected to return to the target schedule. The slope of the control target schedule can then be computed from the distance d and the period. In tested embodiments of the present system and process the period was set to 50 seconds.

V. Implementation Details

[0089] This section highlights implementation details on both the sender and the receiver side.

A. Generation of Virtual Streams

[0090] In tested embodiments of the present a system and process, a fine grained scalable (FGS) stream comprises a set of data units, each tagged by a Lagrange multiplier λ representing the per-bit decrease in distortion if the data unit is received by the client. If the λ for the data unit is above a threshold, then the data unit is included in a virtual stream corresponding to that threshold. Each threshold corresponds to an overall number of bits and hence an average coding bit rate for the virtual stream. In tested embodiments, $N = 50$ virtual streams are generated. A threshold is chosen for each stream such that the resulting streams have coding bit rates that are uniformly spaced in the log domain between lower and upper bounds.

[0091] During streaming, when the server reads a data unit from the media file, it includes the data unit in the virtual stream currently being transmitted if its Lagrange multiplier λ is above the threshold for the stream.

B. Leaky Bucket Computations at the Sender

[0092] For each virtual stream, leaky bucket parameters $(R, B_{\min}(R), F_{\min}^{d}(R))$ are pre-computed offline for $R = R_{avg}$ and $R = R_{\max}$, where $R_{avg} = r_c$ is the average coding bit rate of the stream, and $R_{max} = 2r_c$. These leaky bucket parameters are sent to the client in a preamble.

[0093] In addition, during streaming the server performs on-line leaky bucket simulations for each stream. Specifically, whenever the server reads a data unit from the media file, it determines the virtual streams to which the data unit belongs, using the Lagrange multiplier of the data unit and the list of thresholds for each stream. The sender then updates, for the determined streams, the states of those leaky buckets having leak rates equal to an average coding bit rate R_{avg}, using Eqs. (2) and (3). Once all the data units in a frame are read from the media file, the sender computes $g(n) = B_{\min}(R_{avg}) - B^{e}(n)$ for each of the virtual streams. On a stream switch (i.e., $\hat{r}_c(n) \neq \hat{r}_c(n-1)$), the gap $g^{new}(n)$ for the new stream is transmitted to the client along with $\Delta g(n\text{-}1)=g^{new}(n\text{-}1)\text{-}g^{old}(n\text{-}1)$ as described below. It is easy to see that the cost of updating the leaky bucket states is quite low. However, it is also possible to pre-compute these values and store them with each data unit in the media file.

C. Initial Coding bit rate Selection

[0094] At the beginning of a streaming session, the sender needs to have some knowledge of the available network bandwidth so that it can choose an initial coding bit rate (usually half of the bandwidth). The bandwidth estimate can be drawn from proactive measurements, using approaches such as packet pair [12], path chirp [3], etc., or reactive approximations based on history values. The exact form of the initial bandwidth estimation is beyond the scope of this work.

D. Coding bit rate Switching

[0095] The rate control feedback from the client contains the frame number at which feedback is generated (s.g., n -

Webgroup CZ a.s. Ex. 1002, Page 1011 of 1406

2 in the previous section) and the maximum allowable shift of the upper bound in bits (e.g., $\Delta^{max}g(n\text{-}1)$ in the previous section). If the sender finds a suitable coding bit rate and makes a switch at frame n, it will transmit three values to the client along with the frame: the new coding bit rate $\hat{r}_c^{new}(n)$, the current gap to the upper bound $g^{new}(n)$, and the shift $\Delta g(n\text{-}1) = g^{new}(n\text{-}1)\text{-}g^{old}(n\text{-}1)$. With this information, the client can properly adjust its control target schedule as well as its upper bound. Note that coding bit rate switching always happens at the beginning of a new frame, never inside a frame.

E. Optimal Rate Control at the Client

[0096] Whenever a new coding bit rate starts, the client receives the value $g(n)$ along with the new frame. The values of $g(n)$ for successive frames can be then inferred by the client itself based on the coding bit rate $\hat{r}_c(n)$ and the frame size $b(n)$. The client records the arrival frame time $t_a(n)$, calculates the buffer tube upper bound $t_b(n)$ and then computes the deviation $e(n)$. If there is a coding bit rate switch, it will also compute the buffer tube shift and adjust the control target schedule accordingly. Then, $e(n)$ is fed to the optimal rate controller, which outputs a desired new coding bit rate. The latest new coding bit rate is fed back to the sender whenever there is a feedback opportunity, which could be generated at regular intervals or on-demand.

F. Exemplary Process

[0097] An exemplary process for the implementation of the foregoing system will now be provided as applicable to one embodiment of the present invention.

[0098] Referring to Figs. 11A-C, the server first computes a set of parameters defining an initial state of the encoder buffer as it would exist if a data stream corresponding to a supported coding bit rate were streamed therefrom, for each of the supported coding bit rates (process action 1100). These parameters, which include the coding bit rate associated with the data stream, the size of the encoder buffer employed with the coding bit rate of the data stream, and a value indicative of the initial encoder buffer fullness exhibited at the coding bit rate of the data stream, are provided to the client in a preamble to the streaming media data (process action 1102). The server then streams the media data to the client at a prescribed initial coding bit rate, during a startup period (process action 1104). As the data is streamed, the server computes the upper bound gap for each frame generated for each coding bit rate supported by the server (process action 1106). Initially, the client employs the encoder buffer parameters to determine on a frame-by-frame basis a new, optimal coding bit rate for a future frame (process action 1108). In addition, the client computes the aforementioned maximum allowable difference value for the frame generated by the server just prior to the future frame, i.e., the maximum shift value (process action 1110). The client also begins playback of the frames it has received as soon as the client's decoder buffer has the minimum amount of data therein that is needed to ensure an underflow condition does not occur at the initial coding bit rate and continues to playback each frame received thereafter (process action 1112). In addition, once the aforementioned startup period is over, the client requests that the streaming media data be supplied at a new coding bit rate corresponding to the determined optimal coding rate, starting at the future frame, and provides the maximum shift value along with the request (process action 1114).

[0099] The server finds a supported coding bit rate that is equal to, or if none are equal, the closest smaller rate to, the optimum coding bit rate requested by the client (process action 1116). It is next determined by the server if the supported coding bit rate found is lower or higher than the coding bit rate associated with the frame generated immediately prior to the frame specified in the client request (process action 1118). If it is lower, then server computes the aforementioned shift value for the frame generated immediately prior to the frame specified in the client request (process action 1120), and generates all future frames beginning with the frame specified by the client at the supported rate found and streams them to the client, along with the computed upper bound gap and shift value, and an indication of the new coding bit rate (process action 1122). However, if the supported coding bit rate found is higher, then server computes the shift value for the frame generated immediately prior to the frame specified in the client request (process action 1124) and then determines if the shift value is less than or equal to the maximum shift value provided in the client request (process action 1126). If the shift value is less than or equal to the maximum shift value, then the server generates all future frames beginning with the frame specified by the client at the supported coding bit rate found and streams them to the client, along with the computed upper bound gap and shift value, and an indication of the new coding bit rate (process action 1122). But, if the shift value is greater than the maximum shift value, then the next lower supported coding bit rate is found (process action 1128) and the process actions 1118 through 1128 are repeated.

[0100] The client shifts the currently scheduled target arrival time associated with a just received first frame at the new coding bit rate by the shift value provided, and shifts the currently scheduled target arrival times for future frames such that they collectively approach, over a period of time, and eventually coincide with, the previous target arrival times for those frames (process action 1130). The client then employs the encoder buffer parameters and the upper bound gap value provided by the server to determine a new, optimal coding bit rate for a future frame and to compute the

Webgroup CZ a.s. Ex. 1002, Page 1012 of 1406

maximum shift value for the frame generated by the server just prior to the future frame (process action 1132). The client requests that the streaming media data be supplied at a new coding bit rate corresponding to the determined optimal coding rate starting at the future frame specified by the client, and includes the computed maximum shift value (process action 1134). Process actions 1116 through 1134 are then repeated for the duration of the streaming media data transmission.

VI. Multiple Bit Rate Streaming

[0101] Multiple bit rate (MBR) streaming is a network adaptive technique that is widely used in commercial streaming media systems. In MBR streaming, in contrast to scalable streaming, the content is encoded into several (typically 5-7) independent streams at different coding bit rates. Often, each stream is optimized for a common type of network connection (e.g., dial-up, DSL, cable). During an MBR streaming session, the proper coding bit rate is dynamically selected based on the available network bandwidth, with the goal of achieving the maximum possible quality under the condition of uninterrupted playback. It is easy to see that MBR streaming is analogous to scalable streaming. Indeed MBR streaming can be viewed as a special case of scalable streaming with a limited number of coding bit rates available. Hence, the foregoing optimal control approach should be applicable to this case.

[0102] There are, however, several differences that complicate MBR streaming, which need to be carefully addressed. First, as just mentioned, in MBR streaming there are only a limited number of coding bit rates available. This coarse quantization of the desired coding bit rate introduces a significant nonlinearity into the closed loop system. In fact, the large gaps between the available coding bit rates introduce oscillations. For example, if two neighboring coding bit rates straddle a constant arrival rate, the controller will oscillate between the two coding bit rates in an attempt to keep the client buffer at a target level.

[0103] Second, in MBR streaming the coding bit rate cannot be switched at an arbitrary time. In fact, before the server can switch to a new stream, it may have to wait for the next clean point (e.g., I frame) in the new stream, which could be five or ten seconds away. Thus, the old coding bit rate may continue for quite a while before it changes to the new coding bit rate. From the controller's perspective, this long random extra delay tends to destabilize the closed-loop system.

[0104] Third and finally, in MBR streaming, server performance issues are critical. The commercial-grade streaming media systems that use MBR streaming do so because of the minimal computational load that it imposes on the server compared to scalable streaming. Thus, for MBR streaming it is important to keep almost all computation and state maintenance on the client side. In particular, the server will not be able to update the leaky bucket information for each stream. Instead, the client must use some mechanism for estimating and maintaining this information.

A. Conservative Up-Switching

[0105] In this subsection, a technique to help stabilize the control system and reduce steady state oscillations to a period of at least a minute is described. With this technique, rapid down-switching is permitted. In fact, the value of σ is reduced from 2000 to 500, changing the balance between responsiveness and smoothness of the coding bit rate in favor of rapid switching response. However, only conservative up-switching is permitted. Conservative up-switching ensures that spurious changes in coding bit rate do not occur, and that oscillations in the coding bit rate have a low frequency. In particular, conservative up-switching reduces the oscillations between two adjacent but widely spaced MBR coding bit rates, one above the arrival rate and one below the arrival rate.

[0106] In one embodiment, conservative up-switching establishes a conservative limit that limits the coding bit rate to no more than the arrival rate. However, in another embodiment, the method behind conservative up-switching is to establish a conservative limit on how high the coding bit rate can be raised above the arrival rate. If the current coding bit rate is below the arrival rate, and the client buffer duration begins to increase above its target level, then the coding bit rate can be switched up to a new coding bit rate above the arrival rate only if the new coding bit rate is below the conservative limit. When the client buffer duration begins at the target level, the conservative limit is equal to the arrival rate. However, as the client buffer duration increases, the conservative limit increases as well. Thus, if the current coding bit rate is below the arrival rate, and the next higher coding bit rate is above the arrival rate, then it will be possible to switch up to the next higher coding bit rate only after the client buffer duration has increased sufficiently so that the conservative limit rises above the higher coding bit rate. Once the coding bit rate is switched up to the higher coding bit rate, the client buffer begins to drain since the coding bit rate is then above the arrival rate. Eventually, when the buffer drains back below its target level, the controller will rapidly switch the coding bit rate back down to the coding bit rate below the arrival rate.

[0107] Given the current client buffer duration, the conservative limit is set to a value such that if the coding bit rate is switched up to a new coding bit rate at this value, the client buffer would take at least Δt seconds of client time to drain back to the target level. Thus, the mechanism ensures that the period of oscillation will be at least Δt seconds. In tested embodiments of the present system and process, Δt is set to 60 seconds.

Webgroup CZ a.s. Ex. 1002, Page 1013 of 1406

[0108] Fig. 12 shows how the conservative limit is computed. Let $\Delta\tau_1$ be the client buffer duration (in media time) at the moment that the coding bit rate is switched up from r_c^{old} to r_c^{new}. Thus $\Delta\tau_1$ is the number of seconds of content that will be consumed at the old coding bit rate r_c^{old} before content at the new coding bit rate begins to be consumed. (For simplicity it is assumed that all of the content in the client buffer at the time of the switch is coded at rate r_c^{old}.) Let $\Delta\tau_2$ be the number of seconds of content that is consumed at the new coding bit rate r_c^{new} before the client buffer duration drops to some level $\Delta\tau_3$ seconds (in media time), greater than the target level $\Delta\tau_T$. The duration of this phase is determined such that the total time since the switch is exactly $\Delta t = (\Delta\tau_1 + \Delta\tau_2)/v$ seconds (in client time). Now, the number of bits that arrive in this time is $r_a\Delta t = r_c^{new}(\Delta\tau_2 + \Delta\tau_3) \geq r_c^{new}(\Delta\tau_2 + \Delta\tau_T) = r_c^{new}(v\Delta t - \Delta\tau_1 + \Delta\tau_T)$, or

$$r_c^{new} \leq \frac{r_a \Delta t}{v\Delta t - \Delta\tau_1 + v\Delta t_T}, \tag{60}$$

where Δt_T is the target buffer duration in client time. The parameter Δt can be tuned to yield the desired behavior. A large Δt means that up-switching will be more conservative, while a smaller Δt means that up-switching will be more prompt. In tested embodiments, Δt is set to 60 seconds while the target Δt_T is typically about 10 seconds.

B. Buffer Tube Upper Bound Estimation

[0109] In Section V-D it was specified that the server sends three values to the client at the beginning of each change in coding bit rate: the new coding bit rate $\hat{r}_c^{new}$, the current gap to the upper bound $g^{new}(n)$, and the control target shift $\Delta g(n - 1) = g^{new}(n-1) - g^{old}(n-1)$. The server computes the latter two values by running a leaky bucket simulator for each coding bit rate. The client continues to update $g(n)$ for the new coding bit rate by running its own leaky bucket simulator for the new coding bit rate. That is, beginning with the initial condition $F^e(n) = B - b(n) - g^{new}(n)$, for each successive frame the client computes

$$B^e(n) = F^e(n) + b(n) \tag{61}$$

$$F^e(n+1) = \max\{0, B^e(n) - \hat{r}_c/f(n)\}, \tag{62}$$

where

$$f(n) = \frac{1}{\tau(n+1) - \tau(n)} \tag{63}$$

is the instantaneous frame rate, as in Eqs. (2), (3) and (4). From this, the client can compute

$$g(n) = B - B^e(n) \tag{64}$$

for each frame.

Webgroup CZ a.s. Ex. 1002, Page 1014 of 1406

[0110] However, if the server is unable to simulate the leaky buckets and cannot send $g^{new}(n)$ to the client, then the client must estimate this information for itself. In this case it is recommended that the client estimates $g^{new}(n)$ as an upper bound such as $\hat{g}^{new}(n)=B-b(n)\geq g^{new}(n)$. Then, beginning with initial condition $\hat{F}^{e}(n)=B-b(n)-g^{new}(n)$ (which equals 0 in this case), for each successive frame the client computes

$$\hat{B}^{e}(n) = \hat{F}^{e}(n) + b(n) \tag{65}$$

$$\hat{F}^{e}(n+1) = \max\{0, \hat{B}^{e}(n) - \hat{r}_c/f(n)\}, \tag{66}$$

as well as

$$\hat{g}(n) = B - \hat{B}^{e}(n). \tag{67}$$

It is easy to see by induction that $\hat{F}^{e}(n) \leq F^{e}(n)$, $\hat{B}^{e}(n) \leq B^{e}(n)$, and $\hat{g}(n) \geq g(n)$. Moreover, these bounds each become tighter by $\delta(n) = \hat{r}_c/f(n) - B^{e}(n)$ whenever $\delta(n) > 0$, i.e., whenever $F^{e}(n+1)$ is clipped to 0 in Eq. (66). In fact, given enough time they may eventually become tight.

[0111] Note that whenever the bounds tighten by $\delta(n) > 0$, the control target must be shifted by $\Delta g(n)/\tilde{r}_a$, where $\Delta g(n) = -\delta(n)$. Furthermore, whenever n is the first frame of a new coding bit rate, the control target should be shifted by $\Delta g(n)/\tilde{r}_a$, where $\Delta g(n) = \hat{g}^{new}(n)-\hat{g}^{old}(n)$. Here, $\hat{g}^{old}(n)$ can be determined by running Eqs. (65), (66) and (67) for one extra step, namely if n is the first frame of the new coding bit rate,

$$\hat{F}^{e}(n) = \max\{0, \hat{B}^{e}(n-1) - \hat{r}_c^{old}/f(n-1)\} \tag{68}$$

$$\hat{B}^{e}(n) = \hat{F}^{e}(n) + b(n) \tag{69}$$

$$\hat{g}^{old}(n) = B - \hat{B}^{e}(n). \tag{70}$$

It is easy to see that if $\hat{g}^{new}(n) = B - b(n)$, then $\Delta g(n)=\hat{F}^{e}(n)$ as computed in Eq. (68).

VII. Sender-Driven Streaming

[0112] The preceding discussions have assumed that the control process for adapting the stream or its bit rate to the prevailing conditions is located within the client. This is called *receiver-driven* streaming because the client (i.e., the receiver) makes the decisions and informs the server (i.e., the sender). However, it should be clear that sender-driven streaming is also possible, in which the control process operates at the sending side. For example, using TCP for transmission of the streaming media data, the control process can operate at the server, measuring the transmission times of each frame and estimating the transmission rate, instead of the control process operating at the client, measuring the arrival times of each frame and estimating the arrival rate. Using TCP, the transmission time of a frame is substantially the same as its arrival time, and likewise the transmission rate is substantially the same as its arrival rate; hence these can be used interchangeably. Generally, the transmission time or the arrival time of a packet may be called a time stamp. In sender-driven streaming, the server can infer the state of the client buffer by knowing what it has already transmitted and by knowing the playout times for the transmitted frames. Sender-driven streaming reduces the overhead of communicating control information between the client and the server, but it also increases the computational burden on the server. In some situations, this may be a desirable trade-off. Those skilled in the art will appreciate that it is possible to appropriately modify the protocols described herein to cases where the control algorithm resides in the server or in

Webgroup CZ a.s. Ex. 1002, Page 1015 of 1406

another location, rather than in the client.

VIII. References

[0113]

[1] G.J. Conklin, G.S. Greenbaum, K.O. Lillevold, A.F. Lippman, and Y.A. Reznik. Video coding for streaming media delivery on the Internet. *IEEE Trans. Circuits and Systems for Video Technology,* 11 (3):269-281, March 2001. special issue on Streaming Video.

[2] T. Wiegand and G. Sullivan. Joint video specification rec. h.264 & 14496-10 avc. Non-Final Draft of Final Draft International Standard (FDIS) JVT-G050, ITU-T & ISO/IEC, Pattaya, Thailand, March 2003.

[3] V. J. Ribeiro, R. H. Riedi, J. Navratil, L. Cottrell, and R. G. Baraniuk. pathchirp: efficient available bandwidth estimation for network paths. In *Proc. Passive and Active Measurement Workshop (PAM),* La Jolla, CA, April 2003.

[4] R. Rejaie, M. Handley, and D. Estrin. Layered quality adap-tation for Internet streaming video. *IEEE J. Selected Areas in Communications,* 18(12):2530-2543, December 2000.

[5] Q. Zhang, Y.-Q. Zhang, and W. Zhu. Resource allocation for multimedia streaming over the Internet. *IEEE Trans. Multimedia*, 3(3):339-355, September 2001.

[6] B.-J. Kim, Z. Xiong, and W. A. Pearlman. Low bit-rate scalable video coding with 3D set partitioning in hierarchical trees (3-D SPIHT). *IEEE Trans. Circuits and Systems for Video Technology,* 10(8):1374-1387, December 2000.

[7] F. Wu, S. Li, and Y.-Q. Zhang. A framework for efficient progressive fine granularity scalable video coding. *IEEE Trans. Circuits and Systems for Video Technology,* 11(3):301-317, March 2001.

[8] J. Li. Embedded audio coding (eac) with implicit psychoacoustic masking. In *Proc. Int'l Conf. Multimedia,* pages 592-601, Nice, France, December 2002. ACM.

[9] P. de Cuetos and K. W. Ross. Adaptive rate control for streaming stored fine-grained scalable video. In *Proc. Int'l Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDA V)*, Miami Beach, FL, May 2002.

[10] J. Ribas-Corbera, P. A. Chou, and S. Regunathan. A generalized hypothetical reference decoder for H.264/AVC. *IEEE Trans. Circuits and Systems for Video Technology*, 13(7), July 2003.

[11] B. D. O. Anderson and J. B. Moore. *Optimal Control: Linear Quadratic Methods.* Prentice Hall, 1990.

[12] S. Keshav. Packet-pair flow control. http://www.cs.cornell.edu/-skeshav/papers.html.

[13] P. A. Chou and Z. Miao, "Rate-distortion optimized streaming of packetized media," *Microsoft Research Technical Report MSR-TR-2001-35*, February 2001

Claims

1. A computer-implemented process for controlling a coding bit rate of streaming media data being transmitted to a client from a server over a computer network, comprising performing the following process actions:

   employing a linear quadratic control technique to establish, on an ongoing basis, a current coding bit rate for the streaming media data, which is estimated to provide a high quality playback of the streaming media data while still keeping a decoder buffer of the client used to receive streaming media data from the server filled to a desired duration level so as to reduce the chance of an underflow condition which would result in an interruption of the playback of the streaming media data by the client;
   using each coding bit rate established to control said rate for the streaming media data.

Webgroup CZ a.s. Ex. 1002, Page 1016 of 1406

2. The process of Claim 1, wherein the process action of establishing the current coding bit rate comprises the actions of:

determining on a frame-by-frame basis the coding bit rate which is estimated to keep the client buffer level approximately at the desired target level; and
establishing a new coding bit rate only when it is determined the coding bit rate estimate will not change in relation to the last established rate by more than a desired degree.

3. The process of Claim 2, wherein the client buffer level is determined by a leaky bucket model of the streaming media data at the estimated coding bit rate.

4. The process of Claim 3, wherein the process action of determining on a frame-by-frame basis the coding bit rate which is estimated will keep the client buffer approximately at the desired level, comprises an action of identifying a coding bit rate that reduces a difference between an estimated latest anticipated arrival time of the frame under consideration and a prescribed target arrival time.

5. The process of Claim 4, wherein the process action of determining on a frame-by-frame basis the coding bit rate which is estimated will keep the client buffer approximately at the desired level, comprises an action of reducing the change in the coding bit rate to a prescribed degree, using a quadratic cost function.

6. The process of Claim 5, wherein the process action of estimating the latest anticipated arrival time of the frame under consideration, comprises the actions of:

re-estimating the latest anticipated arrival time associated with the frame immediately preceding the frame under consideration if it were to exhibit the current coding bit rate; and
adding said re-estimated time to the current coding bit rate divided by the product of a current instantaneous frame rate and an estimated arrival rate of the frames.

7. The process of Claim 6, wherein the process action of re-estimating the latest anticipated arrival time associated with the frame immediately preceding the frame under consideration comprises adding the actual arrival time of said immediately preceding frame as measured by the client, to an upper bound gap of an encoder buffer of the server for the immediately preceding frame divided by the estimated arrival rate associated with said immediately preceding frame, wherein the upper bound gap of a frame is defined as the number of data bits that the server's encoder buffer can contain over the bits currently contained therein after the frame is fully input into the encoder buffer.

8. The process of Claim 7, wherein the process action of establishing the current coding bit rate is accomplished by the client, and wherein the client estimates the latest anticipated arrival time of the frame under consideration based on information received from the server concerning the state of the encoder buffer.

9. The process of Claim 8, wherein the information received from the server comprises the current coding bit rate of the streaming media data being received by the client which is received as part of the first frame of the sequence of frames exhibiting that coding bit rate.

10. The process of Claim 9, further comprising, an action of estimating the upper bound gap for each frame received by the client, said estimating comprising:

computing what the encoder buffer fullness value would have been after the last received frame was placed therein as the sum of the last computed value of the encoder buffer fullness prior to insertion of the last received frame and the size of that last received frame,

wherein the encoder buffer fullness value prior to insertion of the last received frame associated with the first frame received by the client at the current coding bit rate of the streaming media is assumed to be zero regardless of its actual value,
and wherein the encoder buffer fullness value prior to insertion of the last received frame associated with each subsequent frame received by the client at the current coding bit rate is deemed to be either zero, or the difference between the last computed value for the encoder buffer fullness after the insertion of the last received frame and the coding bit rate divided by the instantaneous frame rate, whichever is larger, wherein the instantaneous frame rate is equal to the reciprocal of a scheduled playback time of the next frame to be received less a scheduled playback time of the last received frame; and

Webgroup CZ a.s. Ex. 1002, Page 1017 of 1406

computing the upper bound gap associated with the last received frame as the encoder buffer size less the last computed value for the encoder buffer fullness after insertion of the last received frame.

11. The process of Claim 10, wherein the encoder buffer size varies depending on the coding bit rate and is received by the client from the server as a preamble to the streaming media data for all coding bit rates available from the server.

12. The process of Claim 10, further comprising, whenever a frame is received by the client which has a different coding bit rate than the immediately preceding frame, the actions of:

shifting the currently scheduled target arrival time associated with the just received frame by a shift value, wherein said shift value represents a difference between the upper bound gap of the frame and the upper bound gap that would be associated with the frame had it been coded at the immediately preceding coding bit rate;
shifting the currently scheduled target arrival times for future frames such that they, collectively approach over a period of time, and eventually coincide with, the previous target arrival times for those frames; and
shifting each shifted frame by the difference between the encoder buffer fullness value after insertion of the last received frame and the current coding bit rate, divided by the frame rate, and then divided by the estimated arrival rate associated with the last received frame.

13. The process of Claim 12, wherein the upper bound gap that would be associated with the frame had it been coded at the immediately preceding coding bit rate is computed as the encoder buffer size less the last computed value for the encoder buffer fullness value after insertion of the last received frame, wherein the encoder buffer fullness value after insertion of the last received frame is computed as the sum of the last computed value of the encoder buffer fullness value prior to insertion of the last received frame and the size of that last received frame, and wherein the encoder buffer fullness value prior to insertion of the last received frame is computed as either zero, or the difference between the value computed for the encoder buffer fullness after the insertion of the frame received prior to the last received frame and the immediately preceding coding bit rate divided by the instantaneous frame rate associated with the frame received prior to the last received frame, whichever is larger.

14. The process of Claim 8, wherein the information received from the server comprises:

the current coding bit rate of the streaming media data being received by the client which is received as part of the first frame of the sequence of frames exhibiting that coding bit rate; and
the current upper bound gap which is received as part of every frame.

15. The process of Claim 8, wherein the information received from the server comprises:

the current coding bit rate of the streaming media data being received by the client which is received as part of the first frame of the sequence of frames exhibiting that coding bit rate; and
the current upper bound gap associated with the first frame of the sequence of frames exhibiting the current coding bit rate, said current upper bound gap also being received as part of the first frame of said sequence.

16. The process of Claim 15, wherein the information received from the server further comprises a shift value which is received as part of the first frame of the sequence of frames exhibiting a coding bit rate that is different from the immediately preceding frame, said shift value representing a difference between the upper bound gap that would be associated with the immediately preceding frame received by the client had it been coded at the current coding bit rate and the upper bound gap actually associated with the immediately preceding frame coded at the previous coding bit rate.

17. The process of Claim 16, further comprising an action of whenever a frame is received by the client which has a different coding bit rate than the immediately preceding frame, shifting the currently scheduled target arrival time associated with the just received frame by the shift value and shifting the currently scheduled target arrival times for future frames such that they collectively approach over a period of time and eventually coincide with the previous target arrival times for those frames, said shifting of the target values being accomplished so as to prevent the client from attempting to establish new coding bit rates based on the shift in the upper bound gap between the old and new coding bit rates rather than a change in the arrival rate of the frames.

18. The process of Claim 15, further comprising, for each frame received by the client that is not the first frame of the sequence of frames exhibiting the current coding bit rate, an action of estimating the upper bound gap.

Webgroup CZ a.s. Ex. 1002, Page 1018 of 1406

19. The process of Claim 6, wherein computing the estimated arrival rate of the frames of the streaming media data comprises:

computing, on a packet-by-packet basis, the product of the estimated arrival rate computed for the immediately preceding packet to the currently received packet and a first fractional weighting factor, added to the product of the instantaneous arrival rate of the currently received packet and a second fractional weighting factor, wherein at least one of the fractional weighting factors is not a constant but instead based on the time between the packets.

20. The process of Claim 5, wherein the process action of identifying the coding bit rate that reduces the difference between the estimated latest anticipated arrival time of the frame under consideration and the prescribed target arrival time, while at the same time reducing the change in the coding bit rate to a prescribed degree, comprises an action of choosing the prescribed target arrival time for the frame under consideration so as to be a prescribed amount of time earlier than a scheduled playback time for that frame.

21. The process of Claim 20, wherein the process action of choosing the prescribed target arrival time for the frame under consideration comprises an action of making said prescribed amount of time large enough after a startup period that network jitter, delays and throughput changes which may cause the actual arrival time of the frame to be after its target arrival time do not result in the frame arriving after its scheduled playback time.

22. The process of Claim 21, wherein the process action of choosing the prescribed target arrival time for the frame under consideration further comprises making the target arrival time closer to the playback time during the startup period than afterwards for those frames arriving during that period to assist in reducing a startup delay between when the streaming media data begins to be received by the client and when the first frame is played back.

23. The process of Claim 22, wherein the process action of choosing the prescribed target arrival time for the frame under consideration further comprises setting the target arrival time for each frame of the streaming media using a logarithmic target schedule.

24. The process of Claim 22, wherein the process action of choosing the prescribed target arrival time for the frame under consideration further comprises setting the target arrival time for each frame of the streaming media using a two-piece linear target schedule wherein the difference between the target arrival time and the playback time for a frame arriving during the startup period increases linearly to a prescribed amount of time that is large enough to account for said network jitter, delays and throughput changes after which the difference remains substantially constant.

25. The process of Claim 22, further comprising a process action of reducing the startup delay, said reducing action comprising beginning playback of the first frame of the streaming media data as early as when a decoder buffer of the client has a minimum amount of data therein that is needed to ensure an underflow condition does not occur at an initial coding bit rate.

26. The process of Claim 25, wherein the process action of beginning playback of the first frame of the streaming media data as early as when the decoder buffer of the client has a minimum amount of data therein, comprises the actions of:

obtaining an initial encoder buffer fullness value associated with said first frame, wherein the initial encoding buffer fullness value is defined as the size of the encoder buffer less the size of the first frame and less the upper bound gap associated with the first frame;
establishing said minimum amount of data as the encoder buffer size associated with the initial coding bit rate less an initial encoder buffer fullness.

27. The process of Claim 26, wherein the initial coding bit rate, initial encoder buffer fullness, and encoder buffer size are received from the server as a preamble to the streaming media data.

28. The process of Claim 26, wherein the process action of reducing the startup delay further comprises setting the initial coding bit rate to a level that is less than the anticipated arrival rate of the streaming media data at the client since said minimum amount of data decreases as the arrival rate increases relative to the coding bit rate and the startup delay is substantially said minimum amount of data divided by the arrival rate so if the coding bit rate is less than the arrival rate, said minimum amount of data required may be smaller and the startup delay may be less.

Webgroup CZ a.s. Ex. 1002, Page 1019 of 1406

29. The process of Claim 5 wherein the process action of establishing the current coding bit rate comprises an action of initiating the establishment of coding bit rates only after a startup period, wherein said startup period is defined as the period of time prior to the first instance of an estimated latest arrival time of a frame under consideration computed for the initial coding bit rate being earlier than a target arrival time for that frame.

30. The process of Claim 5, wherein the prescribed degree to which the change in the coding bit rate is reduced varies depending on whether the coding bit rate increased, in which case the prescribed degree to which any future change in the coding bit rate is reduced is made greater in comparison to the prescribed degree in cases where the last change in the coding bit rate decreased the rate.

31. The process of Claim 3, wherein the process action of establishing a current coding bit rate for the streaming media data, comprises, in the case where the determined coding bit rate represents an increase from the immediately previous coding bit rate, establishing a new coding bit rate only if the new rate does not exceed the current estimated arrival rate of the frames.

32. The process of Claim 3, wherein the process action of establishing a current coding bit rate for the streaming media data, comprises, in the case where the determined coding bit rate represents an increase from the immediately previous coding bit rate which exceeds the current estimated arrival rate of the frames, establishing a new coding bit rate only if the current client buffer exceeds the desired level by an amount that it is estimated by the client will not be expended at the higher coding bit rate prior to the passing of a prescribed period of time.

33. The process of Claim 3, wherein the process action of establishing a current coding bit rate for the streaming media data, comprises, in the case where the determined coding bit rate represents a decrease from the immediately previous coding bit rate, establishing a new coding bit rate even if it represents a significant departure from the immediately previous coding bit rate.

34. A computer-implemented process for controlling a coding bit rate of streaming media data being transmitted to a client from a server over a computer network, comprising using the server to perform the following process actions:

generating a streaming media data stream which exhibits a coding bit rate supported by the server, and which after an initial startup period exhibits a coding bit rate related to a rate requested by the client;
computing parameters indicative of the state of an encoder buffer of the server, said encoder buffer being used to stage portions of the streaming media data prior to transmission to the client; and
providing the encoder buffer state parameters and the streaming media data stream to the client, whereby said parameters are usable by the client to establish, on an ongoing basis, a current coding bit rate for the streaming media data, which is estimated will provide a high quality playback of the streaming media data while still keeping a decoder buffer of the client used to receive streaming media data from the server filled to a desired duration level so as to reduce the chance of an underflow condition which would result in an interruption of the playback of the streaming media data by the client.

35. The process of Claim 34, wherein the process action of computing parameters indicative of the state of an encoder buffer, comprises an action of, for each coding bit rate supported by the server, computing a set of parameters defining an initial state of the encoder buffer as it would exist if a data stream corresponding to the coding bit rate where streamed therefrom, wherein said encoder buffer parameters comprise the coding bit rate associated with the data stream, the size of the encoder buffer employed with the coding bit rate of the data stream, and a value indicative of the initial encoder buffer fullness exhibited at the coding bit rate of the data stream.

36. The process of Claim 35, wherein the process action of providing the encoder buffer state parameters and the streaming media data stream to the client, comprises an action of providing the encoder buffer parameters computed for each data stream exhibiting one of the supported coding bit rates to the client as part of a preamble sent to the client prior to sending the streaming media data.

37. The process of Claim 35, wherein the size of the encoder buffer employed with the coding bit rate of the data stream is chosen so as to be the minimum size buffer that will still contain the data stream at any point in the streaming process given the coding bit rate and the initial encoder buffer fullness.

38. The process of Claim 35, further comprising a process action of the server computing an upper bound gap for each frame of the streaming media data generated for each coding bit rate supported by the server, wherein the upper

Webgroup CZ a.s. Ex. 1002, Page 1020 of 1406

bound gap is defined as the number of data bits that the server's encoder buffer can contain over the bits currently contained therein after the just-generated frame is fully input into the encoder buffer.

39. The process of Claim 38, further comprising a process action of providing the upper bound gap computed for the first frame of a sequence of frames exhibiting a coding bit rate that is different from that associated with the frame generated immediately before the first frame of said sequence of frames, to the client along with an indication of the coding bit rate associated with the sequence of frames, said gap value and coding bit rate being provided with said first frame of the sequence.

40. The process of Claim 39, wherein the client estimates the upper bound gap for frames provided by the server that do not include the associated gap value.

41. The process of Claim 40, wherein the client employs the encoder buffer parameters and the upper bound gap values to determine on a frame-by-frame basis the coding bit rate that will keep the client buffer approximately at the desired level, said determining comprising identifying a coding bit rate that reduces a difference between an estimated latest anticipated arrival time of the frame under consideration and a prescribed target arrival time.

42. The process of Claim 39, further comprising the process actions of:

the server computing a shift value for each frame representing the first frame of the sequence of frames exhibiting a coding bit rate that is different from the frame generated immediately before this first frame of the sequence, said shift value representing a difference between the upper bound gap that would be associated with the frame generated immediately before the first frame of the sequence had it been encoded at the current coding bit rate and the upper bound gap actually associated with the frame generated immediately before the first frame of the sequence encoded at the previous coding bit rate; and
providing the shift value computed for the first frame of each sequence of frames exhibiting a coding bit rate that is different from the frame generated immediately before the first frame of the sequence, to the client with the data comprising this first frame.

43. The process of Claim 42, wherein whenever a frame is provided to the client which has a different coding bit rate than the immediately preceding frame, the currently scheduled target arrival time associated with the just received frame is shifted by the shift value provided with the just-received frame and the currently scheduled target arrival times for future frames are shifted such that they collectively approach over a period of time and eventually coincide with the previous target arrival times for those frames.

44. The process of Claim 38, wherein a limited number of coding bit rates are supported by the server, and wherein the process action of generating a streaming media data stream which exhibits a coding bit rate supported by the server, and which after an initial startup period exhibits a coding bit rate related to a rate requested by the client, comprises the actions of:

(a) receiving a coding bit rate request from the client;
(b) finding a supported coding bit rate that is equal to, or if none are equal, the closest smaller rate to, the requested coding bit rate;
(c) whenever a supported coding bit rate is found that is a lower rate than the coding bit rate associated with the last generated frame of the streaming media data, generating all future frames at that supported rate; and
(d) whenever a supported coding bit rate is found that is a higher rate than the coding bit rate associated with the last generated frame of the streaming media data, determining if a difference, between the upper bound gap associated with the last generated frame had it been encoded at the supported coding bit rate found and the upper bound gap associated with that frame encoded at the current coding bit rate, is less than or equal to a maximum allowable difference value,

whenever the difference is less than the maximum allowable difference value, generating all future frames at the found supported rate, and
whenever the difference is not less than the maximum allowable difference value, finding the next lower supported coding bit rate and repeat actions (c)-(d).

45. The process of Claim 44, wherein the maximum allowable difference value is received from the client along with the coding bit rate request.

Webgroup CZ a.s. Ex. 1002, Page 1021 of 1406

46. The process of Claim 45, wherein the client chooses the maximum allowable difference value such that a latest anticipated arrival time associated with a frame provided by the server immediately prior to a frame under consideration by the client had it been coded at the requested coding bit rate is no more than a prescribed fraction of the way from that frame's target arrival time to its playback deadline.

Webgroup CZ a.s. Ex. 1002, Page 1022 of 1406

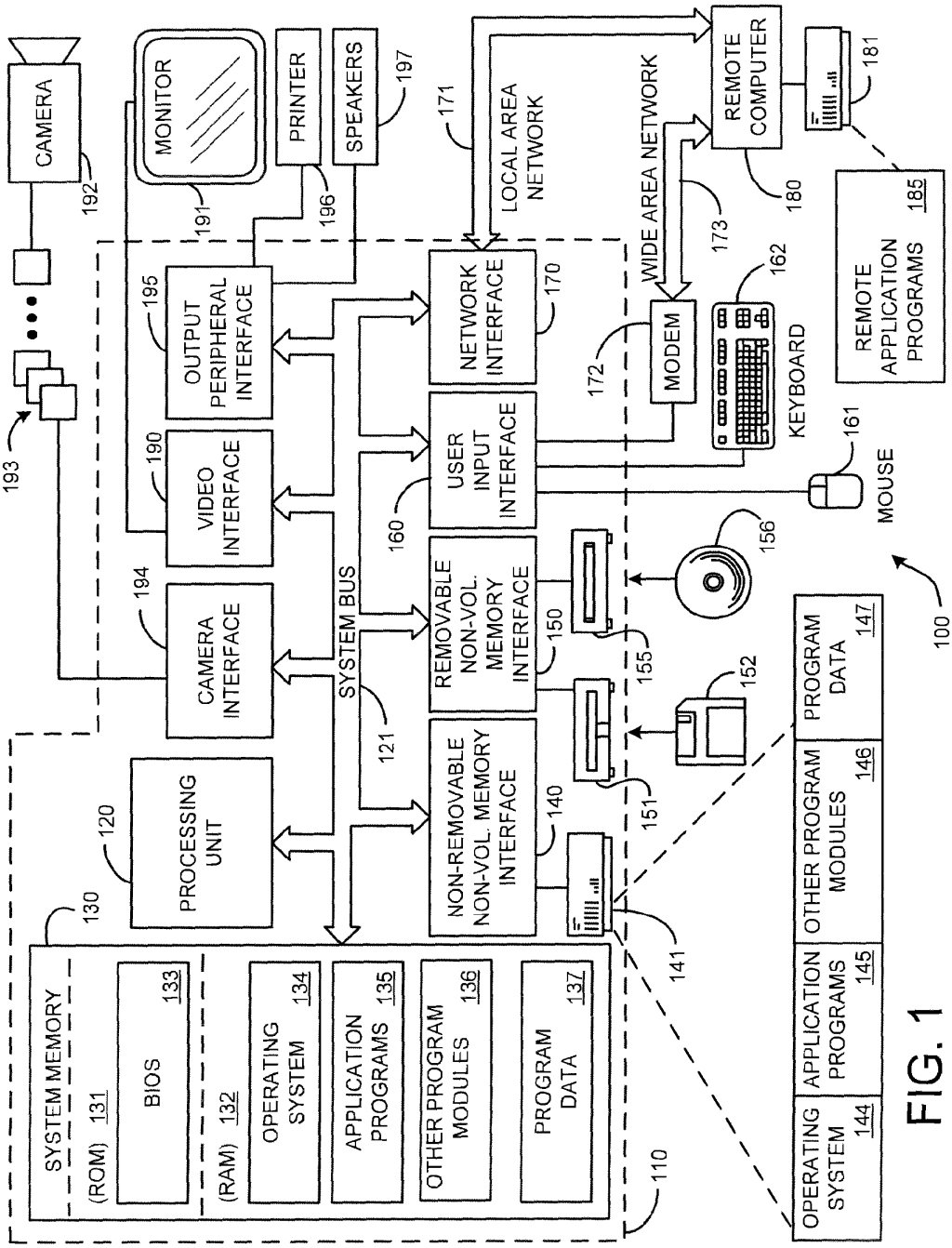


FIG. 1

Webgroup CZ a.s. Ex. 1002, Page 1023 of 1406

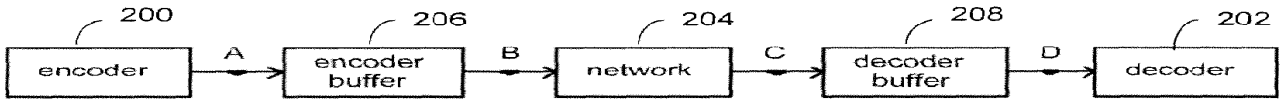


FIG. 2

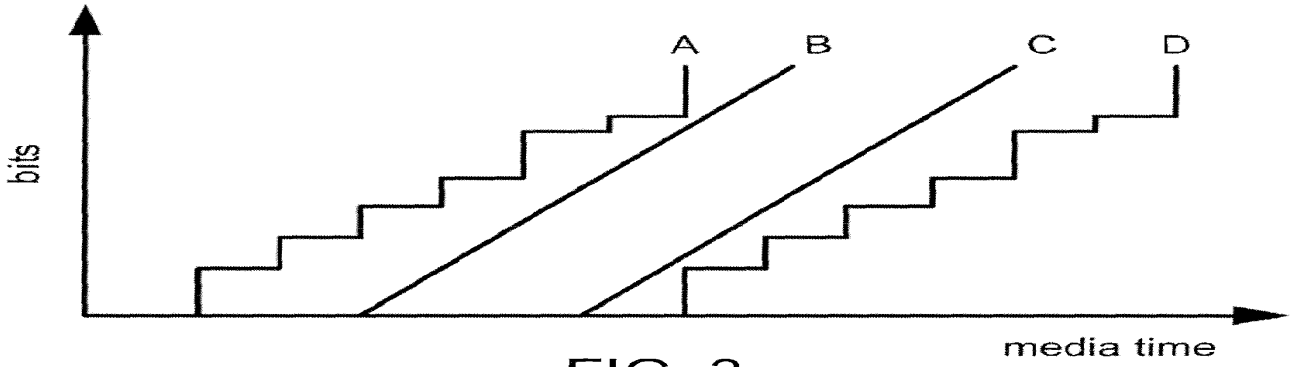


FIG. 3

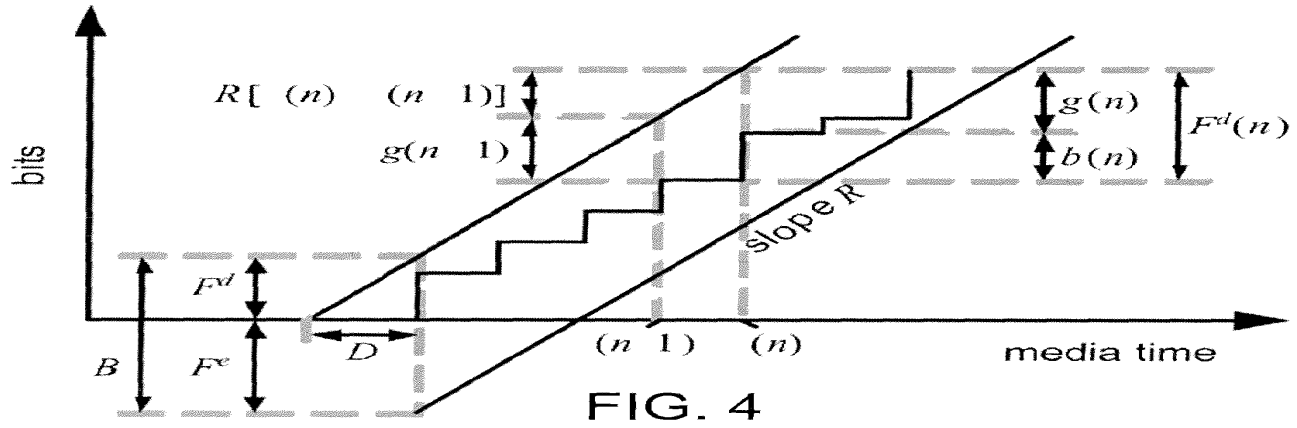


FIG. 4

Webgroup CZ a.s. Ex. 1002, Page 1024 of 1406

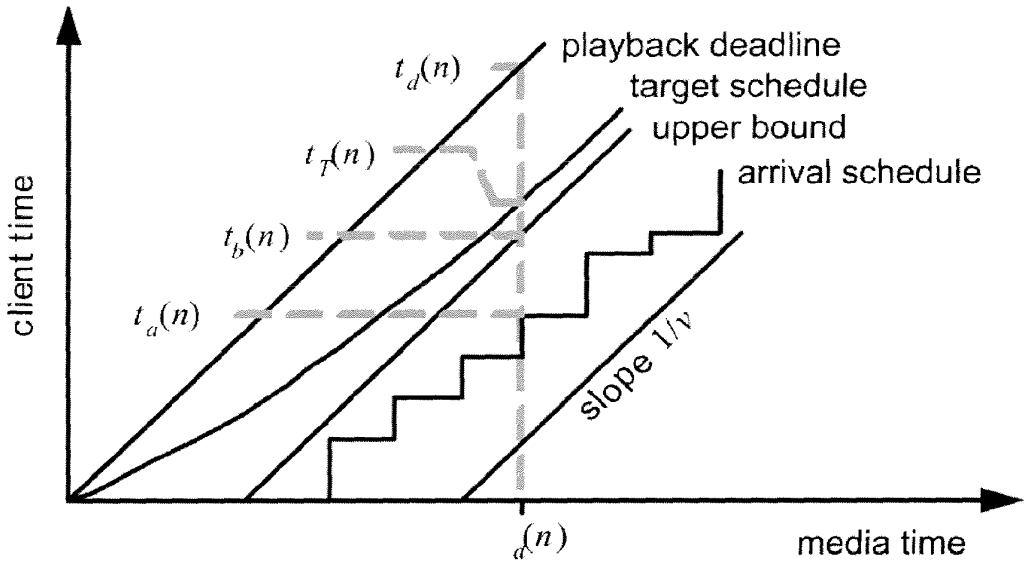


FIG. 5

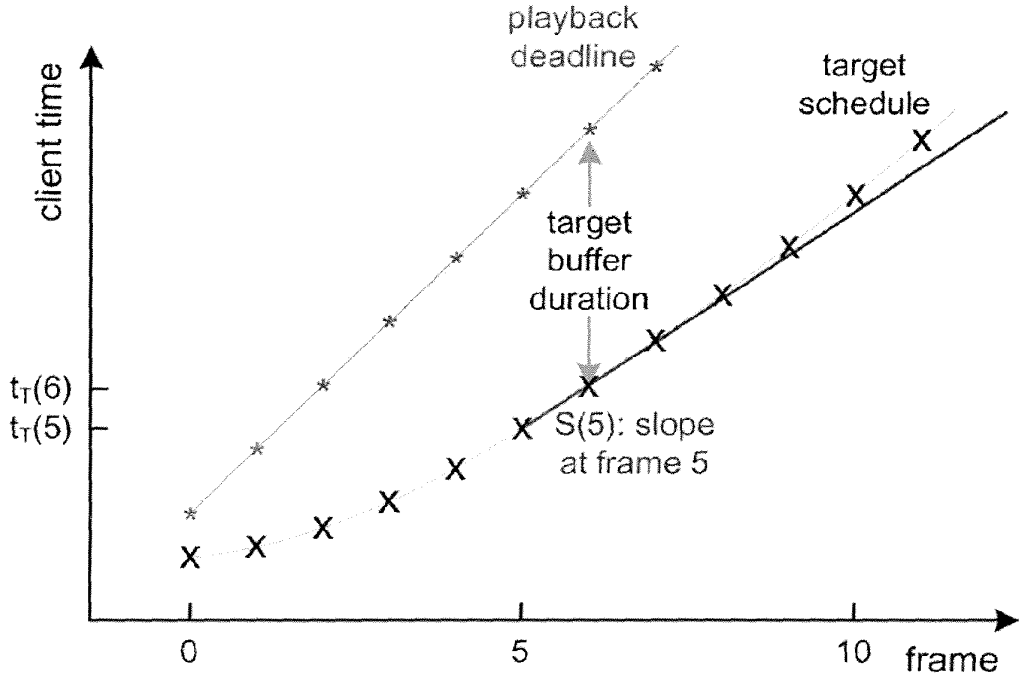


FIG. 6

Webgroup CZ a.s. Ex. 1002, Page 1025 of 1406

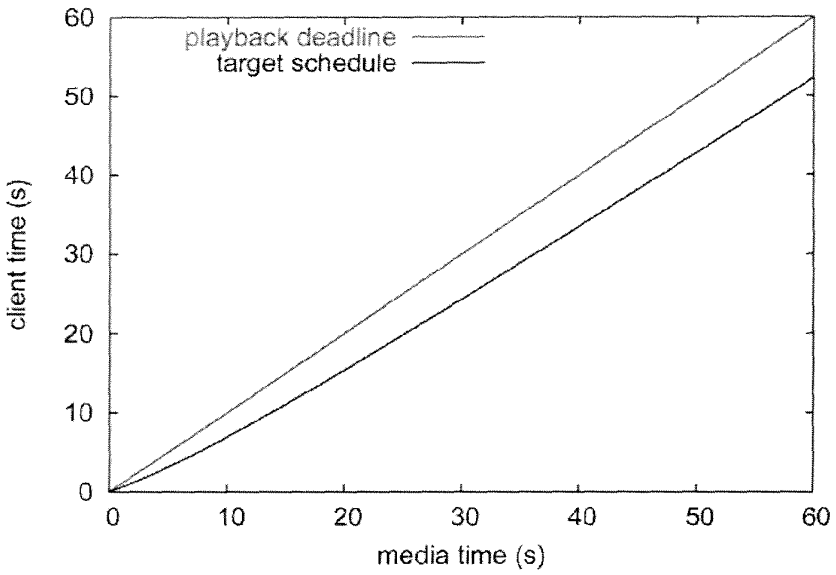


FIG. 7(a)

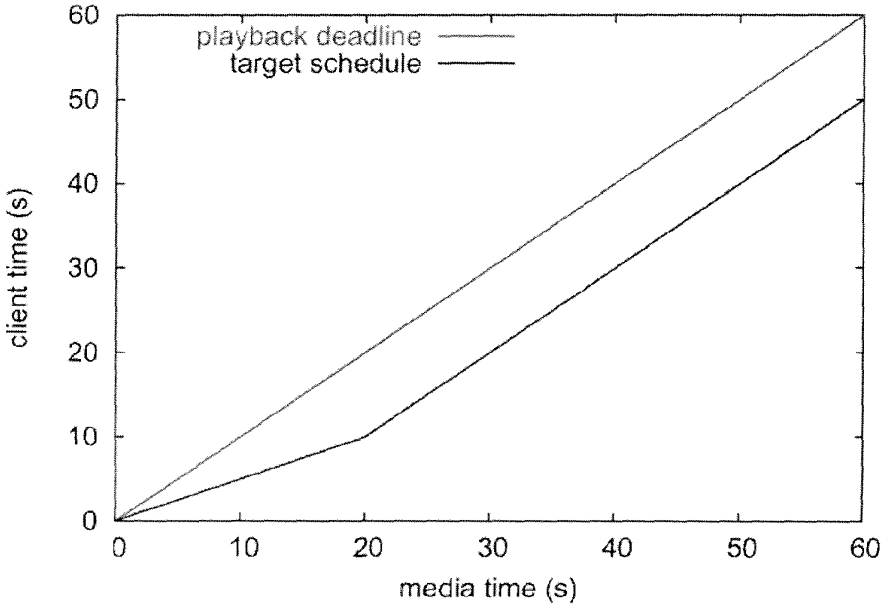


FIG. 7(b)

Webgroup CZ a.s. Ex. 1002, Page 1026 of 1406

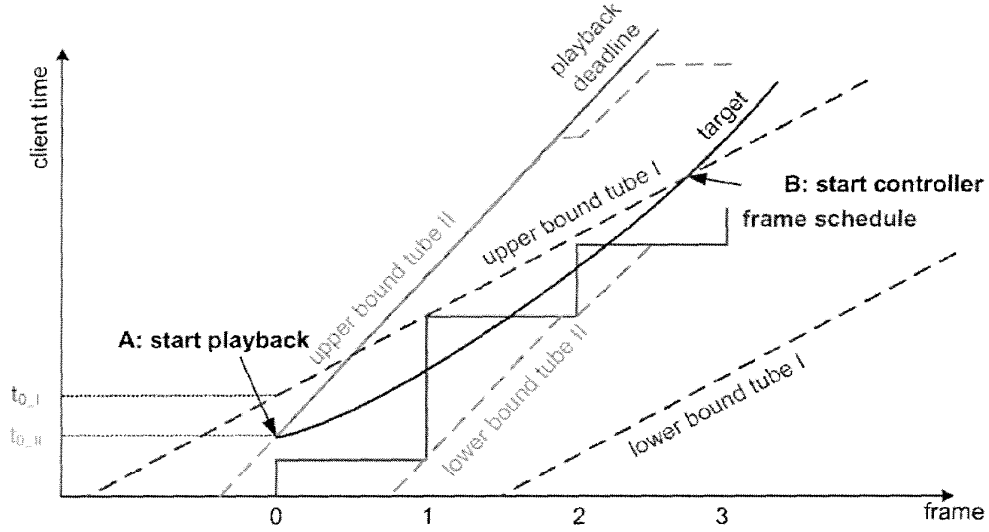


FIG. 8

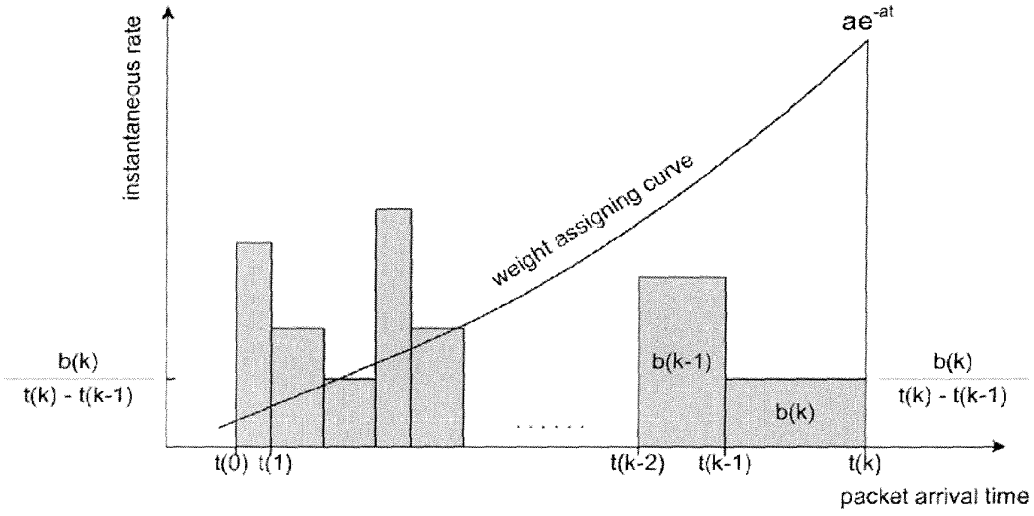


FIG. 9

Webgroup CZ a.s. Ex. 1002, Page 1027 of 1406

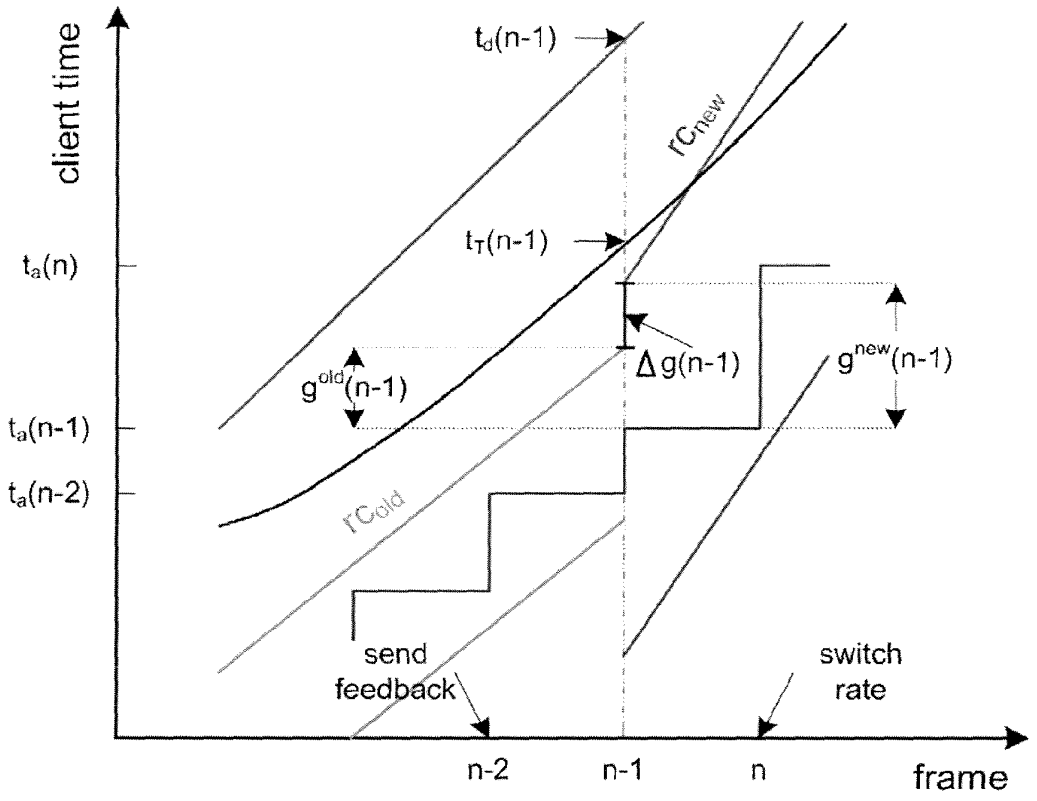

client time
$t_d(n-1)$
rC_{new}
$t_T(n-1)$
$t_a(n)$
$\Delta g(n-1)$
$g^{new}(n-1)$
$g^{old}(n-1)$
$t_a(n-1)$
$t_a(n-2)$
rC_{old}
send feedback
switch rate
n-2
n-1
n
frame

FIG. 10

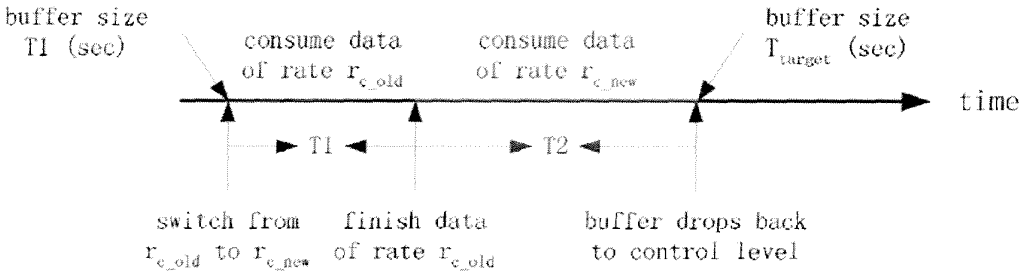

buffer size T1 (sec)
consume data of rate r_{c_old}
consume data of rate r_{c_new}
buffer size T_{target} (sec)
time
T1
T2
switch from r_{c_old} to r_{c_new}
finish data of rate r_{c_old}
buffer drops back to control level

FIG. 12

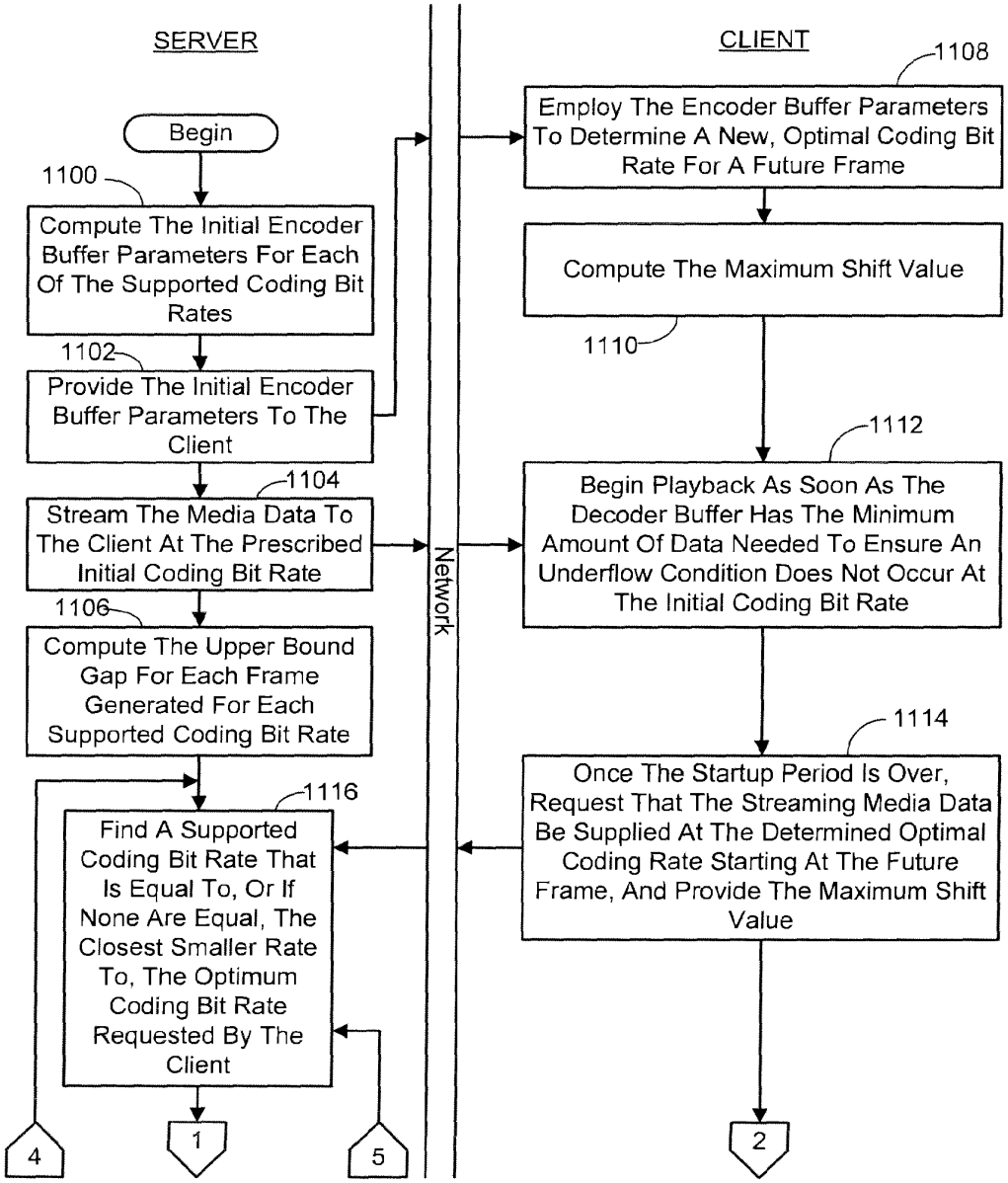


FIG. 11A

Webgroup CZ a.s. Ex. 1002, Page 1029 of 1406

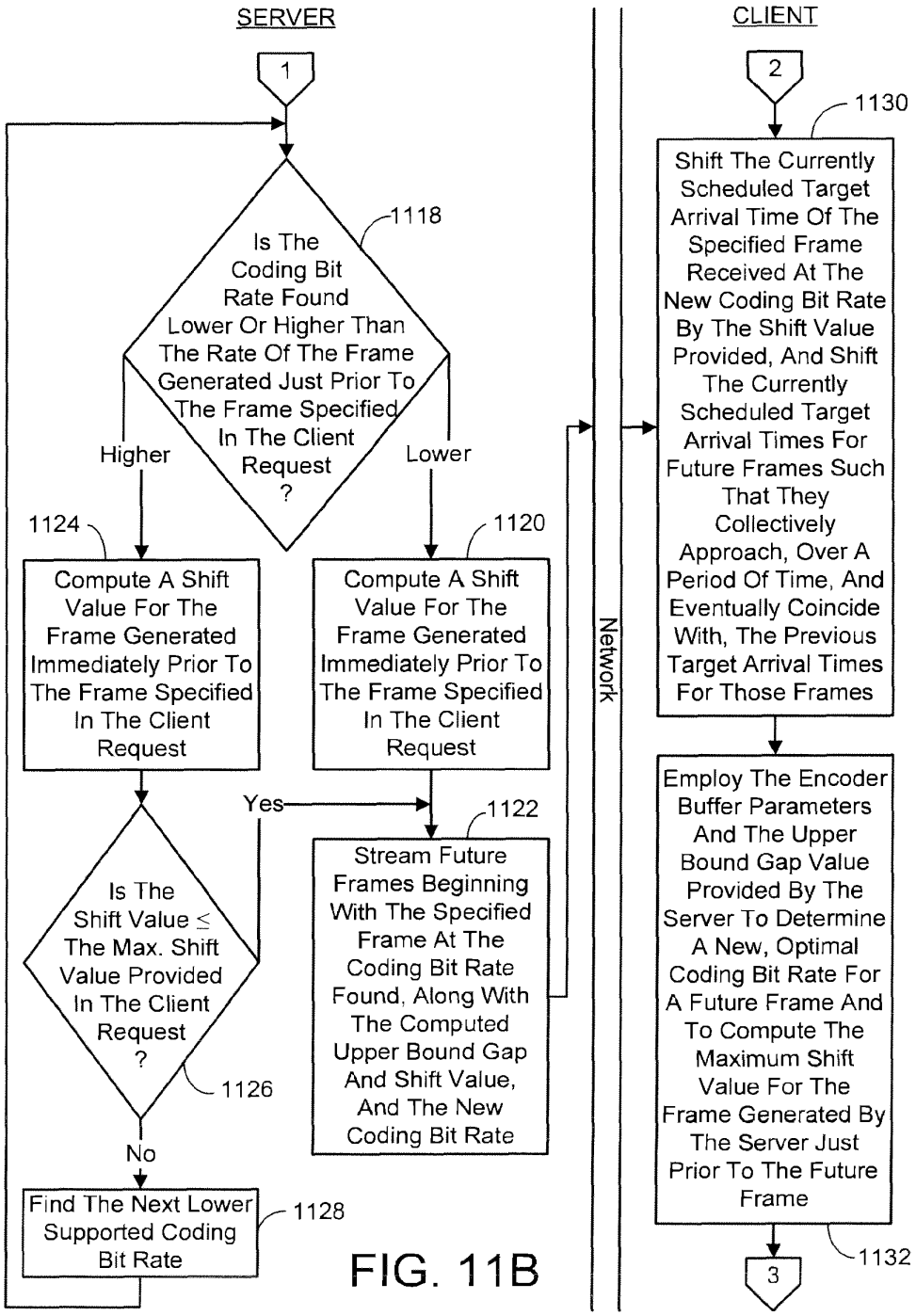


FIG. 11B

Webgroup CZ a.s. Ex. 1002, Page 1030 of 1406

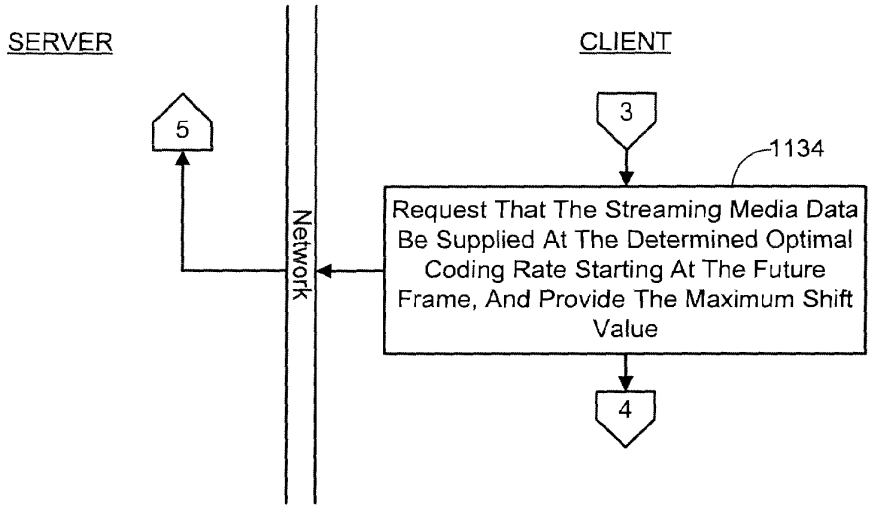


FIG. 11C

Webgroup CZ a.s. Ex. 1002, Page 1031 of 1406

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(71) Applicant: **BRITISH TELECOMMUNICATIONS public limited company**
London EC1A 7AJ (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Lloyd, Barry George William et al**
BT Group Legal
Intellectual Property Department
PP C5A
BT Centre
81 Newgate Street
London EC1A 7AJ (GB)

(54) Adaptive video transmission with variable frame rate

(57) Video signals are sent via a network, such as an internet protocol network, the bandwidth of which varies with time. The amount of data to be sent is controlled by varying the frame rate. This is achieved by (a) measuring the transmission capacity to the receiver; (b) determining the rate of change of transmission capacity; and (c) adjusting the transmitted video frame rate as a function of the said rate of change.

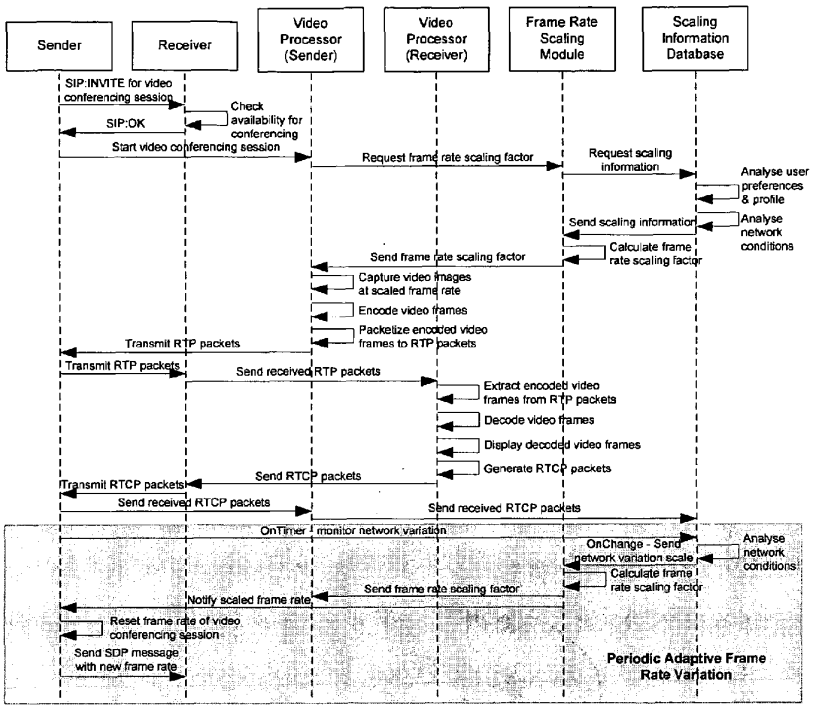


Figure 3 Sequence Diagram of Adaptive Video Frame Rate Application

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EP 1 777 969 A1

Description

[0001] The present invention is concerned with the transmission of video signals via a network.

[0002] In the future, the next generation communication environment is envisaged as allowing users to roam freely and to communicate with each other at any time and any place [1]. Client devices with different capabilities, which range from low power mobile phones to high performance workstations, may be used for communications. Users will be interconnected by networks with various capacities, with packet loss rates that range from almost lossless transmission to quite error prone environments. The rapid development of the client device industry and the proliferation of network access technologies is expected to result in the extensive growth of bandwidth-intensive real-time multimedia internetworking applications (e.g. voice over IP, video streaming, video conferencing and so on).

[0003] Real-time multimedia transmission over a variable bandwidth network environment requires a strict guarantee of network bandwidth and of several other quality of service (QoS) parameters, such as end-to-end delay, delay variation and packet loss. Unfortunately, most of the current QoS mechanisms in existing networks (such as wireless and mobile networks) do not provide such guarantees. In dynamic and unpredictable network environments, due to diverse forms of mobility and interference at the air interface, it gives rise to varying bandwidth and dynamically changing error rates [2]. This further intensifies the challenge for consistent provision of QoS. Traditional QoS mechanisms (e.g. Integrated Services and Differentiated Services), which are typically designed for wired networks, assume a fixed network topology and a fixed amount of available resources. These are inadequate to satisfy users' QoS requirements or to utilize the system resources efficiently, especially in bandwidth-limited and error prone network environments.

[0004] In order to solve this, adaptive multimedia applications are proposed. By implementing adaptive applications, media quality can, in the case of bandwidth variation of network, be adapted appropriately. The bandwidth of the media stream can be scaled down to provide a degraded quality at the destination. In this invention, we are particularly interested in the implementation of video applications. Adaptive video applications use protocols such as Real-Time Streaming Protocol (RTSP) and Real-Time Protocol (RTP), to adapt to changing network conditions using a number of techniques. These techniques include hierarchical encoding, efficient compression, bandwidth smoothing, rate shaping, error control, and adaptive synchronization. Feedback from lower networking layers can be used by the application layer and this helps to match the transmission to the available bandwidth as well as to increase the robustness of the video transmission. However, the perceived quality of video applications is being neglected. Variations of frame rates are proposed in some of these adaptive mechanisms [3] [4]. However, abrupt changes of frame rates can annoy users and hence have a severe impact on the perceived quality of such video applications.

[0005] QoS provisioning is an important issue in real-time internetworking video applications. The dramatic fluctuation of network conditions further intensifies the problems of QoS provisioning. Under variable bandwidth network environments (such as users are moving from one network to another with different bandwidth capacity or network is being congested by heavy traffic), characteristics of video applications need to be adjusted in order to fit the requirements of the current operating network and also maintain the perceived QoS.

[0006] An IBM document on QoS policies [5] clearly states that "the priority for smooth video is higher than the priority for frame quality". It points out that the importance of smooth video is even more significant when users are watching high motion videos (such as sports programmes). Traditional adaptive frame rate variation mechanisms in video applications, which adjust the video requirements according to the rate supportable by the network, attempt to keep the quality of video constant by varying the frame rate. In these mechanisms, the perceived quality of video application is often degraded as frame rates are reduced to a much lower rate or being increased to a much higher rate in order to fit network conditions. The abrupt changes of frame rates (from higher rate to lower rate and vice versa), which cause jerkiness and unsteady video displays, annoy users who are expecting a smooth and continuous flow of video frames in real-time video applications. The users are able to notice the sudden change of frame rate in video transmission. For example, a video application may be sending video at 25 frames per second (fps) during normal network condition and frame rate is reduced to 8fps when network congestion is detected; the frame rate is then increased to 15fps again when network conditions improve. This drastic fluctuation of frame rates will affect the smoothness of the video display and hence have a severe impact on perceived quality.

[0007] References:

1. T. Takebayashi et al, Approaches to User-Centric Computing System for Ubiquitous Solutions, Fujitsu Sci. Tech. J., 39, 2, December 2003, p.261-269.

2. M. Naghshineh et al, End-to-End QoS Provisioning in Multimedia Wireless/Mobile Networks Using an Adaptive Framework, IEEE Communication Magazine November 1997.

3. J. Kim et al, TCP-Friendly Internet Video Streaming Employing Variable Frame-Rate Encoding and Interpolation, IEEE Transaction on Circuits and Systems for Video Technology, Vol.10, NO.7, October 2000.

Webgroup CZ a.s. Ex. 1002, Page 1033 of 1406

[4] W. Guetz et al., U.S. Patent 6,091,777.

[5] IBM. Functions of mobile multimedia QoS control. http://www.trl.ibm.com/projects/mmqos/system_e.htm.

[0008] According to the present invention there is provided a method of transmitting video over a network to a receiver, comprising repeatedly

(a) measuring the transmission capacity to the receiver;
(b) determining the rate of change of transmission capacity;
(c) adjusting the transmitted video frame rate as a function of the said rate of change.

[0009] Other aspects of the invention are set out in the claims.

[0010] Some embodiments of the invention will now be described, with reference to the accompanying drawings.

[0011] The basic system operational view of our implementation is depicted in Figure 1. The figure shows one-way communication (sender-to-receiver), however, it can be implemented as a two-way communication application (client-to-client). Session Initiation Protocol (SIP) can be used to start a communication session between two or more clients. Real-Time Protocol (RTP) and

[0012] Real-Time Control Protocol (RTCP) can be used as underlying transport layer to send data packets and also control packets. In this implementation, Session Description Protocol (SDP) signalling can be used to reset the parameters of a video conferencing session and send them to the receiving end.

[0013] The video processor, which involves capture/display, encoder/decoder and transmitter/receiver, is mainly for media processing. The adaptation mechanism appears as a standalone module in the application. A scaling information database extracts and stores network statistical information (monitored periodically using a timer) and user profiles (set by users). The frame rate scaling module is the core mechanism which calculates a frame rate scaling factor based on information obtained from information database. A scaled frame rate will then be fed to the video processor for setting new video parameters.

[0014] Figure 2 illustrates how the different parameters influence the frame rate in the case of fluctuation in the network . To calculate the frame rate scaling factor, several parameters need to be taken into consideration. These parameters may include network statistics, RTCP feedback statistics and the user profile. The main contributor to the scaling factor is the network statistics, where the changes with time (Δbandwidth/Δt) are tracked.

[0015] The sequence diagram (Figure 3) shows the activity flows of our implementation. The periodic adaptive frame rate variation mechanism (shaded portion) is applied to avoid the situation that frame rate variation is only incurred when network congestion is detected. A timer is initiated for periodic network condition monitoring at the client end. The frame rate will be scaled based on the scaling factor extracted from scaling information as discussed previously. This will improve the perceived quality by giving a gradual change of frame rate and smooth playbacks of video throughout entire communication.

[0016] The control mechanism essentially comprises the following steps:

(a) measurement, at intervals, of the network bandwidth $B(t_i)$;
(b) determination of the gradient $\{B(t_i) - B(t_{i-1}))/(t_i - t_{i-1})$;
(c) determination of a scaling factor *M,* as a function of the gradient *m*;
(d) determination of a new frame rate, multiplying the existing rate by the scaling factor - subject however to the rate remaining within a range determined by preset maximum and minimum values..

[0017] In more detail:

(a) Bandwidth could be measured by any one of a number of conventional methods. If the communication session is peer to peer within a similar subnet, say, in an enterprise scenario, the backhaul link of the connecting equipment could expose its bandwidth availability through its SNMP agent residing in that particular equipment. This could be queried via SNMP calls. On the other hand, in an environment when there are several nodes in the path of its communication, an application level implementation of measuring its delay and thus bottleneck within that particular path could be used. This would suggest bandwidth availability.
Clearly it is important, in terms of reducing the risk of large changes in frame rate, to measure the bandwidth (and adjust the frame rate) at frequent intervals - that is to say, frequent in relation to the rate of change of network conditions. A typical rate might be every 10 seconds. It would be possible to measure the bandwidth once per frame, but this is not preferred, in that it involves additional overheads. In theory the bandwidth could be measured more often than once per frame, but naturally the frame rate adjustment cannot occur more often than once per frame.
(b) The gradient is determined by the formula given above. The use of the gradient rather than simply the absolute value of the bandwidth is significant because it introduces an element of prediction into the assessment of bandwidth availability.
(c) The determination of the scaling factor *M* as a function of the gradient *m* should be such that

Webgroup CZ a.s. Ex. 1002, Page 1034 of 1406

If *m* is large & positive, multiplier is >1;
If *m* is small & positive, multiplier is > 1 (but smaller than when *m* is large);
If *m* is 0, multiplier is 1;
If *m* is small & negative, multiplier is <1;
If m is large & negative, multiplier is <1 (but smaller than when *m* is small and negative.
For example, a possible relationship for the situation where the bandwidth gradient is expected to vary over the range -50 to 50 kbit/s/s is: that M varies between 0.4 and 2.5. A simple, piecewise-linear implementation would be to specify that for m>0: M = 1 + 0.03 m; for m=0: M = 1; and for m<0: M = 1 + 0.012 m. However we prefer a nonlinear relationship in which frame rate changes are more extreme at the ends of the scale. Such a relationship would best be implemented by the use of a look-up table.
(d) A typical limit range for frame rate might be from 10 to 25 frames per second. Thus if the existing frame rate is f_i then the new frame rate will be

$$f_{i+1} = \mathrm{Max}\{\mathrm{Min}\{Mf_i, 25\}, 10\}.$$

[0018] The user preferences referred to earlier could mean constraints on the level of adaptation that the user is prepared to live with in a congested network situation, i.e reaction time, image resolution resizing, colour depth. This could influence the extent for the need to switch to a lower frame rate.

[0019] In order to achieve better perceived quality of real-time internetworking video application in variable bandwidth network environments, degradation of video quality needs to be occur gracefully. In the method we have described, an adaptive mechanism, which resides in the video application, allows smooth variation of frame rates under variable bandwidth network environments. It varies frame rates gradually and hence minimises the jerkiness and flickering of video displays. A gradual degradation or upgrade of video quality gives an illusion to users that there is only little change in video quality throughout the communication period. The variation incurred is less aggressive and significant as compared with traditional frame rate variation mechanisms.

[0020] The method improves the perceived QoS of real-time internetworking video applications by implementing smooth variation frame rate mechanism of adaptive video application. An adaptation mechanism resides in a real-time internetworking multimedia application to adapt video quality dynamically to changes in network conditions. Network conditions are absorbed and analysed from time to time and network statistical analysis is then fed back to the video processor of the application. The application is then triggered to set the frame rate of the video to a requested rate based on the analysis of network conditions. The frame rate changes dynamically when network conditions vary - but not only when network congestion is detected. The degree of variation in frame rate depends on the degree of variation in network conditions (such as network utilization) and the variations of frame rates occur throughout the communication session. Hence, it prevents sudden changes in frame rate of the video transmission and helps to minimise the jerkiness of video displays under variable bandwidth conditions. User preferences and profiles may also be taken into account when frame rate is being adjusted. This further improves user perceived QoS of the application.

Claims

1. A method oftransmitting video over a network to a receiver, comprising repeatedly

   (a) measuring the transmission capacity to the receiver;
   (b) determining the rate of change of transmission capacity;
   (c) adjusting the transmitted video frame rate as a function of the said rate of change.

2. A method according to claim 1 in which the frame rate is adjusted to equal the existing frame rate multiplied by a factor which is a monotonically increasing function of rate of change of transmission capacity.

3. A method according to claim 2 in which the factor is a nonlinear function of rate of change of transmission capacity.

4. A method according to claim 3 in which the factor is obtained by means of a look-up table.

5. A method according to any one of the preceding claims in which the rate of change of transmission capacity is evaluated to determine whether an adjustment of frame rate is necessary at regular intervals.

Webgroup CZ a.s. Ex. 1002, Page 1035 of 1406

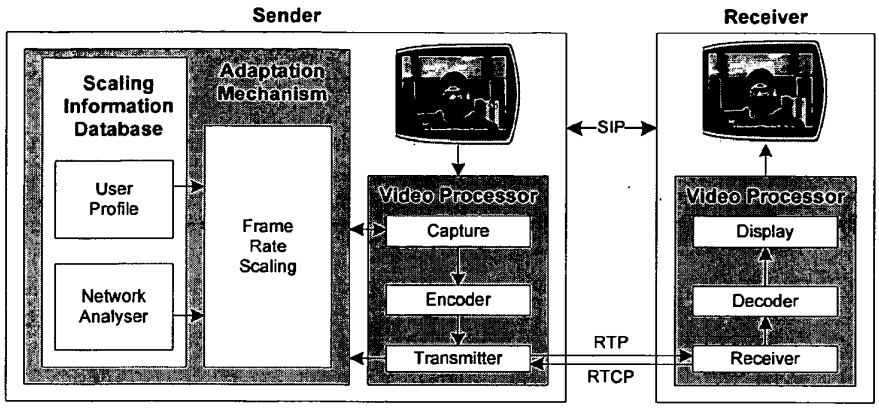


Figure 1 Basic System Operational View

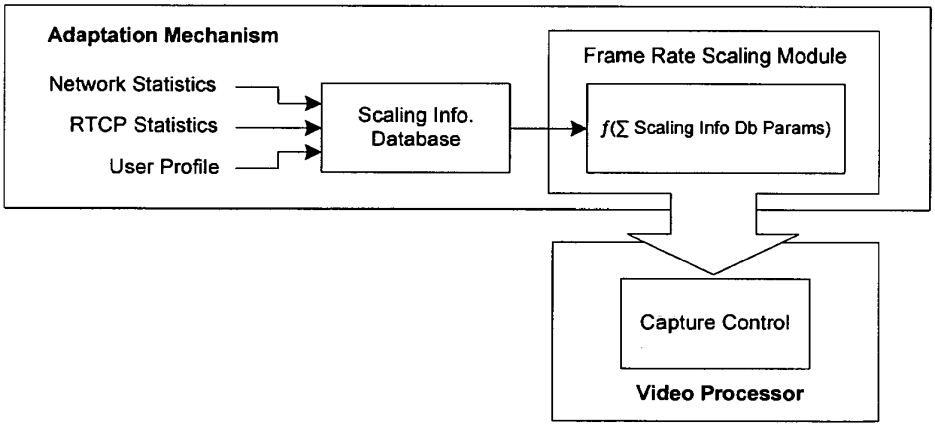


Figure 2

Webgroup CZ a.s. Ex. 1002, Page 1036 of 1406

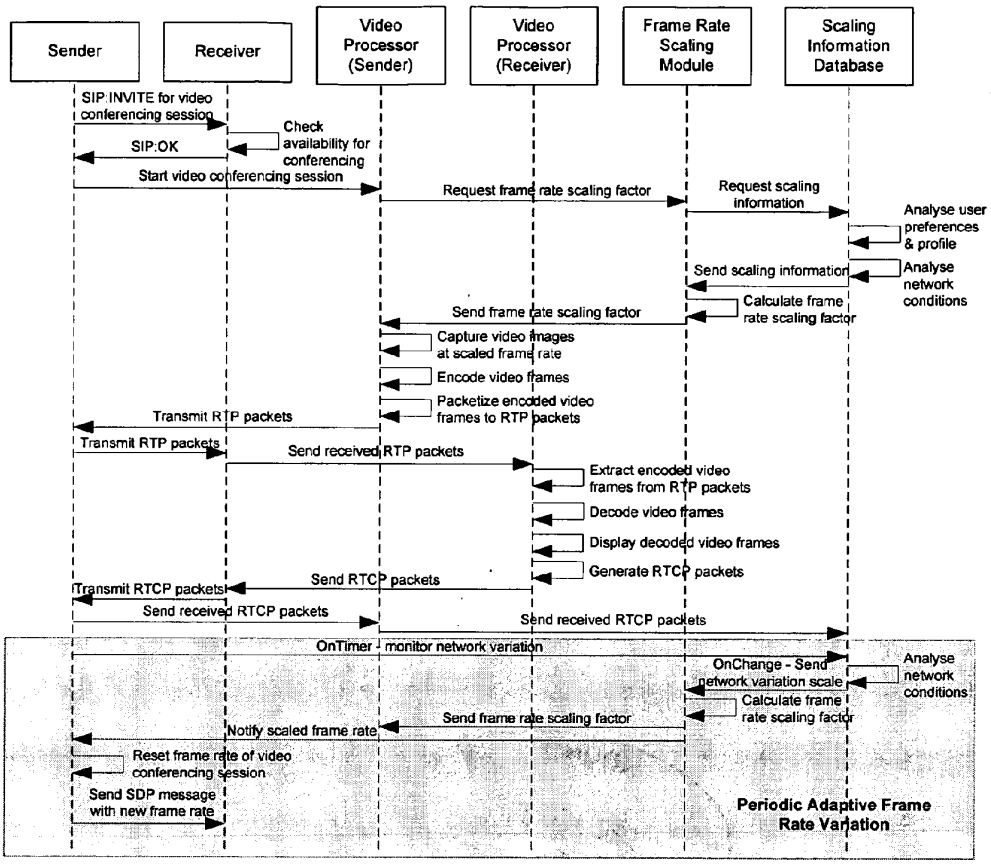


Figure 3 Sequence Diagram of Adaptive Video Frame Rate Application

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 6302

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	KIM JONGWON ET AL: "TCP-Friendly Internet Video Streaming Employing Variable Frame-Rate Encoding and Interpolation" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 10, no. 7, 1 October 2000 (2000-10-01), pages 1164-1177, XP002369021 ISSN: 1051-8215 * page 1168, left-hand column, paragraph B *	1-5	H04N7/46
A	REED E C ET AL: "CONSTRAINED BIT-RATE CONTROL FOR VERY LOW BIT-RATE STREAMING-VIDEO APPLICATIONS" IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 11, no. 7, July 2001 (2001-07), pages 882-889, XP001083363 ISSN: 1051-8215 * page 885, right-hand column - page 886, left-hand column *	1-5	TECHNICAL FIELDS SEARCHED (IPC) H04N
A	N. SEELAM, P. SETHI, W.FENG: "A hysteresis based approach for quality, frame rate, and buffer management for video streaming using TCP" SPRINGER VERLAG, INTERNATIONAL CONFERENCE ON MANAGEMENT OF MULTIMEDIA NETWORKS AND SERVICES, vol. 2216, 29 October 2001 (2001-10-29), pages 1-15, XP002374403 * paragraph [3.1.3] *	1-5	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	28 March 2006	Raeymaekers, P

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 6302

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	NEE P ET AL: "The performance of two-dimensional media scaling for Internet videoconferencing" NETWORK AND OPERATING SYSTEM SUPPORT FOR DIGITAL AUDIO AND VIDEO, 1997., PROCEEDINGS OF THE IEEE 7TH INTERNATIONAL WORKSHOP ON ST. LOUIS, MO, USA 19-21 MAY 1997, NEW YORK, NY, USA,IEEE, US, 19 May 1997 (1997-05-19), pages 223-234, XP010251701 ISBN: 0-7803-3799-9 * page 226, right-hand column * -----	1-5	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	28 March 2006	Raeymaekers, P

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Patent documents cited in the description

- US 6091777 A, W. Guetz **[0007]**

Non-patent literature cited in the description

- **T. TAKEBAYASHI et al.** Approaches to User-Centric Computing System for Ubiquitous Solutions. *Fujitsu Sci. Tech. J.,* 02 December 2003, vol. 39, 261-269 **[0007]**
- **M. NAGHSHINEH et al.** End-to-End QoS Provisioning in Multimedia Wireless/Mobile Networks Using an Adaptive Framework. *IEEE Communication Magazine,* November 1997 **[0007]**
- **J. KIM et al.** TCP-Friendly Internet Video Streaming Employing Variable Frame-Rate Encoding and Interpolation. *IEEE Transaction on Circuits and Systems for Video Technology,* October 2000, vol. 10 (7 **[0007]**
- *IBM. Functions of mobile multimedia QoS control, http://www.trl.ibm.com/projects/mmqos/system_e.htm* **[0007]**

Webgroup CZ a.s. Ex. 1002, Page 1040 of 1406

(12) UK Patent Application (19) GB (11) 2 367 219 (13) A

(43) Date of A Publication 27.03.2002

(21) Application No 0023062.3

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(71) Applicant(s)
Vintage Global
(Incorporated in the British Virgin Islands)
c/o Ernst & Young Trust Corp (BVI) Ltd, P.O Box 3340, Road Town, Tortola, British Virgin Islands

(72) Inventor(s)
Benjamin Neeman
Yossi Rubner
Nehemia Davidson
Uri Salomon

(74) Agent and/or Address for Service
Geoffrey L Melnick
c/o Solo Photographic, 12 Catherine Street, ST ALBANS, Herts, AL3 5BX, United Kingdom

(51) INT CL[7]
H03M 7/30 , H04L 1/00

(52) UK CL (Edition T)
H4P PDCFM

(56) Documents Cited
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WO98/09387 A1 **WO 00/72601 A2**
US 5847760 A

(58) Field of Search
UK CL (Edition S) **H4P PDCFM PDCFP PDCFX PF**
INT CL[7] **H03M 7/30 , H04L 1/00 , H04N 7/26 7/32**
Online: WPI, EPODOC, JAPIO

(54) Abstract Title
Streaming of media file data over a dynamically variable bandwidth channel

(57) A method of transmitting data streams over a variable bandwidth channel, comprising modifying the quantity of data to be injected into the channel to accord with a measured capacity or bandwidth of the channel. An input stream is passed through a plurality of parallel compressors 40.1-40.4 which each produce an output stream of a different rate to the other streams. Each stream preferably comprises key or reference frames and delta frames. The reference frames are synchronized between the streams so that a data unit in one stream contains the same information as the corresponding data unit in another stream, but is compressed to a different extent. A data stream for transmission along the channel is produced by selecting data units from more than one compressor output stream so as to produce a stream which makes optimum use of the available channel bandwidth. In one embodiment the duration of the data units are one of a group comprising fixed predetermined durations and duration determined by changes in the channel bandwidth. The method is useful in sending multimedia data streams such as audio and video over a channel such as a cellular telephone network or the internet.

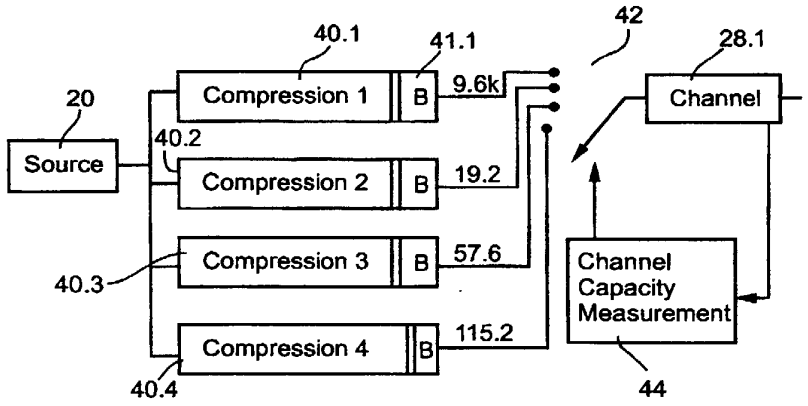


Fig. 4

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

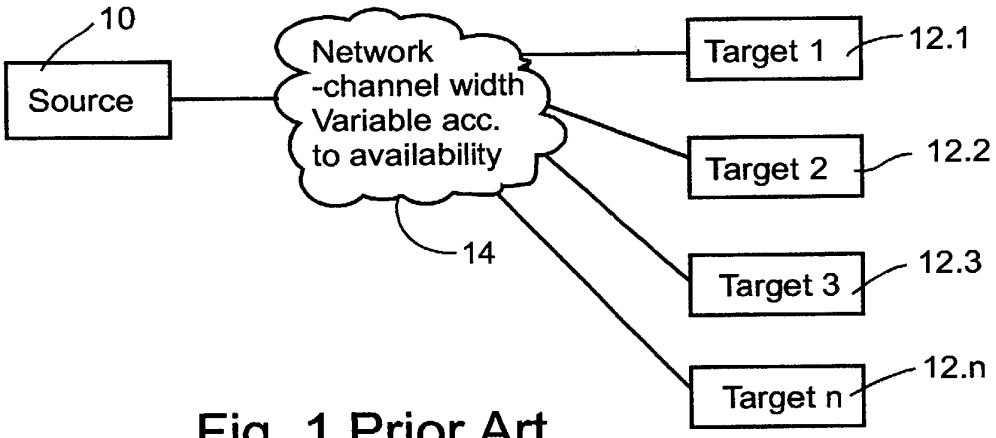


Fig. 1 Prior Art

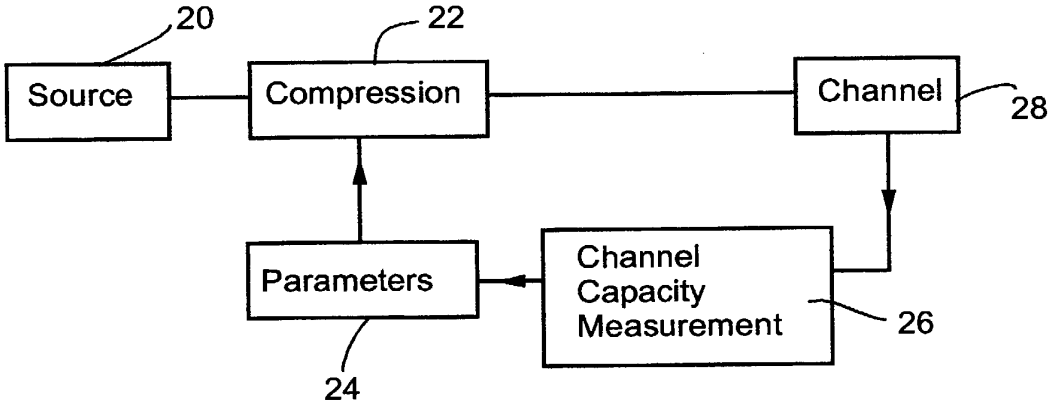


Fig. 2

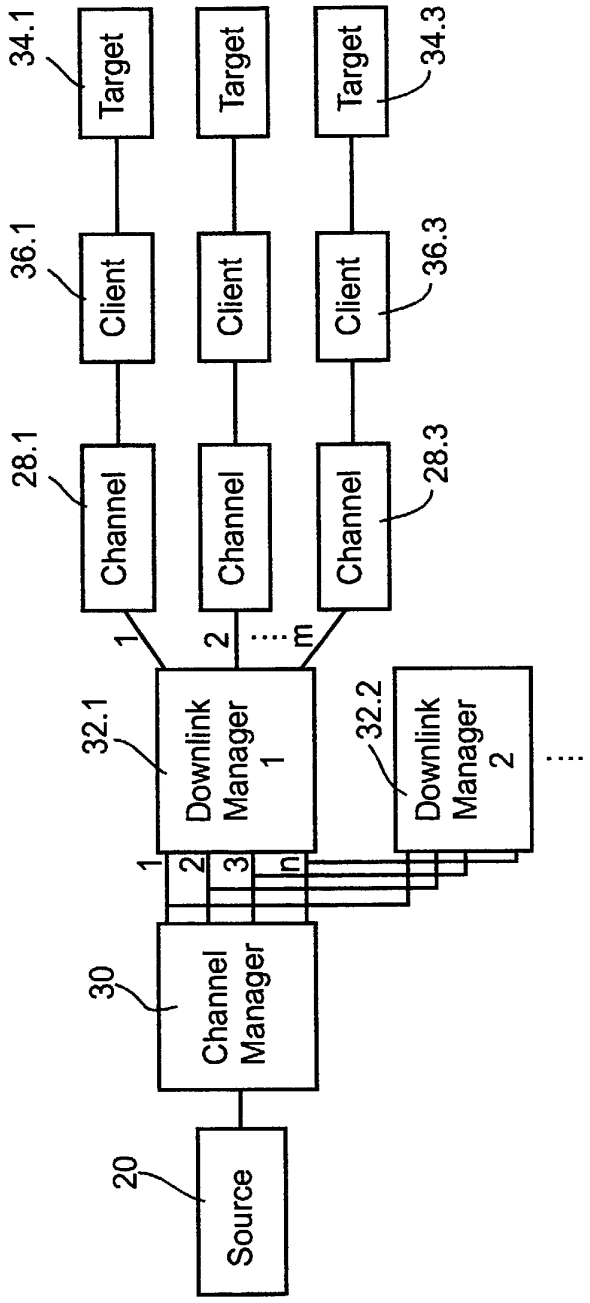

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Target
Target
Target
34.3
36.1
Client
Client
Client
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28.1
Channel
Channel
Channel
28.3
1
2
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32.2
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1
2
3
n
30
Channel Manager
20
Source

Fig. 3

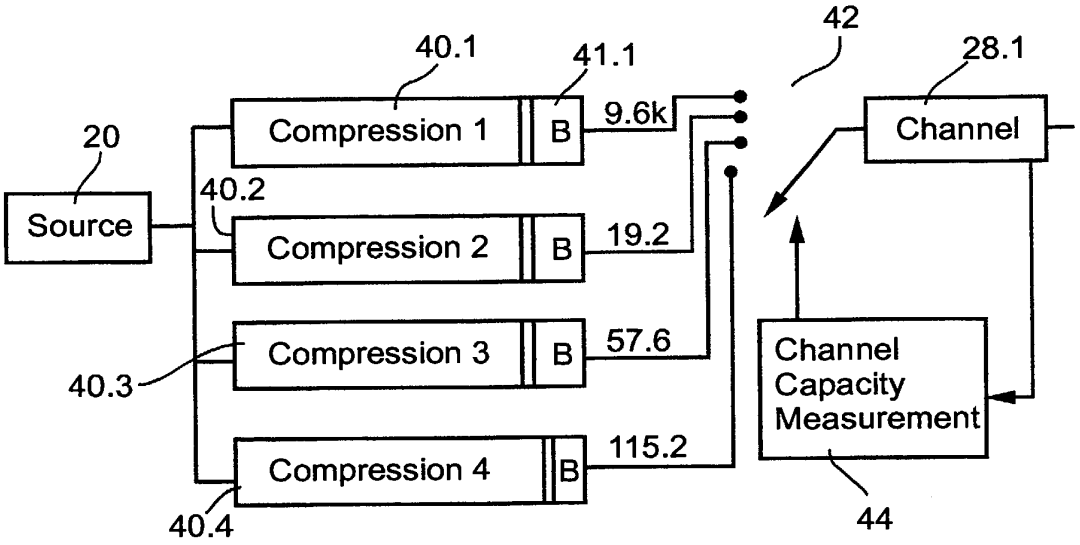

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41.1
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115.2
40.4
44

Fig. 4

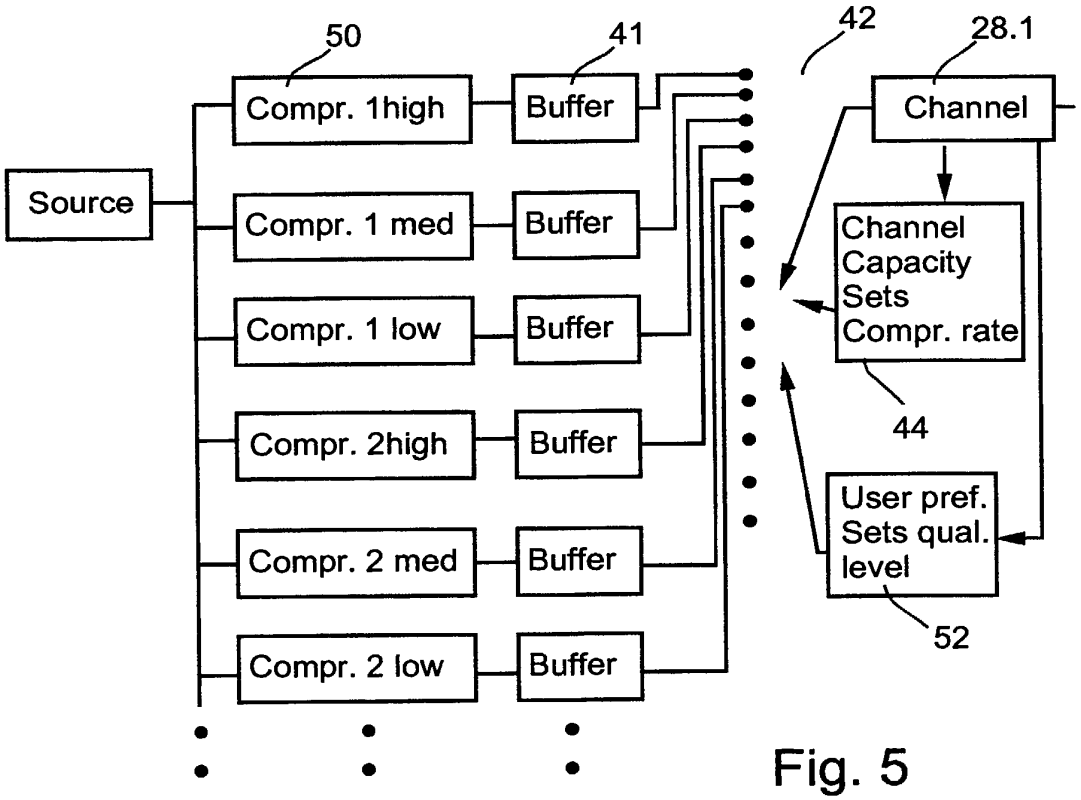

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Buffer
Channel
Source
Compr. 1 med
Buffer
Channel
Capacity
Sets
Compr. rate
Compr. 1 low
Buffer
44
Compr. 2high
Buffer
User pref.
Sets qual.
level
Compr. 2 med
Buffer
52
Compr. 2 low
Buffer

Fig. 5

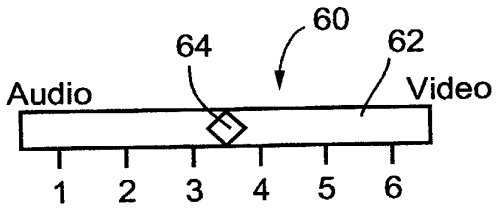


Fig. 6

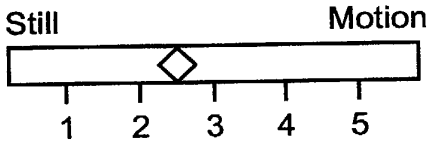


Fig. 7

00/20757 -UK. 9/12/00

Title of the Invention

Streaming of Media File Data Over a Dynamically Variable Bandwidth Channel

Field of the Invention

The present invention relates to streaming of media file data over a channel having a dynamically variable bandwidth, and more particularly but not exclusively to streaming of multimedia data such as video and /or audio data over a channel having a dynamically variable bandwidth.

Background of the Invention

Dynamically varying channel bandwidths are particularly encountered over the Internet and like networks and over radio and cellular telephone links. On the Internet the total bandwidth is fixed and the bandwidth available per channel tends to depend on the amount of usage, the greater the usage the smaller the bandwidth available per user. In radio and cellular links the available bandwidth depends on usage, but the overall capacity may also be dependent on environmental factors.

The Internet relies on packet switched communication, whereas radio and cellular telephone links may be either circuit-switched or packet switched. Either way, the same considerations of channel bandwidth broadly apply.

As the bandwidth changes, a number of approaches are currently in use. One of these is simply to buffer received video frames, to start to show the frames as soon as the buffer is full, and to continue to show the video until the buffer is empty, then to halt the display until the buffer is full again. Another method is to show the video at a real time rate, displaying all frames that arrive in time and dropping all frames that arrive too late.

In both of these methods, data is sent at the same high rate. In the first method, unacceptable delays in showing the data are experienced. In the second method, valuable channel bandwidth is wasted transmitting data that does not get used.

Whether the network is a cellular telephone network or the Internet or like wide area data network, the bandwidth of the data network is variable. In all cases the

Webgroup CZ a.s. Ex. 1002, Page 1046 of 1406

larger the number of users the lower the bandwidth per user, and radio-based networks may also suffer from reduced bandwidth due to environmental conditions. Furthermore, in the case of cellular telephone networks, events such as handover between two base stations may also affect the available bandwidth.

In general, cellular networks are able to absorb changes in bandwidth without the user noticing a change in the quality of the voice signal. However, it is desirable to go beyond mere voice communication over cellular telephone networks. Already, low level data capability is being built into mobile telephones and it is envisaged that within the next few years, mobile telephones will be able to receive and display multimedia data. Multimedia data uses large amounts of bandwidth and generally requires to be displayed in real time. Thus bandwidth fluctuations will be immediately noticeable. Currently, however, transmission of video data over cellular phone channels is not being attempted on a commercial basis.

At present, mobile telephone systems are on their second generation and a third generation is on the drawing board but will not be available for some years. The problem is particularly associated with the design of advanced second generation equipment (generation 2.5) which, it is envisaged will be able to provide multimedia within the limitations of second generation capacity. It should be noted however that the same considerations apply to further generations of mobile telephones and also to other environments in which it is desired to transmit multimedia data, such as the Internet.

Generally, multimedia data is sent over a network as a datastream in compressed form. There are numerous algorithms for compressing data, and different forms of compression are appropriate for compressing different forms of data. Furthermore, a single form of compression may give rise to different levels of compression according to compression parameters that may be set. The greater the compression the lower will be the resulting data rate and a high level of compression may be used to overcome channel capacity constraints. A solution may involve selection of the compression parameters to meet a likely worst-case scenario. However, the solution is not complete as a high level of compression leads to low quality output and no advantage is taken of the availability for most of the transmission time of a higher bandwidth availability.

US Patent No. 6,014,694, Aharoni et al, discloses a system for adaptively transporting video over networks wherein the bandwidth varies with time. The

Webgroup CZ a.s. Ex. 1002, Page 1047 of 1406

system comprises a video/audio codec that functions to compress, encode, decode and decompress video streams that are transmitted over networks having available bandwidths that vary with time and location. Depending on the channel bandwidth, the system adjusts the compression ration to accommodate a plurality of bandwidths ranging from 20kbps for POTS to several Mbps for switched LAN and ATM environments. Bandwidth adjustability is provided by offering a trade-off between video resolution, frame rate and individual frame quality. The system generates a video data stream comprising of key, P and B frames from a raw video source. Each frame type is further comprised of multiple levels of data representing varying degrees of quality. In addition, several video server platforms can be utilized in tandem to transmit video/audio information with each video server platform transmitting information for a single compression/resolution level.

P and B frames are delta frames that depend on previous frames to allow a complete picture to be generated. Thus it is not possible simply to mix groups of frames of different quality levels since the deltas between frames are different. The above US Patent solves the problem by taking advantage of what is known as a group of pictures (GOP) which is a self-contained unit such as a scene. Because they are self-contained, GOPs of different compression levels can be successfully mixed. However, GOP boundaries are content related and thus irregular. When GOP boundaries are widely spaced, dynamic following of bandwidth changes are highly inaccurate or generate delays for new users.

Webgroup CZ a.s. Ex. 1002, Page 1048 of 1406

Summary of the Invention

Embodiments of the present invention attempt to solve the above problems by modifying the quantity of data to be injected into the channel to accord with a measured capacity or bandwidth of the channel. The quantity of data is preferably modified only by altering compression parameters, so that data fully usable in real time can be received from the channel. Thus a reduction in bandwidth of the channel leads to a drop in quality of the received signal and not to dropped frames or a reduction in performance.

According to a first aspect of the present invention there is thus a device for streaming of media file data to be sent over at least one channel having a dynamically variable bandwidth, comprising

an input for receiving media file data at a first rate,

a multiple stream creator for creating a plurality of streams of said media file data, each stream compressed to predetermined other rates, each stream comprising a series of autonomous compressed data units which are mutually compatible, and

a stream selector for dynamically matching a bandwidth of the channel to rates of said streams to send said data file as a combination of said autonomous units from said streams via said channel,

wherein said autonomous units have durations which are one of a group comprising fixed predetermined durations and durations determined by changes in said channel bandwidth.

Preferably, said stream selector is operable to select a combination of said streams in succession said combination being chosen to produce an average stream rate over a period of time which matches said channel bandwidth.

Preferably, said bandwidth of said channel is liable to vary dynamically and wherein said stream selector is operable to repeat said matching throughout said streaming operation.

Preferably, said bandwidth of said channel is liable to vary dynamically and wherein said stream selector is operable to repeat said matching throughout said streaming operation.

Preferably, said autonomous units match each other across said plurality of streams, thereby to enable switching between said streams.

Webgroup CZ a.s. Ex. 1002, Page 1049 of 1406

Preferably, said data file is arranged in said streams in a compressed media format utilizing reference frames and delta frames and wherein each autonomous unit is self-contained in respect of reference frames.

In an embodiment, said channel is a cellular telephone channel. Alternatively, said channel is an Internet channel.

Preferably, the predetermined other rate is different for each stream. In another embodiment, the predetermined other rate is identical for a set of said streams, each stream in said set being assigned a different balance between quality and speed of said media.

A preferred device comprises a plurality of media types, said predetermined other rate being identical for a set of said streams, each stream in said set being assigned a different balance between quality of said different media types.

Preferably, streams in said set are selectable by a signal received from said channel.

Preferably, streams in said set are selectable by a signal received from said channel.

An embodiment comprises a detector for detecting a change in the bandwidth of said at least one channel and operable to request a corresponding change in the data rate, and wherein the device is operable, upon receipt of said request, to set a delay, and to issue a reference frame within said delay.

The device preferably issues said reference frame at the end of said delay.

The device alternatively issues said reference frame at the occurrence of a largest detected interframe change within the time delay.

According to a second aspect of the invention there is provided a multiple stream creator for receiving a data stream at a first data rate and converting said data stream into a plurality of data streams at a plurality of data rates, said creator comprising an input for receiving said data stream at said first data rate, and a plurality of outputs, each operable to receive said data stream at said first rate and to output said data stream at a predetermined rate individually set for each output as a series of autonomous units having a duration, and wherein said duration is one of a group comprising a fixed predetermined duration and a duration dynamically changeable in accordance with bandwidth conditions in a transmission channel.

Preferably said outputs each comprise data buffers.

Webgroup CZ a.s. Ex. 1002, Page 1050 of 1406

The multiple stream creator preferably comprises a data stream processor for processing said data stream received at said first rate into said plurality of autonomous units, said autonomous units being synchronized blocks, thereby allowing said output streams to be mixed in said transmission channel to produce continuously usable output.

Preferably, said received data stream is in an uncompressed data format and said data is compressed into a compressed data format independently for each one of said output data streams.

According to a third aspect of the invention there is provided a method of sending a datastream over a variable bandwidth channel comprising modifying a quantity of data to be injected into the channel to accord with a measured capacity of the channel, said method comprising the steps of

compressing the datastream, using an algorithm having compression parameters, to produce a plurality of compressed datastreams each comprising reference frames and delta frames, each compressed datastream produced by using the algorithm together with different parameters, and

synchronizing reference frames between the compressed datastreams so that combinations of said compressed datastreams can be sent via said channel.

Preferably, said step of synchronizing reference frames is carried out at intervals determined by a dynamic status of said channel bandwidth.

Alternatively or additionally, said step of synchronizing reference frames is carried out at predetermined intervals.

Alternatively or additionally, said combination of said compressed datastreams is selected substantially dynamically to match the measured capacity of the channel.

Preferably, a change in bandwidth of a channel causes a request for commencement of a new autonomous unit, and wherein said request causes initiation of measurement of a time delay, and wherein a new autonomous unit is commenced within said time delay.

Preferably, the new autonomous unit is commenced at the end of said time delay.

Preferably, the step is provided of determining the largest delta frame during the time delay and sending a reference frame, to initiate said new autonomous unit, in place of said determined largest delta frame.

Webgroup CZ a.s. Ex. 1002, Page 1051 of 1406

According to a fourth aspect of the present invention there is provided a tool for controlling receipt of media file data over a network, wherein said media file data is available at a plurality of quality levels, the tool comprising a quality selector to enable a user to select between said different quality levels for receipt.

Preferably, said media file comprises a plurality of data groups and each quality level is a different balance between quality levels of the plurality of data groups.

Preferably, said quality selector comprises a slider operable to be moved along a scale, the position of the slider on the scale indicating a quality level.

Brief Description of the Drawings

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings, in which:

Fig. 1 is a generalized diagram showing a data source sending data to a series of targets over a variable bandwidth network,

Fig. 2 is a generalized block diagram showing a first embodiment of the present invention in which feedback concerning available bandwidth within a channel is used to modify parameters governing compression of the datastream,

Fig. 3 is a generalized block diagram showing a second embodiment of the present invention in which a series of compressed datastreams are continually created and are selected for use in individual channels according to measured parameters of the channel,

Fig. 4 is a generalized block diagram showing the channel manager and part of a downlink manager of Fig. 3 in greater detail,

Fig. 5 is a generalized block diagram showing a third embodiment of the present invention in which the user is able to set a quality level of the data that is being sent,

Fig. 6 is a generalized schematic diagram of a quality level selection tool for use by a user in selecting a quality level in the embodiment of Fig. 5, and

Fig. 7 is a generalized schematic diagram of another quality level selection tool for use with the device of Fig. 5.

Webgroup CZ a.s. Ex. 1002, Page 1052 of 1406

Description of the Preferred Embodiments

Reference is now made to Fig. 1, which is a generalized diagram showing a data source 10 sending data to a series of targets 12.1..12.n over a variable bandwidth network 14. The network may be a cellular telephone network or the Internet or like wide area data network or a combination. In both cases, the bandwidth of the data network is variable. In all cases the larger the number of users the lower the bandwidth per user, and radio-based networks may also suffer from reduced bandwidth due to environmental conditions. Furthermore, in the case of cellular telephone networks, events such as handover between two base stations may also affect the available bandwidth.

Data is generally compressed before sending over the channel. The level of compression may be preselected to accord with known or likely channel capabilities, as described in the introduction. However such a solution has to concentrate on the lower margins of available bandwidth and thus fails to make full use of higher bandwidth levels when available. Conversely, solutions which send datastreams at higher data rates and do not take the lower bandwidth levels into account lead to unacceptable breaks and delays in performance at the receiving end.

Reference is now made to Fig. 2 which is a generalized block diagram showing a first embodiment of the present invention in which feedback concerning available bandwidth within a channel is used to modify parameters governing compression of a datastream.

A multimedia datastream is received from a source 20 such as a host or server. The datastream may be a video datastream and may be in uncompressed or barely compressed format, for example AVI or MPEG1. The datastream is passed to a compression unit 22 which compresses the data into a very low bit-rate stream using compression parameters. A typical format that may be used for the very low bit-rate stream is MPEG 4 which uses a system based on reference frames and delta frames to compress the image part of the video data. H.263 is another typical format that may be used. A video frame is selected as a reference frame and encoded in its entirety. Then a series of subsequent frames are selected, but for each of these frames, the only data that is encoded is that which has changed with respect to the previous frame. The encoded changes form what is known as the delta frame.

Whichever of the available compression formats are used, compression is governed by a series of parameters 24. This allows the compression level to be raised

Webgroup CZ a.s. Ex. 1002, Page 1053 of 1406

or lowered depending on the data rate required and the quality of picture desired. A greater level of compression gives a lower quality of data at a lower data rate and a lower level of compression gives a higher quality of data at a higher data rate.

In the embodiment of Fig. 2 a channel capacity measurement 26 is received from a channel 28 over which the transmission occurs. The measurement may be received from a receiving client who simply reports the received data rate. If the received data rate is reported to be lower than the rate at which data is being sent then it is assumed that data is being produced too fast for the channel and the parameters 24 are altered to increase the compression level until the data output rate is the same as the channel rate. Conversely, if the data rate rises at the receiving end, the parameters 24 may be altered to reduce the compression level and increase the output data rate.

Reference is now made to Fig. 3, which is a generalized block diagram showing a second embodiment of the present invention in which a series of compressed datastreams are continually created and are selected for use in individual channels according to measured parameters of the channel. Parts that are the same as those mentioned in previous embodiments are given the same reference numerals and are not referred to again except as necessary for an understanding of the present embodiment.

In the embodiment of Fig. 3, an input datastream is received from a source 20 as before. The stream is passed to a channel manager 30, which compresses the input datastream. However, instead of compressing it once only, it compresses it into a plurality of output data streams, each one using different compression parameters so as to produce a plurality of streams each having a different data rate. The various streams are then passed to one or more downlink managers 32.1...32.n, each of which is able to manage a limited number of channels 28 for sending output data to a limited number of targets 34. Each target 34 is associated with a client 36, typically client software located at the target 34, which is able to send back, to the downlink manager 32, feedback data such as the received channel rate.

The downlink manager 32 simply obtains the received channel rate from the client 36 and mixes the various streams from the channel manager to produce an average stream rate which matches the channel rate as closely as possible. For example if the received channel rate is 39.5 kbits/sec and the downlink manager has available a 35 kbits/sec stream and a 45 kbits/sec stream then the downlink manager

Webgroup CZ a.s. Ex. 1002, Page 1054 of 1406

will attempt to mix the two streams in suitable proportions to match the 39.5 kbits/sec channel. Thus the target 36 may receive a continuous stream of data, the quality of the channel influencing only the quality of the data and not the continuity.

It will be recalled that the compression systems in use include reference and delta frame style compression. Such compression systems, when used to produce streams at different data rates, do not produce delta frames which are interchangeable between the different data rates. Thus in order to create streams that are interchangeable, it is preferable to arrange all of the streams as a series of self-contained packets of given time duration. Each of the packets is self-contained in that it begins with a reference frame and hence does not depend on previously transmitted data. Thus the target is able to use consecutive packets from different streams without any data discontinuity.

The self-contained units are preferably of relatively short duration. The shorter the duration the better the system is able to follow dynamically changes in the bandwidth of the connection. On the other hand, since each unit must start with a reference or key frame, and such frames are very costly in bandwidth since they must be transmitted in full, the use of short self-contained units itself increases the required bandwidth. A compromise unit length of less than ten seconds, preferably 3, 5 or 7 seconds, is preferred.

In an alternative embodiment the length of the self-contained unit is itself allowed to vary dynamically in accordance with circumstances. When the downlink manager 32 detects a significant change in the channel bandwidth it issues a request for a new data rate from the channel manager 30. Alternatively, a new target may be requesting the data feed. The channel manager 30 initiates a time delay when a first request is received, the delay being less than ten seconds, as discussed above, and at the end of the delay starts new self-contained units at all data rates. Thus dynamic following of changes in bandwidth is provided whilst transmitting the minimum possible number of key or reference frames. If no request is received, then the system continues to use delta frames as long as it is practical.

In a variation of the above, instead of waiting to the end of the time delay, the channel manager first of all looks ahead at the approaching data stream and checks whether there is a reference frame approaching during the time delay period in any case. If so, no further action is needed. If there is no reference frame then the channel manager looks ahead to find the biggest delta frame, representing the biggest

Webgroup CZ a.s. Ex. 1002, Page 1055 of 1406

instantaneous change in the picture, over the delay time period. A reference frame is then inserted in place of the identified largest delta frame. Thus, the insertion of a full reference frame is optimized to the data.

Reference is now made to Fig. 4 which is a generalized block diagram showing the channel manager 30 and a part of a downlink manager 32 of Fig. 3 in greater detail. Parts that are the same as those mentioned in previous embodiments are given the same reference numerals and are not referred to again except as necessary for an understanding of the present embodiment.

As shown in Fig. 4, the channel manager 30 comprises a series of compression units 40.1, 40.2, 40.3, etc. Each of these compression units is preferably operative to compress an input signal received from source 20, using a different compression parameter or set of compression parameters to produce an output having a different data rate. Each compression unit is followed by a buffer 41. The buffer 41 may be used to arranged the compressed data into packets of fixed time duration.

The downlink manager 32 comprises a series of selector switches 42, one for each channel being managed. For the sake of simplicity, only one such switch 42 is shown in the figure. The switch 42 receives each one of the data streams produced by the source 20 and selects one of them at any given time to be sent to the channel 28. Selection is carried out based on a channel capacity measurement 44, which is received from the client 36.

Reference is now made to Fig. 5, which is a generalized block diagram showing a third embodiment of the present invention in which the user is able to set a quality level of the data that is being sent. Parts that are the same as those mentioned in previous embodiments are given the same reference numerals and are not referred to again except as necessary for an understanding of the present embodiment. As described above, compression parameters are altered in order to change the data rate. Generally speaking, there are numerous parameters that can be set in order to alter the data rate, and there are numerous combinations of these parameters that can give the same data rate. For example, parameters that may be altered include:

the extent of image compression within an individual frame,

the number of frames per second to be transmitted,

the proportion of reference frames to delta frames, and

a balance between compression levels of different parts of the data – for example video data includes both sound and image. It is possible to increase a level

Webgroup CZ a.s. Ex. 1002, Page 1056 of 1406

of compression to the image and to decrease a level of compression to the sound or vice versa.

In Fig. 5, part of a channel manager 30 is shown as well as a switch 42 of a downlink manager. In the channel manager of the embodiment of Fig. 5, a series of data compressors 50 are provided for each required data rate. The data compressors are labeled high, medium and low, although in fact they are different compromises between compression parameters. For example "high" may indicate high image quality but low frame rate, whereas "low" may indicate low image quality but high frame rate. The selector switch 48 is the same as in the previous embodiment except that it now chooses channels based on two different items of information. One item of information is the received channel rate 44, which selects the data rate as before. The other item of information is a data quality request which is received from the target. This selects, within the given data rate, between the different quality levels.

Reference is now made to Fig. 6, which is a generalized schematic diagram of a quality level selection tool 60 for use by a user in selecting a quality level in the embodiment of Fig. 5. The selection tool 60 comprises a simple longitudinal bar 62 which may be marked with labels and numbers, and a slider 64 for moving along the bar 62. The bar shown in Fig, 6 indicates that the user may select different compromises between sound quality and image quality.

Reference is now made to Fig. 7, which is a generalized schematic diagram of another quality level selection tool 70 for use by a user in selecting a quality level in the embodiment of Fig. 5. The selection tool 70 is likewise in the form of a bar and slider but this time the choice is between high quality images at a low frame rate (marked "still") and low quality images at a high frame rate (marked "motion"). It will be appreciated that a low bandwidth "high" may yield a lower image quality than a high bandwidth "low" and vice versa.

Embodiments of the present invention thus provide a system and method in which the measured received data level of a channel is used to select a transmitted data rate so that full advantage may be taken of fluctuating channel capacity levels to send the highest possible quality multimedia data.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention

Webgroup CZ a.s. Ex. 1002, Page 1057 of 1406

which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined by the appended claims and includes both combinations and subcombinations of the various features described hereinabove as well as variations and modifications thereof which would occur to persons skilled in the art upon reading the foregoing description.

Webgroup CZ a.s. Ex. 1002, Page 1058 of 1406

Claims

1. A device for streaming of media file data to be sent over at least one channel having a dynamically variable bandwidth, comprising

an input for receiving media file data at a first rate,

a multiple stream creator for creating a plurality of streams of said media file data, each stream compressed to predetermined other rates, each stream comprising a series of autonomous compressed data units which are mutually compatible, and

a stream selector for dynamically matching a bandwidth of the channel to rates of said streams to send said data file as a combination of said autonomous units from said streams via said channel,

wherein said autonomous units have durations which are one of a group comprising fixed predetermined durations and durations determined by changes in said channel bandwidth.

2. A device according to claim 1, wherein said stream selector is operable to select a combination of said streams in succession said combination being chosen to produce an average stream rate over a period of time which matches said channel bandwidth.

3. A device according to claim 1, wherein said bandwidth of said channel is liable to vary dynamically and wherein said stream selector is operable to repeat said matching throughout said streaming operation.

4. A device according to claim 2, wherein said bandwidth of said channel is liable to vary dynamically and wherein said stream selector is operable to repeat said matching throughout said streaming operation.

5. A device according to claim 1, wherein said autonomous units match each other across said plurality of streams, thereby to enable switching between said streams.

6. A device according to claim 5, wherein said data file is arranged in said streams in a compressed media format utilizing reference frames and

Webgroup CZ a.s. Ex. 1002, Page 1059 of 1406

delta frames and wherein each autonomous unit is self-contained in respect of reference frames.

7. A device according to claim 1, wherein said channel is a cellular telephone channel.

8. A device according to claim 1, wherein said channel is an Internet channel.

9. A device according to claim 1, said predetermined other rate being different for each stream.

10. A device according to claim 1, said predetermined other rate being identical for a set of said streams, each stream in said set being assigned a different balance between quality and speed of said media.

11. A device according to claim 1, said media file comprising a plurality of media types, said predetermined other rate being identical for a set of said streams, each stream in said set being assigned a different balance between quality of said different media types.

12. A device according to claim 10, said streams in said set being selectable by a signal received from said channel.

13. A device according to claim 11, said streams in said set being selectable by a signal received from said channel.

14. A device according to claim 1, comprising a detector for detecting a change in the bandwidth of said at least one channel and operable to request a corresponding change in the data rate, and wherein the device is operable, upon receipt of said request, to set a delay, and to issue a reference frame within said delay.

Webgroup CZ a.s. Ex. 1002, Page 1060 of 1406

15. A device according to claim 14, operable to issue said reference frame at the end of said delay.

16. A device according to claim 14, operable to issue said reference frame at the occurrence of a largest detected interframe change within the time delay.

17. A multiple stream creator for receiving a data stream at a first data rate and converting said data stream into a plurality of data streams at a plurality of data rates, said creator comprising an input for receiving said data stream at said first data rate, and a plurality of outputs, each operable to receive said data stream at said first rate and to output said data stream at a predetermined rate individually set for each output as a series of autonomous units having a duration, and wherein said duration is one of a group comprising a fixed predetermined duration and a duration dynamically changeable in accordance with bandwidth conditions in a transmission channel.

18. A multiple stream creator according to claim 17, wherein said outputs each comprise data buffers.

19. A multiple stream creator according to claim 17, comprising a data stream processor for processing said data stream received at said first rate into said plurality of autonomous units, said autonomous units being synchronized blocks, thereby allowing said output streams to be mixed in said transmission channel to produce continuously usable output.

20. A multiple stream creator according to claim 17, wherein said received data stream is in an uncompressed data format and wherein said data is compressed into a compressed data format independently for each one of said output data streams.

21. A method of sending a datastream over a variable bandwidth channel comprising modifying a quantity of data to be injected into the channel to accord with a measured capacity of the channel, said method comprising the steps of

Webgroup CZ a.s. Ex. 1002, Page 1061 of 1406

compressing the datastream, using an algorithm having compression parameters, to produce a plurality of compressed datastreams each comprising reference frames and delta frames, each compressed datastream produced by using the algorithm together with different parameters, and

synchronizing reference frames between the compressed datastreams so that combinations of said compressed datastreams can be sent via said channel.

22. A method according to claim 21, wherein said step of synchronizing reference frames is carried out at intervals determined by a dynamic status of said channel bandwidth.

23. A method according to claim 21, wherein said step of synchronizing reference frames is carried out at predetermined intervals.

24. A method according to claim 21, wherein said combination of said compressed datastreams is selected substantially dynamically to match the measured capacity of the channel.

25. A method according to claim 22, wherein a change in bandwidth of a channel causes a request for commencement of a new autonomous unit, and wherein said request causes initiation of measurement of a time delay, and wherein a new autonomous unit is commenced within said time delay.

26. A method according to claim 25, wherein said new autonomous unit is commenced at the end of said time delay.

27. A method according to claim 25, comprising the step of determining the largest delta frame during the time delay and sending a reference frame, to initiate said new autonomous unit, in place of said determined largest delta frame.

28. A tool for controlling receipt of media file data over a network, wherein said media file data is available at a plurality of quality levels, the

Webgroup CZ a.s. Ex. 1002, Page 1062 of 1406

tool comprising a quality selector to enable a user to select between said different quality levels for receipt.

29. A tool according to claim 28, wherein said media file comprises a plurality of data groups and wherein each quality level is a different balance between quality levels of the plurality of data groups.

30. A tool according to claim 28, wherein said quality selector comprises a slider operable to be moved along a scale, the position of the slider on the scale indicating a quality level.

31. A device for streaming of media file data to be sent over at least one channel having a dynamically variable bandwidth, substantially as hereinbefore described with reference to the accompanying drawings.

32. A multiple stream creator for receiving a data stream at a first data rate and converting said data stream into a plurality of data streams at a plurality of data rates, substantially as hereinbefore described with reference to the accompanying drawings.

33. A method of sending a datastream over a variable bandwidth channel comprising modifying a quantity of data to be injected into the channel to accord with a measured capacity of the channel, substantially as hereinbefore described with reference to the accompanying drawings.

34. A tool for controlling receipt of media file data over a network, substantially as hereinbefore described with reference to the accompanying drawings.

Webgroup CZ a.s. Ex. 1002, Page 1063 of 1406

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Application No: GB 0023062.3
Claims searched: 1-27, 31-33
Examiner: John Cullen
Date of search: 6 November 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4P (PDCFM, PDCFP, PDCFX, PF)

Int Cl (Ed.7): H03M 7/30; H04L 1/00; H04N 7/26, 7/32

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A, E	EP 1049074 A1	(LUCENT) See Abstract, Figs. 2 and 4, and paragraphs 14-18 and 28-35.	---
A, E	WO 00/72601 A2	(BIGBAND NETWORKS) See Figs. 1-4, 6, 7 and 9, line 26 of p15 to line 24 of p17 and line 10 of p21 to line 2 of p22.	---
A	WO 99/00984 A1	(CITRIX) See Fig. 15 and line 13 of p30 to line 14 of p33.	---
A	WO 98/09387 A1	(ERICSSON) See Figs. 3A, 6 and 7, and line 35 of p14 to line 26 of p15.	---
A	US 5847760	(OPTIBASE) See whole document.	---

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

PATENT ABSTRACTS OF JAPAN

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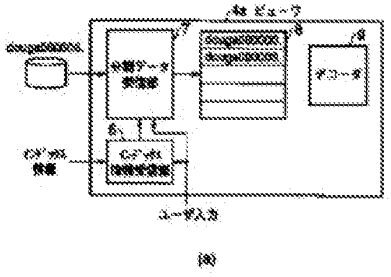
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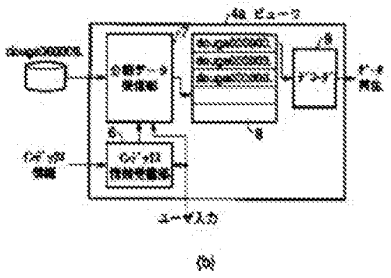
(71)Applicant : TOSHIBA CORP
(72)Inventor : CHIJITANI MASAHIDE

(54) MOVING IMAGE DATA REPRODUCING DEVICE, MOVING IMAGE DATA DIVIDING DEVICE AND RECORDING MEDIUM READABLE BY COMPUTER IN WHICH PROGRAM IS RECORDED

(57)Abstract:
PROBLEM TO BE SOLVED: To enable random access to moving image data without changing a server function.
SOLUTION: A moving image data reproducing device with an index information receiving means 6 to receive index information to be generated by relating plural pieces of divided data to be obtained by deviding the moving image data to its reproduction time information by requesting the information to a server, a divided data receiving means 7 to receive the divided data related to reproduction time information at the reproduction time information to which starting of reproducing is instructed and afterward by successively requesting the information to the server by referring to the index information received by the index information receiving means 6, a storage means 9 to store the divided data received by the divided data receiving means 7 and a reproducing means to successively reproduce the divided data stored in the storage means 9 according to the index information received by the index information receiving means 6 is provided.



(a)



(b)

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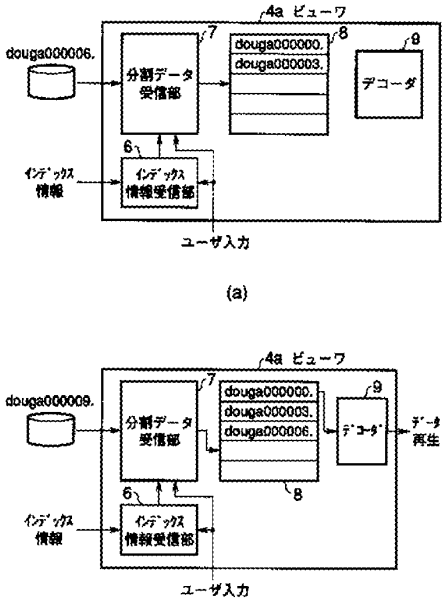
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(71)出願人　000003078
株式会社東芝
神奈川県川崎市幸区堀川町72番地
(72)発明者　千々谷　眞英
東京都府中市東芝町１番地　株式会社東芝府中工場内
(74)代理人　100058479
弁理士　鈴江　武彦　（外６名）

Ｆターム(参考)　5C064 BA07 BB10 BC16 BC20 BC27 BD16

(54)【発明の名称】　動画像データ再生装置及び動画像データ分割装置並びにプログラムを記録したコンピュータ読み取り可能な記録媒体

(57)【要約】
【課題】サーバの機能を変更することなく、動画像データのランダムアクセスを可能にする。
【解決手段】動画像データが分割されて得られる複数の分割データとその再生時刻情報とを関連付けて生成されるインデックス情報を、サーバに要求して受信するインデックス情報受信手段と、当該インデックス情報受信手段に受信されたインデックス情報を参照し、再生開始を指示された再生時刻情報以降の再生時刻情報に関連付けられた分割データをサーバに順次要求して受信する分割データ受信手段と、当該分割データ受信手段に受信された分割データを記憶する記憶手段と、インデックス情報受信手段に受信されたインデックス情報にしたがって、記憶手段に記憶されている分割データを順次再生させる再生手段とを具備した動画像データ再生装置を提供する。



1

【特許請求の範囲】

【請求項１】　動画像データが分割されて得られる複数の分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報を、サーバに要求して受信するインデックス情報受信手段と、

当該インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられた分割データを、サーバに順次要求して受信する分割データ受信手段と、

当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、

前記記憶手段に記憶されている分割データを順次再生させる再生手段とを具備したことを特徴とする動画像データ再生装置。

【請求項２】　請求項１記載の動画像データ再生装置において、

前記分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定手段を付加し、

前記分割データ受信手段は、当該時間推定手段によって推定された時間とほぼ同じ時間分の分割データが前記記憶手段に記憶されていない場合に、前記インデックス情報にしたがってサーバに分割データを要求し、

前記再生手段は、前記時間推定手段によって推定された時間とほぼ同じ時間分の分割データが前記記憶手段に記憶された場合に、この記憶手段に記憶されている分割データの再生を開始することを特徴とする動画像データ再生装置。

【請求項３】　動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複数の種別が生成されている場合に、この複数種別の各分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報を、サーバに要求して受信するインデックス情報受信手段と、

前記分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定手段と、

当該時間推定手段によって推定された時間に基づいて、要求する分割データの種別を選択する分割データ選択手段と、

前記インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられ、かつ前記分割データ選択手段によって選択されている種別の分割データを、サーバに順次要求して受信する分割データ受信手段と、

当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、

前記記憶手段に記憶されている分割データを順次再生させる再生手段とを具備したことを特徴とする動画像データ再生装置。

2

【請求項４】　請求項３記載の動画像データ再生装置において、

前記分割データ受信手段は、前記時間推定手段に推定された時間とほぼ同じ時間分の分割データが前記記憶手段に記憶されていない場合に、前記データ選択手段によって選択されている種別の分割データを、前記インデックス情報にしたがって前記サーバに要求し、

前記再生手段は、前記時間推定手段によって推定された時間とほぼ同じ時間分の分割データが前記記憶手段に記憶された場合に、この記憶手段に記憶されている分割データの再生を開始することを特徴とする動画像データ再生装置。

【請求項５】　動画像データを複数に分割して複数の分割データを生成し、かつ前記複数の分割データとこの分割データの再生時刻情報とを関連付けたインデックス情報を生成する動画像データ分割装置。

【請求項６】　動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複数の種別を生成し、この複数の種別の各分割データをそれぞれの再生時刻情報に関連付けたインデックス情報を生成する動画像データ分割装置。

【請求項７】　コンピュータに、

動画像データが分割されて得られる複数の分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報を、サーバに要求して受信するインデックス情報受信機能と、

当該インデックス情報受信機能によって受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられた分割データを、サーバに順次要求して受信する分割データ受信機能と、

当該分割データ受信機能によって受信された分割データを記憶する記憶機能と、

前記記憶機能によって記憶されている分割データを順次再生させる再生機能とを実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

【請求項８】　請求項７記載のコンピュータ読み取り可能な記録媒体において、

前記分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定機能を付加し、

前記分割データ受信機能は、当該時間推定機能によって推定された時間とほぼ同じ時間分の分割データが前記記憶機能によって記憶されていない場合に、前記インデックス情報にしたがってサーバに分割データを要求し、

前記再生機能は、前記時間推定機能によって推定された時間とほぼ同じ時間分の分割データが前記記憶機能によって記憶された場合に、この記憶機能によって記憶され

ている分割データの再生を開始することを特徴とするコンピュータ読み取り可能な記録媒体。

【請求項９】　コンピュータに、
動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複数の種別が生成されている場合に、この複数種別の各分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報をサーバに要求して受信するインデックス情報受信機能と、
前記分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定機能と、
当該時間推定機能によって推定された時間に基づいて、要求する分割データの種別を選択する分割データ選択機能と、
前記インデックス情報受信機能によって受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられ、かつ前記分割データ選択機能によって選択されている種別の分割データを、サーバに順次要求して受信する分割データ受信機能と、
当該分割データ受信機能によって受信された分割データを記憶する記憶機能と、
前記記憶機能によって記憶されている分割データを順次再生させる再生機能とを実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

【請求項１０】　請求項９記載のコンピュータ読み取り可能な記録媒体において、
前記分割データ受信機能は、前記時間推定機能によって推定された時間とほぼ同じ時間分の分割データが前記記憶機能に記憶されていない場合に、前記データ選択機能によって選択されている種別の分割データを、前記インデックス情報にしたがって前記サーバに要求し、
前記再生機能は、前記時間推定機能によって推定された時間とほぼ同じ時間分の分割データが前記記憶機能によって記憶された場合に、この記憶機能によって記憶されている分割データの再生を開始することを特徴とするコンピュータ読み取り可能な記録媒体。

【請求項１１】　コンピュータに、
動画像データを複数に分割して複数の分割データを生成し、かつ前記複数の分割データとこの分割データの再生時刻情報とを関連付けたインデックス情報を生成する機能を実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

【請求項１２】　コンピュータに、
動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複数の種別を生成し、この複数の種別の各分割データをそれぞれの再生時刻情報に関連付けたインデックス情報を生成する機能を実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

【請求項１３】　サーバに記憶されている動画像データをクライアントに配信する動画像データ配信システムにおいて、
前記サーバは、
前記動画像データが分割されて得られる複数の分割データと、この各分割データとそれぞれの再生時刻情報とを関連付けたインデックス情報とを保持し、
前記クライアントは、
前記インデックス情報を前記サーバに要求して受信するインデックス情報受信手段と、
当該インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられた分割データを前記サーバに順次要求して受信する分割データ受信手段と、
当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、
前記記憶手段に記憶されている分割データを順次再生させる再生手段とを備えることを特徴とする動画像データ配信システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、サーバの構成及び機能を変更することなく、動画像データのランダムアクセスを可能にするための動画像データ再生装置及び動画像データ分割装置並びにプログラムを記録したコンピュータ読み取り可能な記録媒体に関する。

【０００２】

【従来の技術】従来の動画像データ配信システムは、主にクライアントとＷＷＷサーバとから構成される。この従来の動画像データ配信システムでは、まずクライアントからＷＷＷサーバに再生を求める動画像データ（動画コンテンツ）の伝送要求が送信される。

【０００３】ＷＷＷサーバは各種データを保持しており、このデータの中から要求された動画像データを選択し送信する。

【０００４】送信された動画像データは、伝送要求を送信したクライアントに受信され、ストリーム再生がなされる。

【０００５】このような従来の動画像データ配信システムにおいて、クライアント及びＷＷＷサーバがインターネットを介して接続されている場合には、一般的にＨＴＴＰプロトコルにより動画像データの伝送がなされる。

【０００６】ここで、例えば動画像データの再生を求めるユーザの中には、動画像データの途中位置からの再生（以下、「ランダムアクセス」という）を求める者もいる。

【０００７】従来の動画像データ配信システムによってランダムアクセスを実現するためには、ランダムアクセスを可能とする専用のＨＴＴＰサーバをこの動画像デー

タ配信システムに適用する必要がある。

【０００８】また、別の手法として、ランダムアクセスを可能とする専用のプログラムであるＣＧＩ（Common Gateway Interface）をWWWサーバに実装させる必要がある。

【０００９】この専用のＨＴＴＰサーバや、ＣＧＩを実装したWWWサーバは、動画像データを再生するクライアントから独自の要求を受信し、動画像データを指定された位置からＨＴＴＰプロトコルによって送信する機能を持つ。

【００１０】

【発明が解決しようとする課題】しかしながら、上記のように、ランダムアクセスを可能とするために専用のＨＴＴＰサーバを用いたり、サーバにＣＧＩを実装する方法においては、従来の動画像データ配信システムのWWWサーバに手を加える必要があり、現状のインフラのままでは実現することができない。

【００１１】したがって、ランダムアクセスの実現、導入が困難であり、作業が複雑である。

【００１２】また、この従来の方法では、ランダムアクセスのための処理が主にサーバでなされるため、サーバの負荷が増加するという問題が生じる。特に、動画像データ配信システムが複数のクライアントを有する場合には、その傾向が強くなる。

【００１３】本発明は、以上のような実状に鑑みてなされたもので、サーバの構成や機能に手を加えることなく動画像データのランダムアクセスを可能とするための動画像データ再生装置及び動画像データ分割装置並びにプログラムを記録したコンピュータ読み取り可能な記録媒体を提供することを目的とする。

【００１４】

【課題を解決するための手段】本発明の骨子は、動画像データを複数の分割して分割データとし、この分割データにそれぞれの再生時間を示す再生時刻情報を関連づけてインデックス情報とし、このインデックス情報にしたがって分割データを順次再生する点にある。

【００１５】以下、本発明を実現するにあたって講じた具体的手段について説明する。

【００１６】第１の発明は、動画像データが分割されて得られる複数の分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報をサーバに要求して受信するインデックス情報受信手段と、当該インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられた分割データをサーバに順次要求して受信する分割データ受信手段と、当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、インデックス情報受信手段に受信されたインデックス情報の再生時刻情報にしたがって、記憶手段に記憶されている分割データを順次再生させる再生手段とを具備した動画像データ再生装置である。

【００１７】この第１の発明の動画像データ再生装置においては、再生開始を指示された再生時刻情報以降の分割データが順次受信されストリーム再生される。

【００１８】また、この動画像データ再生装置を適用する場合には、サーバは自己が保持するデータのうち要求されたデータを送信する機能を有していればよい。

【００１９】したがって、第１の発明においては、サーバに新しい構成や機能を付加することなく容易にランダムアクセスが実現される。

【００２０】また、ランダムアクセスを実現させるための処理が、サーバではなく動画像データ再生装置（クライアント）側によって実行されるため、サーバの負荷の増加を防止することができる。

【００２１】第２の発明は、第１の発明の動画像データ再生装置において、分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定手段を付加し、分割データ受信手段は、当該時間推定手段によって推定された時間とほぼ同じ時間分の分割データが記憶手段に記憶されていない場合に、前記インデックス情報にしたがってサーバに分割データを要求し、再生手段は、時間推定手段によって推定された時間とほぼ同じ時間分の分割データが記憶手段に記憶された場合に、この記憶手段に記憶されている分割データの順次再生を開始する動画像データ再生装置である。

【００２２】この第２の発明の動画像データ再生装置においては、分割データを要求してから受信するまでの間に再生されると推測される分割データが、記憶手段に保持される。

【００２３】したがって、この第２の発明においては、第１の発明と同様の作用効果に加えて、必要最低限の量の分割データが格納されしだい、動画像データの再生がなされるため、再生が開始されるまでの時間を最適化することができる。

【００２４】これにより、再生開始までの時間を短縮させることができる。

【００２５】また、次の分割データが要求されてから受信されるまでの間に必要な分割データは確保済みであるため、動画像データの再生が途切れることを防止することができる。

【００２６】さらに、分割データをサーバに要求してから受信するまでの時間が逐次測定され、この時間にしたがって再生可能な状態で記憶しておく分割データの量が決定される。

【００２７】ゆえに、回線の動的な負荷変動にも対応することができ、適切な量の分割データが確保される。

【００２８】したがって、スムーズなストリーム再生が可能となる。

【００２９】第３の発明は、動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複

数の種別が生成されている場合に、この複数種別の各分割データとそれぞれの再生時刻情報とを関連付けて生成されるインデックス情報をサーバに要求して受信するインデックス情報受信手段と、分割データの送信をサーバに要求してから、この分割データを受信するまでの時間を推定する時間推定手段と、当該時間推定手段によって推定された時間に基づいて、要求する分割データの種別を選択する分割データ選択手段と、インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられ、かつ分割データ選択手段によって選択されている種別の分割データをサーバに順次要求して受信する分割データ受信手段と、当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、インデックス情報受信手段に受信されたインデックス情報の再生時刻情報にしたがって、記憶手段に記憶されている分割データを順次再生させる再生手段とを具備した動画像データ再生装置である。

【００３０】この第３の発明の動画像データ再生装置においては、伝送速度の異なる複数種別の分割データのうち、回線の負荷変動を考慮して適した伝送速度の分割データが選択され受信される。

【００３１】したがって、回線の伝送速度が遅い場合には、高速伝送可能な分割データにより伝送がなされるため、再生すべきデータが未伝送となることを防止することができる。

【００３２】また、第１の発明と同様の作用により、サーバを変更することなく、ランダムアクセスが可能である。

【００３３】第４の発明は、第３の発明の動画像データ再生装置において、分割データ受信手段は、時間推定手段に推定された時間とほぼ同じ時間分の分割データが記憶手段に記憶されていない場合に、データ選択手段によって選択されている種別の分割データを、インデックス情報にしたがってサーバに要求し、再生手段は、時間推定手段によって推定された時間とほぼ同じ時間分の分割データが記憶手段に記憶された場合に、この記憶手段に記憶されている分割データの順次再生を開始する動画像データ再生装置である。

【００３４】この第４の発明の動画像データ再生装置においては、第３の発明と同様の作用効果に加えて、分割データをサーバに要求してから受信するまでの間の再生に必要と推測される分の分割データが記憶手段に保持される。

【００３５】したがって、先の第２の発明と同様の効果を得ることができる。

【００３６】第５の発明は、動画像データを複数に分割して複数の分割データを生成し、かつ前記複数の分割データとこの分割データの再生時刻情報とを関連付けたインデックス情報を生成する動画像データ分割装置である。

【００３７】この第５の発明の動画像データ分割装置を用いて複数の分割データ及びインデックス情報を作成してサーバに備え、第１又は第２の発明の動画像データ再生装置を用いることで、サーバの構成、機能に手を加えることなくランダムアクセスが可能となる。

【００３８】また、この動画像データ分割装置を用いることで、複数の分割データ及びインデックス情報を容易に作成できる。

【００３９】第６の発明は、動画像データが分割されて得られる複数の分割データについて伝送速度が異なる複数の種別を生成し、この複数の種別の各分割データをそれぞれの再生時刻情報に関連付けたインデックス情報を生成する動画像データ分割装置である。

【００４０】この第６の発明の動画像データ分割装置を用いて複数種別の各分割データ及びインデックス情報を作成してサーバに備え、第３又は第４の発明の動画像データ再生装置を用いることで、サーバの構成、機能に手を加えることなくランダムアクセスが可能となり、伝送にかかる時間を調節することができる。

【００４１】また、この動画像データ分割装置を用いることで、複数種別の分割データ及びインデックス情報を容易に作成できる。

【００４２】第７乃至第１２の発明は、それぞれ上記第１乃至第６の発明と同様の機能をコンピュータに実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体である。

【００４３】この第７乃至第１２の発明のようなプログラムを記録した記録媒体を用いることによって、上述した機能を有していない装置や、計算機においても、簡単に上述した機能を付加することができる。

【００４４】第１３の発明は、サーバに記憶されている動画像データをクライアントに配信する動画像データ配信システムにおいて、サーバは、動画像データが分割されて得られる複数の分割データと、この各分割データとそれぞれの再生時刻情報とを関連付けたインデックス情報とを保持し、クライアントは、インデックス情報をサーバに要求して受信するインデックス情報受信手段と、当該インデックス情報受信手段に受信されたインデックス情報にしたがって、再生開始を指示された再生時刻情報及びその後の再生時刻情報に関連付けられた分割データをサーバに順次要求して受信する分割データ受信手段と、当該分割データ受信手段によって受信された分割データを記憶する記憶手段と、インデックス情報受信手段に受信されたインデックス情報の再生時刻情報にしたがって、記憶手段に記憶されている分割データを順次再生させる再生手段とを備える動画像データ配信システムである。

【００４５】この第１３の発明の動画像データ配信システムにおいては、クライアントが先の第１の発明の動画

像データ再生装置と同様に機能する。

【００４６】これにより、第１の発明と同様の作用効果を得ることができる。

【００４７】なお、第２乃至第１２の発明も、この第１３の発明と同様に、動画像データ配信システムに適用可能である。

【００４８】

【発明の実施の形態】以下、図面を参照しながら本発明の実施の形態について説明する。

【００４９】（第１の実施の形態）本実施の形態においては、動画像データ（動画コンテンツ）を複数に分割した分割データと、この複数の分割データとそれぞれの再生時間情報を関連付けたインデックス情報とを用いることで、サーバを変更することなく動画像データのランダムアクセスを可能とする動画像データ配信システムについて説明する。

【００５０】図１は、本実施の形態に係る動画像データ配信システムの構成を示すブロック図である。

【００５１】この動画像データ配信システム１は、動画像データから分割データとインデックス情報とを生成するエンコーダ２と、内部の記憶装置３ａに各種データをファイル形式で記憶するサーバ３と、動画像データ再生用のビューワ４ａを有するクライアント４とから構成されている。

【００５２】この動画像データ配信システム１では、動画像データがスプライスポイントでファイル分割されており、ビューワ４ａがインデックス情報に基づいて好きな位置の分割データをサーバ３に要求し、受信する。

【００５３】以下、この動画像データ配信システム１の各構成要素について詳しく説明する。

【００５４】図２は、本実施の形態に係る動画像データ配信システム１に備えられるエンコーダ２の機能を示すブロック図である。

【００５５】このエンコーダ２は、動画エンコード時に、ビデオ等の動画素材からなる動画像データ（動画コンテンツ）を所定のスプライスポイント毎に分割して複数の分割データを生成する。また生成した各分割データには異なるファイル名を付けて出力する。この図２では、分割データのファイル名の例として「douga000000」、「douga000003」、「douga000006」等が示されている。

【００５６】なお、この各分割データは、ビューワ４ａ内の受信ページバッファの１ページ内に収まるサイズで生成される。

【００５７】さらに、このエンコーダ２は、各分割データのファイル名と、それぞれの再生時刻の情報とを関係付けてインデックス情報５を生成し、ファイル形式で出力する。

【００５８】図３は、本実施の形態に係る動画像データ配信システム１に備えられるサーバ３の構成を示すブロック図である。

【００５９】サーバ３は、主に記憶装置３ａと、サーバ本体３ｂとから構成される。

【００６０】サーバ本体３ｂは、記憶装置３ａに様々なデータを蓄積する機能と、クライアント４からの要求にしたがって記憶装置３ａの内容を読み出して送信する機能を有する。

【００６１】記憶装置３ａは、各種のデータを記憶し、ここではエンコーダ２によって生成された複数の分割データ及びインデックス情報５も記憶している。

【００６２】クライアント４は、図１で示すように、主にクライアント本体４ｂと、動画像データ再生装置として機能するビューワ４ａとから構成されており、クライアント本体４ｂ上でビューワ４ａが稼働する。

【００６３】図４は、本実施の形態に係る動画像データ配信システム１に備えられるビューワ４ａの機能を示すブロック図である。

【００６４】なお、図４（ａ）は再生開始前のバッファリング中の状態を示し、３ページ分の分割データがページバッファに格納されるまでの状態を示している。

【００６５】一方、図４（ｂ）は再生中の状態を示しており、１ページ分の分割データがデコーダに読み出されると、再びサーバ３から分割データが読み出される状態を示している。

【００６６】このビューワ４ａは、動画像データを再生する装置であり、インデックス情報受信部６、分割データ受信部７、ページバッファ８、デコーダ９から構成される。

【００６７】インデックス情報受信部６は、再生を求める動画像データの指定をユーザから入力する。また、指定された動画像データに関するインデックス情報５をサーバ３に要求し、この要求の応答としてサーバ３からインデックス情報５を受信して保持する。

【００６８】分割データ受信部７は、動画像データの再生開始位置となる再生時刻情報をユーザから入力する。また、インデックス情報受信部６のインデックス情報５を参照し、ユーザから入力された再生時刻情報以降の再生時刻情報に関連付けられているファイルの送信をサーバ３に要求する。この要求は、ページバッファ８に格納された分割データの量が一定量（ここでは３つとする）になるまで順次出力する。

【００６９】そして、この分割データ受信部７は、この要求の応答として分割データを順次受信し、ページバッファ８に出力する。

【００７０】ページバッファ８は、複数のページからなり、各ページ毎に一つの分割データをバッファリングする。また、各ページの内容を再生時刻順に並び替えて記憶する。さらに、デコーダ９によって読み出されたページ内の分割データを破棄し、次に入力される分割データを新規に確保する。

【００７１】デコーダ９は、ページバッファ８内に一定量の分割データが記憶されると、デコード処理を開始し、その後順次デコード処理を続ける。これにより滞りなく動画像データの再生がなされる。

【００７２】次に、上記のような構成を有する動画像データ配信システム１の動作について以下に説明する。

【００７３】まず、エンコーダ２によって動画像データが分割され、分割データ及びインデックス情報が生成され、サーバ３に記憶される。

【００７４】次に、再生を求める動画像データの指定及び再生を開始させる位置が、ユーザによってビューワ４ａに入力される。

【００７５】次に、ユーザに指定された動画像データから生成されたインデックス情報５が、ビューワ４ａのインデックス情報受信部６からサーバ３に要求され、受信される。

【００７６】この受信されたインデックス情報５には、動画像データの再生時刻情報に対して分割データのファイル名が記述されている。

【００７７】分割データ受信部７では、受信されたインデックス情報５に基づいて、再生を開始したい位置以降に対応付けられている分割データがサーバ３に要求され、受信される。

【００７８】受信された分割データは、ページバッファ８の各ページに格納され、再生される時刻順に並び替えられる。

【００７９】また、ページバッファ８において一定量のバッファリングがなされると、デコーダ９によってストリーム再生が開始される。

【００８０】ページバッファ８においては、分割データが１ページ分再生される度にそのデータが破棄されてページが空けられる。

【００８１】そして、分割データ受信部７において、未受信の次の分割データが、インデックス情報５に基づいて検索され、サーバ３に要求、受信され、再生が繰り返される以上説明したように、本実施の形態に係る動画像データ配信システム１においては、動画像データがスプライスポイントにおいてファイル分割されており、その状態がインデックス情報５に記述されている。

【００８２】また、ビューワ４ａが、このインデックス情報５を要求し、続いてこのインデックス情報５に記されている好きな位置から分割データを順次要求・受信し、再生する。

【００８３】したがって、ユーザの望む位置からの分割データが順次再生されるため、動画像データのランダムアクセスが可能となる。

【００８４】また、本実施の形態においては、サーバ３の機能はファイルを保持し、またこの保持されているファイルの中から要求されたファイルを送信するのみである。したがって、この動画像データ配信システム１を導入する場合にはサーバ３に新しい機能や作用を追加する必要がない。

【００８５】ゆえに、クライアント４側のビューワ４ａを備え、サーバ３に分割データとインデックス情報５とを格納するのみで、容易にランダムアクセスを実現することができる。

【００８６】さらに、ランダムアクセスを実現させるための処理が、サーバ３ではなくビューワ４ａによって実行されるため、クライアント４が複数存在してもサーバ３の負荷の増加を防止することができる。

【００８７】なお、本実施の形態に係る動画像データ配信システム１では、エンコーダ２の機能をクライアント４に実装させ、クライアント４がネットワークを介して分割データ及びインデックス情報５をサーバ３に格納するとしてもよい。

【００８８】また、本実施の形態においては、ビューワ４ａの機能をブラウザ等の機能として実現可能であり、サーバ３はＷＷＷサーバとすることができる。

【００８９】これにより、ブラウザで参照する動画コンテンツのランダムアクセスが可能となる。

【００９０】さらに、本実施の形態に係る動画像データ配信システム１では、クライアント４の台数を複数にすることができる。

【００９１】（第２の実施の形態）本実施の形態においては、第１の実施の形態に係る動画像データ配信システム１に備えられるビューワ４ａを変形したビューワについて説明する。

【００９２】先の第１の実施の形態においては、ビューワ４ａがサーバ３に分割データを要求してから受信するまでの時間がネットワークの回線の負荷に依存する。また、この回線の負荷は、様々な要因により時々刻々と変化する。

【００９３】先のビューワ４ａでは、伝送に要する時間や、回線の負荷による伝送速度の変化を吸収するために、動画像データの再生開始時に一定量分（しきい値を設定する）の分割データをバッファリングし、以後順次分割データを読み出している。

【００９４】この手法では、ビューワ４ａにバッファリングされる分割データの量を大きくすればその分だけ回線の負荷による遅延に対応可能となるが、その分再生開始までの待ち時間が長くなる。

【００９５】この再生開始までの待ち時間は、回線の負荷による遅延を吸収できる範囲で最小化されることが望ましい。したがって、バッファリングされる分割データの量も、回線負荷による伝送時間の変化に対応可能な範囲で最小化されることが望ましい。

【００９６】本実施の形態においては、分割データを要求してから受信するまでの時間を推定する。また、この推定された時間に基づいて、ページバッファに記憶しておく分割データの量を変更し、バッファリングされる分

割データの量を動的に最適化するビューワに関して説明する。

【００９７】図５は、本実施の形態に係るビューワの構成を示すブロック図であり、図４と同一の部分には同一の符号を付してその説明を省略し、ここでは異なる部分についてのみ詳しく説明する。

【００９８】このビューワ１０は、第１の実施の形態において説明したビューワ４ａの分割データ受信部７の機能を変更した分割データ受信部１１を備え、新規の構成として時間推定部１２を付加している。また、このビューワ１０は、第１の実施の形態と同様の動画像データ配信システム１に設置可能である。

【００９９】時間推定部１２は、分割データ受信部１１がサーバ３に分割データを要求し、この分割データを受信するまでの時間（以下、「要求受信時間」という）を測定する。

【０１００】なお、この測定された要求受信時間を厳密に用いると、バッファリングの際に余裕がなくなる。したがって、時間推定部１２は多少余分を持たせるために若干多めの値を要求受信時間として推定する。例えば実際の要求受信時間が０．５秒であってとしても、要求受信時間を０．７秒と推定し、設定する。

【０１０１】この時間推定部１２において、要求受信時間は、再生開始以降には分割データが要求されて受信される度に再推定され、更新される。

【０１０２】分割データ受信部１１は、先の第１の実施の形態で説明した分割データ受信部７と同様の処理を行うが、サーバ３から分割データを読み出す際の条件が異なっている。

【０１０３】再生開始前においては、この分割データ受信部１１は、ページバッファ８内の分割データの再生時間の合計が要求受信時間を超えるまで、サーバ３から分割データを受信する。

【０１０４】再生中においては、現在再生中の分割データに関連付けされている再生時刻情報に現状の要求受信時間を加算し、この加算値に該当する再生時刻情報に関連付けされた分割データを要求し、受信する。すなわち、例えば要求受信時間が０．７秒と設定されているとすると、０．７秒後に再生されることになる分割データを要求し、受信する。

【０１０５】上記のような構成を有するビューワ１０の動作について以下に説明する。

【０１０６】図６は、本実施の形態に係るビューワ１０の再生開始前までの動作を示すフローチャートである。

【０１０７】このビューワ１０においては、まずインデックス情報５がサーバ３から受信される（ｓ１）。

【０１０８】次に、このインデックス情報５とユーザの指定内容に基づいて、再生開始位置の分割データが要求される（ｓ２）。

【０１０９】次に、要求された分割データが受信され（ｓ３）、この際に余分を持たせた要求受信時間が推定される（ｓ４）。

【０１１０】次に、インデックス情報５を参照して、次の分割データが要求され（ｓ５）、受信される（ｓ６）。

【０１１１】そして、要求受信時間分の分割データが、ページバッファ８に受信されたか否かが判定され（ｓ７）、受信されている場合には、再生が開始される。

【０１１２】受信されていない場合には、再度次の分割データが要求され、受信される。

【０１１３】図７は、本実施の形態に係るビューワ１０の再生開始後の動作を示すフローチャートである。

【０１１４】再生開始後においては、ページバッファ８に空きがあり（ｔ１）、かつ要求受信時間分の分割データがページバッファ８にない場合に（ｔ２）、次の分割データが要求される（ｔ３）。

【０１１５】なお、この間にもページバッファ８内の分割データはデコードされ再生されている（ｔ４、ｔ９）。

【０１１６】次に、要求された分割データが受信され（ｔ５）、この分割データが最後の分割データか否かが判定される（ｔ６）。

【０１１７】最後の分割データの場合にはデコード処理及び再生が継続され（ｔ７）、処理が終了される。

【０１１８】最後の分割データでない場合には、余分を持たせた要求受信時間が推定され（ｔ８）、デコード処理の実行により動画像データが再生されつつ（ｔ９）、上記の処理が繰り返される。

【０１１９】以上説明したように、本実施の形態に係るビューワ１０においては、サーバに分割データを要求してから受信するまでの時間に多少の余分を加えた時間分の分割データがページバッファ８に蓄積される。

【０１２０】したがって、必要最小限の分割データのみが先行確保されるため、再生開始までの時間を最適化することができる。

【０１２１】（第３の実施の形態）動画像データの再生中に、ネットワークの負荷により回線の伝送速度が分割データの伝送速度未満となると、動画像データがビューワにおいて途切れなく再生されない場合がある。

【０１２２】本実施の形態においては、このような場合に、再生の途中からでも高速伝送可能な分割データに切り換えて伝送を行い、これによりスムーズな再生を維持する動画像データ配信システムについて説明する。

【０１２３】本実施の形態に係る動画像データ配信システムは、図１と同様の構成を有するが、エンコーダ及びビューワに特別の機能が付加されている。

【０１２４】本システムのエンコーダは、元の動画像データが同一であり、スプライスポイントも同一であるが同一の条件における伝送速度が異なる複数種別の分割データ及びインデックス情報を生成する。

【０１２５】また、本システムのビューワは、要求受信時間に基づいて分割データの種別を選択する機能を有する。

【０１２６】以下、図１の場合と異なる機能を有するエンコーダ、及びビューワについて詳しく説明する。

【０１２７】図８は、本実施の形態に係る動画像データ配信システムに備えられるエンコーダの機能を示すブロック図である。

【０１２８】このエンコーダ１３は、エンコード時に、１つの動画像データから伝送速度の異なる複数種別の分割データを生成し、出力する。

【０１２９】なお、以下においては伝送速度の異なる２つの種別の分割データが生成される場合を例として説明するが、３つ以上の種別が生成される場合も同様である。また、この２つの種別のうち、一方を標準分割データとし、この標準分割データよりも伝送速度の速いもう一方を高速分割データとして説明する。

【０１３０】さらに、このエンコーダ１３は、生成された標準分割データのファイル名と高速分割データのファイル名を再生時刻情報に関連付けたインデックス情報１４を生成し、ファイル形式で出力する。

【０１３１】すなわち、このインデックス情報１４には、各再生時刻情報に複数列の分割データのファイル名が関連付けられており、この各列は異なる伝送速度になるようにエンコードされた分割データ列である。

【０１３２】サーバは、標準分割データ、高速分割データ、インデックス情報をファイルとして記憶し、クライアントのビューワから要求されたファイルを送信する。

【０１３３】ビューワは、第２の実施の形態に係る図５のビューワ１０と同様の構成を有するが、分割データ受信部１１に分割データ選択機能が付加されている点が異なる。

【０１３４】この分割データ選択機能は、標準分割データを要求してから受信するまでの時間が、時間推定部１２で推定された要求受信時間よりも大幅に大きい場合に、ネットワークの伝送速度が分割データの伝送速度よりも遅いと判断する。この場合、分割データ選択機能は、インデックス情報１４中の分割データの参照を、標準分割データ列から高速分割データ列に切り換える。

【０１３５】一方、高速分割データを要求してから受信するまでの時間が、時間推定部１２で推定された要求受信時間よりもある程度小さくなった場合には、ネットワークの伝送速度が分割データの伝送速度よりも速くなったと判断し、インデックス情報１４中の分割データの参照を、高速分割データから伝送速度は遅いが画質のよい標準分割データ列に切り換える。

【０１３６】図９は、このビューワにおいて再生開始後に実行される処理を示すフローチャートである。

【０１３７】このビューワでは、動画像データがデコードされ、再生されるが（ｕ１）、それと並列に要求伝送時間分の分割データがページバッファ８に格納されているか否かが判定される（ｕ２）。

【０１３８】ここで、要求伝送時間分の分割データがページバッファ８に格納されていない場合には、この要求伝送時間が大きすぎるか否かが分割データ選択機能によって判定される（ｕ３）。

【０１３９】要求伝送時間が大きすぎる場合には、インデックス情報１４の分割データ列のうち伝送速度の速い方が選択される（ｕ４）。

【０１４０】一方、要求伝送時間が大きすぎない場合には、要求伝送時間が小さすぎないか否かが判定される（ｕ５）。

【０１４１】要求伝送時間が小さすぎる場合には、インデックス情報１４の分割データ列のうち伝送速度の遅い方が選択される（ｕ６）。

【０１４２】そして、この分割データ選択機能によって選択された種別における次の分割データが、サーバに要求される（ｕ７）。

【０１４３】この間にも、動画像データのデコード処理が実行され、再生がなされている（ｕ８）。

【０１４４】要求された分割データが受信されると（ｕ９）、余分を持たせた要求受信時間が推定される（ｕ１０）。

【０１４５】そして、要求する分割データがなくなり（ｕ１１）、かつ再生する分割データもなくなると（ｕ１２）、処理が終了する。

【０１４６】要求する分割データが存在する場合には、上記の処理が繰り返される。

【０１４７】以上説明したように、本実施の形態に係る動画像データ配信システムにおいては、異なる伝送速度の分割データが生成され、分割データを要求してから受信するまでの時間が長い場合には、ビューワは伝送速度の速い分割データを読み出す。

【０１４８】また、分割データの種別の切り替えは各分割データの読み出し毎に行うことができるため、動画像データの再生開始後においても伝送速度を変更することができ、ネットワークの状況変更に柔軟に対応することができる。

【０１４９】さらに、伝送速度に余裕のある場合には画質のよい分割データに変更することができる。

【０１５０】ゆえに、クライアントのビューワで動画像データを途切れなく、良好に再生することができる。

【０１５１】なお、上記の各実施の形態において説明したビューワ、エンコーダの機能は、コンピュータに実行させることのできるプログラムとして、例えば磁気ディスク（フロッピーディスク、ハードディスク等）、光ディスク（ＣＤ－ＲＯＭ、ＤＶＤ等）、半導体メモリなどの記録媒体に書き込んで適用したり、通信媒体により伝送して各種装置に適用することも可能である。このビューワやエンコーダの機能を実現するコンピュータは、記

録媒体に記録されたプログラムを読み込み、プログラムによって動作が制御されることにより、上述した処理を実行する。

【０１５２】

【発明の効果】以上詳記したように本発明では、動画像データを分解した複数の分割データと、この各分割データとそれぞれの再生時刻情報とを関連付けたインデックス情報をサーバに備える。

【０１５３】そして、動画像データ再生装置は、まずインデックス情報を受信し、再生を開始したい位置の時間再生情報以降に関連付けられている分割データを順次読み出す。

【０１５４】これにより、サーバの構成、機能に手を加えることなく、ランダムアクセスが可能になる。

【０１５５】また、このランダムアクセスのための処理がサーバではなく動画像データ再生装置によって実行されるため、ランダムアクセス実行によるサーバの負荷の増加を防止することができる。

【０１５６】さらに、本発明では、動画像データ再生装置に蓄える分割データの量を、分割データを要求してからこの分割データを受信するまでの時間分とすることで、再生開始までの待ち時間を最適化することができる。

【０１５７】さらに、本発明では、伝送速度の異なる複数種別の分割データを用意しておき、ネットワークの状況によって受信する分割データの種別を切り換えることで、ネットワークにおける負荷の影響を受けることなくスムーズな再生が可能となる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態に係る動画像データ配信システムの構成を示すブロック図。

＊【図２】同実施の形態におけるエンコーダの機能を示すブロック図。

【図３】同実施の形態に係る動画像データ配信システムに備えられるサーバの構成を示すブロック図。

【図４】同実施の形態に係る動画像データ配信システムに備えられるビューワの機能を示ブロック図。

【図５】本発明の第２の実施の形態に係るビューワの構成を示すブロック図。

【図６】同実施の形態に係るビューワの再生開始前までの動作を示すフローチャート。

【図７】同実施の形態に係るビューワの再生開始後の動作を示すフローチャート。

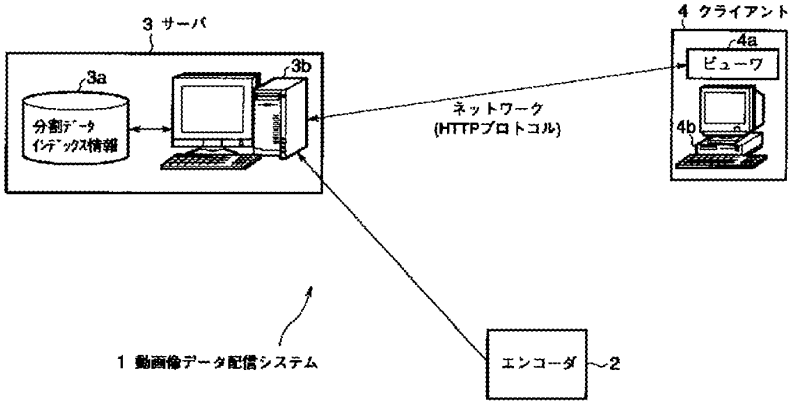
【図８】本発明の第３の実施の形態に係る動画像データ配信システムに備えられるエンコーダの機能を示すブロック図。

【図９】同実施の形態に係る動画像データ配信システムに備えられるビューワの再生開始後の動作を示すフローチャート。

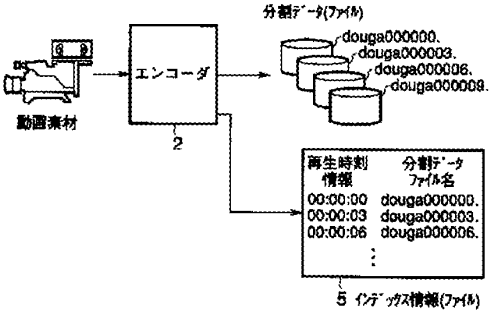
【符号の説明】

１…動画像データ配信システム
２、１３…エンコーダ
３…サーバ
４…クライアント
４ａ、１０…ビューワ
５、１４…インデックス情報
６…インデックス情報受信部
７、１１…分割データ受信部
８…ページバッファ
９…デコーダ
１２…時間推定部

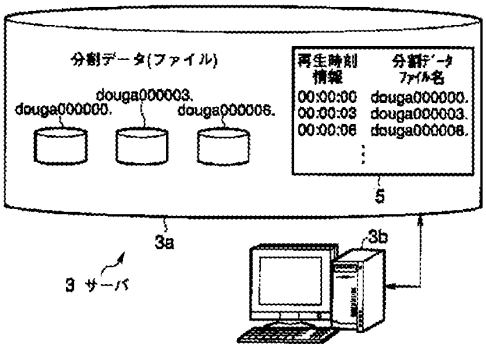
【図１】



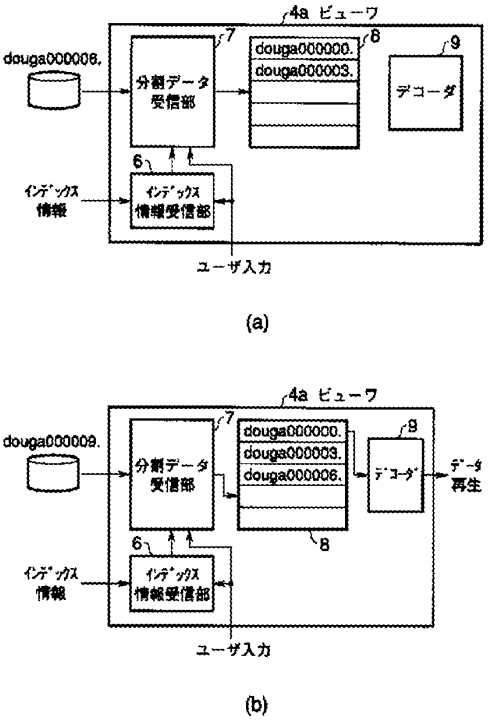
【図２】


分割ﾃﾞｰﾀ(ﾌｧｲﾙ)
douga000000.
douga000003.
douga000006.
douga000009.
エンコーダ
動画素材
2
再生時刻情報
分割ﾃﾞｰﾀﾌｧｲﾙ名
00:00:00 douga000000.
00:00:03 douga000003.
00:00:06 douga000006.
5 ｲﾝﾃﾞｯｸｽ情報(ﾌｧｲﾙ)

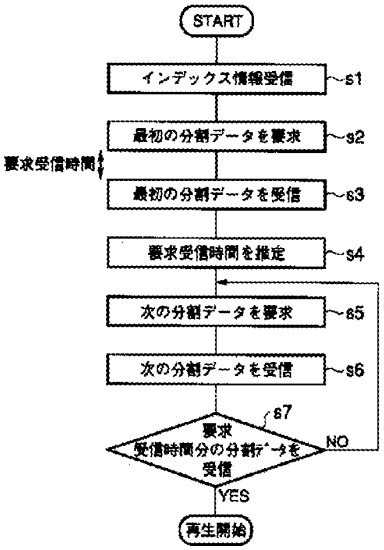
【図３】


分割データ(ファイル)
douga000000.
douga000003.
douga000006.
再生時刻情報
分割ﾃﾞｰﾀﾌｧｲﾙ名
00:00:00 douga000000.
00:00:03 douga000003.
00:00:06 douga000006.
5
3a
3b
3 サーバ

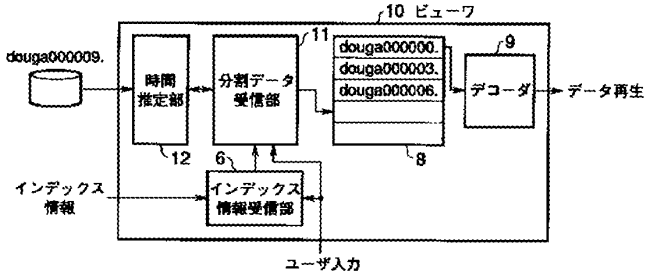
【図４】


4a ビューワ
douga000006.
分割データ受信部
7
douga000000.
douga000003.
8
デコーダ
9
ｲﾝﾃﾞｯｸｽ情報
6
ｲﾝﾃﾞｯｸｽ情報受信部
ユーザ入力
(a)
4a ビューワ
douga000009.
分割データ受信部
7
douga000000.
douga000003.
douga000006.
8
ﾃﾞｺｰﾀﾞ
9
ﾃﾞｰﾀ再生
ｲﾝﾃﾞｯｸｽ情報
6
ｲﾝﾃﾞｯｸｽ情報受信部
ユーザ入力
(b)

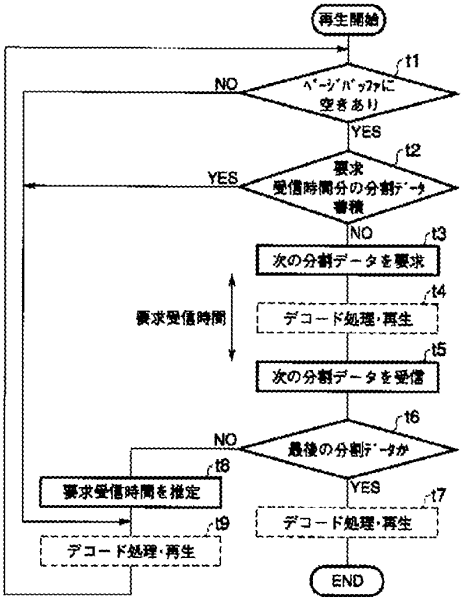
【図６】


START
インデックス情報受信
s1
最初の分割データを要求
s2
要求受信時間
最初の分割データを受信
s3
要求受信時間を推定
s4
次の分割データを要求
s5
次の分割データを受信
s6
s7
要求受信時間分の分割ﾃﾞｰﾀを受信
NO
YES
再生開始

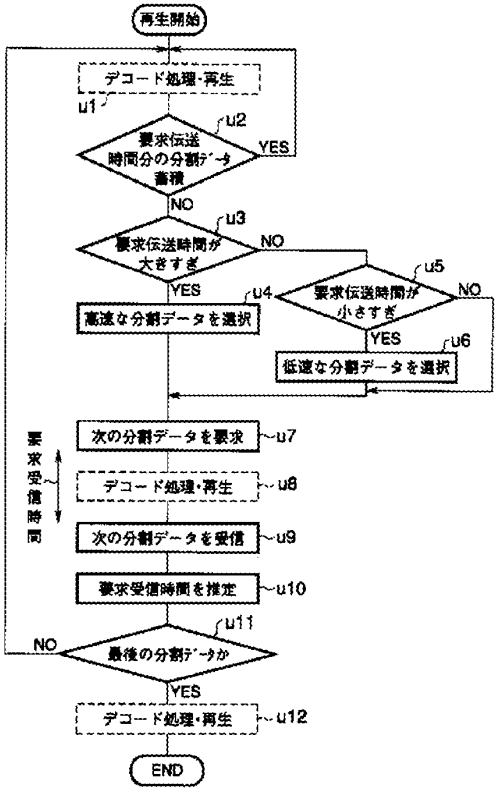
【図５】


10 ビューワ
douga000009.
時間推定部
分割データ受信部
11
douga000000.
douga000003.
douga000006.
9
デコーダ
データ再生
12
6
8
インデックス情報
インデックス情報受信部
ユーザ入力

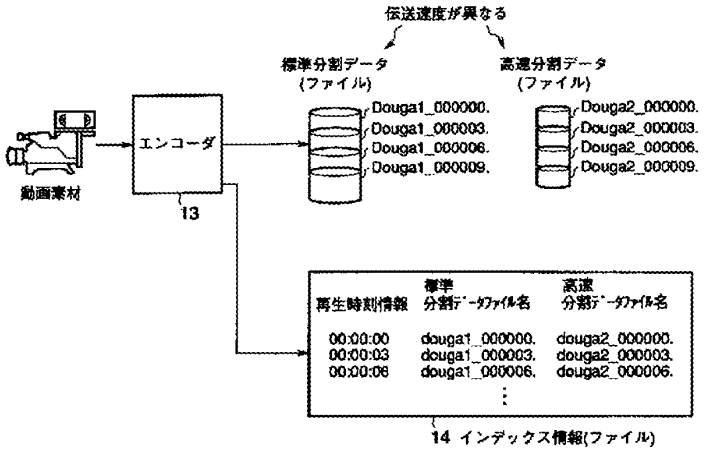
【図７】


再生開始
t1
NO
ページバッファに空きあり
YES
t2
YES
要求受信時間分の分割データ蓄積
NO
t3
次の分割データを要求
要求受信時間
t4
デコード処理・再生
t5
次の分割データを受信
t6
NO
最後の分割データか
YES
t8
要求受信時間を推定
t7
デコード処理・再生
t9
デコード処理・再生
END

【図９】


再生開始
デコード処理・再生
u1
u2
要求伝送時間分の分割データ蓄積
YES
NO
u3
要求伝送時間が大きすぎ
NO
YES
u4
高速な分割データを選択
u5
要求伝送時間が小さすぎ
NO
YES
u6
低速な分割データを選択
要求受信時間
次の分割データを要求
u7
デコード処理・再生
u8
次の分割データを受信
u9
要求受信時間を推定
u10
u11
NO
最後の分割データか
YES
デコード処理・再生
u12
END

【図８】


伝送速度が異なる
標準分割データ
(ファイル)
高速分割データ
(ファイル)
Douga1_000000.
Douga1_000003.
Douga1_000006.
Douga1_000009.
Douga2_000000.
Douga2_000003.
Douga2_000006.
Douga2_000009.
エンコーダ
動画素材
13
再生時刻情報
標準
分割ﾃﾞｰﾀﾌｧｲﾙ名
高速
分割ﾃﾞｰﾀﾌｧｲﾙ名
00:00:00
00:00:03
00:00:06
douga1_000000.
douga1_000003.
douga1_000006.
douga2_000000.
douga2_000003.
douga2_000006.
14 インデックス情報(ファイル)

PATENT ABSTRACTS OF JAPAN

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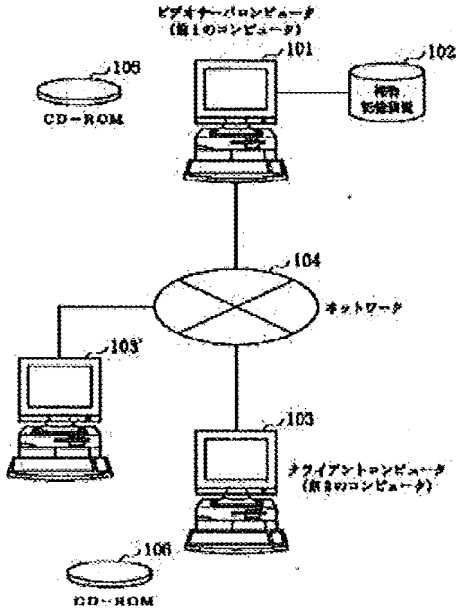
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H04N 7/24

(21)Application number : 11-271422
(22)Date of filing : 24.09.1999

(71)Applicant : HITACHI INFORMATION SYSTEMS LTD
(72)Inventor : SHIOMI YOSHIHIRO
AIKAWA NOBUYUKI
NIGO MASAKI

(54) SYSTEM FOR DISTRIBUTING PICTURE DATA AND RECORDING MEDIUM USED FOR THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a picture data distribution system capable of efficiently distributing picture data with appropriate quality in accordance with changes of the network connection environment of a client computer from moment to moment and a recording medium on which its program is recorded.
SOLUTION: This system has a 1st computer (image server computer 101) capable of distributing the picture data and one or more 2nd computers (client computer 103) receiving the picture data, and the 1st computer 101 receives a line situation notification message from the 2nd computer 103 and transmits the picture data (picture data extracted among a plurality of pieces of picture data which are preliminarily stored and have different compressibility or picture data compressed with optimum compressibility every time) which are subjected to compressibility being optimum to the communication speed of a line to which the 2nd computer is connected on the basis of the message.



Webgroup CZ a.s. Ex. 1002, Page 1079 of 1406

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Ｈ０４Ｌ	12/56		Ｈ０４Ｌ	11/20	１０２Ａ	５Ｃ０５９
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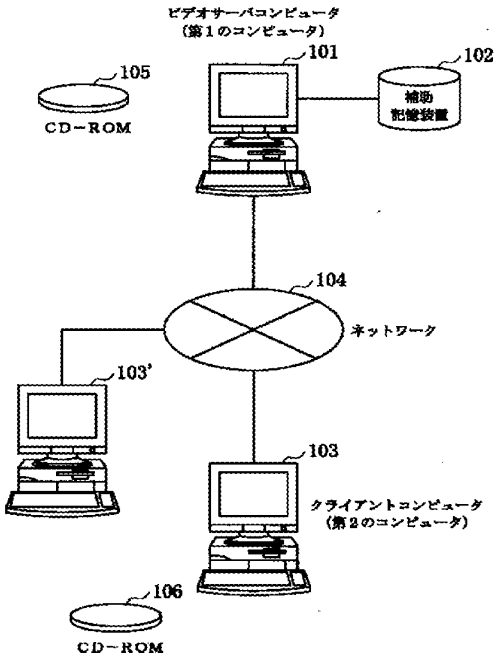
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(71)出願人　000152985
株式会社日立情報システムズ
東京都渋谷区道玄坂１丁目16番５号
(72)発明者　塩見　芳弘
東京都渋谷区道玄坂一丁目16番５号　株式会社日立情報システムズ内
(72)発明者　相川　伸之
東京都渋谷区道玄坂一丁目16番５号　株式会社日立情報システムズ内
(74)代理人　100077274
弁理士　磯村　雅俊　（外１名）

最終頁に続く

(54)【発明の名称】　画像データ配信システムおよびそれに用いる記録媒体

(57)【要約】
【課題】　クライアントコンピュータのネットワーク接続環境の時々刻々の変化に応じて、適切な品質の画像データを効率よく配信することが可能な画像データ配信システムおよびそのためのプログラムを記録した記録媒体の提供。
【解決手段】　画像データを配信可能な第１のコンピュータ（画像サーバコンピュータ１０１）とその画像データを受信する１以上の第２のコンピュータ（クライアントコンピュータ１０３）を有し、第１のコンピュータ１０１は、第２のコンピュータ１０３から回線状況通知メッセージを受信し、そのメッセージに基づいて、第２のコンピュータが接続されている回線の通信速度に最適な圧縮を施した画像データ（予め記憶している圧縮率の異なる複数の画像データから抽出した画像データかまたはその都度最適な圧縮率で圧縮した画像データ）を送信する。



1

【特許請求の範囲】

【請求項１】　画像データをストリーミング配信可能な第１のコンピュータとその画像データを受信する１以上の第２のコンピュータを有する画像データ配信システムにおいて、

前記第１のコンピュータは、

前記第２のコンピュータから回線状況通知メッセージに基づいて、該第２のコンピュータが接続されている回線の通信速度に最適な圧縮を施した画像データを送信する最適画像配信手段を有することを特徴とする画像データ配信システム。

【請求項２】　前記最適画像配信手段は、

送信時間を計測するタイマと、

圧縮率の異なる複数の画像データおよび該画像データ毎に該画像データの内容を識別可能な内部識別アドレスと送信の際の送信タイミングを規定するタイムスタンプとの対応データを保持する記憶手段と、

前記第２のコンピュータからの回線状況通知メッセージに基づいて前記記憶手段から最適な圧縮率の画像データを抽出するとともに、該抽出した画像データの、前記タイマで計測された送信時間に対応する前記内部識別アドレス以降の画像データ内容を配信する手段とを有することを特徴とする請求項１記載の画像データ配信システム。

【請求項３】　前記最適画像送出手段は、

１つの画像データを保持する記憶手段と、

前記第２のコンピュータから所定の時間間隔で受信する回線状況通知メッセージに基づいて、前記記憶手段に保持されている１つの画像データから、該第２のコンピュータが接続されている回線に最適な圧縮率の画像データを動的に作成して配信する手段とを有することを特徴とする請求項１記載の画像データ配信システム。

【請求項４】　前記第１のコンピュータは、画像サーバコンピュータであり、前記第２のコンピュータは、クライアントコンピュータであることを特徴とする請求項１または請求項２記載の画像データ配信システム。

【請求項５】　請求項１または２記載の第１のコンピュータにおける各手段および第２のコンピュータにおける各手段を実現する処理をプログラムコード化して記憶したことを特徴とするコンピュータで読み取り可能な記録媒体。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ネットワーク上でビデオストリーミングデータを送信する場合におけるデータ作成および配信システムに関し、特にデータを要求するクライアントコンピュータのネットワーク接続環境の動的な変化に対応して最適なビデオデータ配信を実現するビデオデータ配信システムおよびそのためのプログラムを記録した記録媒体に関する。

2

【０００２】

【従来の技術】ネットワーク上における一般的なビデオデータ配信においては、ビデオサーバコンピュータはクライアントコンピュータのデータ送信要求に対し該当するデータのストリーミング配信を行なっている。通常のビデオデータは非常にサイズが大きいため、回線上に大きな帯域幅を必要としていた。従って、従来は、限られたネットワーク内において回線の帯域幅を考慮し適切な圧縮を行うことにより、ビデオデータ配信が行われていた。

【０００３】しかし、近年のインターネット技術の普及に伴い、インターネットを利用したビデオ配信システムが多数考案されている。インターネットを利用した場合、インターネットに接続され世界中に点在する膨大な数のコンピュータがクライアントコンピュータとなり得る。そのため、クライアントコンピュータのネットワーク接続環境はクライアントコンピュータ毎に異なることとなる。

【０００４】従って、例えば高品質（低圧縮率）のビデオデータを配信した場合、帯域幅の狭い通信回線に接続しているクライアントコンピュータは、配信された全てのビデオデータを受信しきれなくなる。この理由により、インターネット上でビデオ配信を行なう場合には、できるだけ多くのクライアントコンピュータで受信可能となるように、帯域幅の狭い通信回線に合わせた低品質（高圧縮率）のビデオデータを配信するようにしていた。この環境においては、高品質のビデオデータの受信可能なクライアントコンピュータであっても品質の低いビデオデータを受信することに甘んじなければならなかった。

【０００５】この問題点に関するものとして、ビデオサーバが、予め記憶装置に格納してある中間形態の動画データを事前に高品質および低品質の複数のデータを準備し、さらにビデオデータを要求するクライアントコンピュータが接続されている回線の通信速度を取得する手段を具備し、取得した通信速度により最適なデータを配信する仕組みが考案されている。

【０００６】

【発明が解決しようとする課題】しかしながら、一般に、クライアントコンピュータのネットワーク接続環境すなわち帯域幅は回線の混雑の度合等により刻々と変化するものであるが、上記従来技術においては、動画データの配信要求のあったクライアント端末のネットワーク性能（伝送速度）を検知し、それに応じた圧縮率の動画データを送信するものであり、ネットワーク性能の時々刻々の変化に応じて送信ビデオデータの品質（データ圧縮率）を変化させるものとはなっていない。

【０００７】本発明の目的は、クライアントコンピュータのネットワーク接続環境すなわち帯域幅の時々刻々の変化に応じて、適切な品質の画像データを効率よく配信

することが可能な画像データ配信システムおよびそのためのプログラムを記録した記録媒体を提供することである。

【０００８】

【課題を解決するための手段】本発明は、上記目的を達成するために、画像データをストリーミング配信可能な第１のコンピュータ（好ましくは画像サーバコンピュータ）とその画像データを受信する１以上の第２のコンピュータ（好ましくはクライアントコンピュータ）を有する画像データ配信システムにおいて、第１のコンピュータは、第２のコンピュータから回線状況通知メッセージに基づいて、第２のコンピュータが接続されている回線の通信速度に最適な圧縮を施した画像データを送信する最適画像配信手段を有することを特徴としている。

【０００９】なお、前記最適画像配信手段は、（ａ）送信時間を計測するタイマと、圧縮率の異なる複数の画像データおよび該画像データ毎に該画像データの内容を識別可能な内部識別アドレスと送信の際の送信タイミングを規定するタイムスタンプとの対応データを保持する記憶手段と、第２のコンピュータからの回線状況通知メッセージに基づいて記憶手段から最適な圧縮率の画像データを抽出するとともに、該抽出した画像データの、タイマで計測された送信時間に対応する内部識別アドレス以降の画像データ内容を配信する手段とを有するか、あるいは、（ｂ）１つの画像データを保持する記憶手段と、第２のコンピュータから所定の時間間隔で受信する回線状況通知メッセージに基づいて、記憶手段に保持されている１つの画像データから、第２のコンピュータが接続されている回線に最適な圧縮率の画像データを動的に作成して配信する手段とを有している。

【００１０】また、本発明の記録媒体は、前記第１のコンピュータ（画像サーバコンピュータ）における各手段および第２のコンピュータ（クライアントコンピュータ）における各手段を実現する処理をプログラムコード化してコンピュータ読み取り可能なＣＤ－ＲＯＭ，ＤＶＤ，ＦＤなどの記録媒体に記録したものである。

【００１１】

【発明の実施の形態】以下、本発明の好ましい実施の形態を説明する。画像データを配信する機能を有するネットワークに接続されている画像配信サーバを具備し、該画像配信サーバは画像データを格納可能な記憶装置を具備し、画像配信サーバにアクセス可能な不特定多数のクライアントコンピュータを具備する構成とする。

【００１２】配信するビデオデータ作成において、ビデオサーバコンピュータは、オリジナルビデオデータを基に、高品質から低品質まで複数のビデオデータを記憶装置に作成し、個々のビデオデータに対し一定時間間隔のタイムスタンプを付加する機能を具備する。

【００１３】また、ビデオデータを受信するクライアントコンピュータでは、ビデオデータ受信中に受信パケットの状態を監視し、損失パケットが一定の基準を超えた場合、クライアント側の通信回線に十分な帯域が確保されていないと判定し、また、一定の基準時間の間に損失パケットが無い場合は、クライアント側の通信回線に十分な帯域が確保されていると判定し、その判定結果を配信中のビデオサーバコンピュータへ送信する手段を具備する。

【００１４】上述の判定結果を受信したビデオサーバは、その判定結果に適切な品質のビデオデータファイルを選択し、現在配信中のビデオデータファイルの切り換えを行う。その際、切り換え前後の２つのビデオデータに付加されているタイムスタンプを参照し、配信を中止する時点でのタイムスタンプと同様のタイムスタンプを持つ時点より切り換え後のビデオデータの配信を開始する機能を具備する。

【００１５】また、上記目的を達成するために、本発明は、ビデオデータを配信する機能を有するネットワークに接続されているビデオサーバコンピュータを具備し、さらにその記憶装置に記憶されているオリジナルビデオデータを送信時に所定の圧縮率で圧縮しながら配信する機能を具備する構成とする。

【００１６】ビデオデータを受信する際において、クライアントコンピュータは、ビデオデータ受信中に受信パケットの状態を監視し、損失パケットが一定の基準を超えた場合クライアント側の通信回線に十分な帯域が確保されていないと判定し、また、一定の基準の時間、損失パケットが無い場合、クライアント側の通信回線に十分な帯域が確保されていると判定し、その判定結果を配信中のビデオサーバコンピュータへ送信する手段を特徴とする機能を具備する。

【００１７】さらに、上述の判定結果を受信したビデオサーバコンピュータは、その判定結果に従い、動的に圧縮率に変更し、その変更された圧縮率で圧縮されたビデオデータを配信する機能を具備する。

【００１８】上記構成を採用することにより、配信されるビデオデータは、受信するクライアントコンピュータのネットワーク接続環境に従い配信するビデオデータの品質を動的に変化させることができる。これにより、クライアントコンピュータは常に最適化されたビデオデータを見掛け上切れ目なく受信することが可能となる。

【００１９】また、本発明の記録媒体は、上記の如きクライアントコンピュータが行う処理やビデオサーバコンピュータが行う処理をプログラムコード化してコンピュータ読み取り可能なＣＤ－ＲＯＭ，ＤＶＤ，ＦＤなどの記録媒体に記録したものである。

【００２０】（実施例の説明）以下、本発明の実施例として、２つの実施例を説明する。図１は、第１の実施例および第２の実施例における共通のハードウエア構成を示すブロック図である。本発明は、圧縮して配信することが可能な全てのデータ（特に画像データ）に対して適

用可能であるが、本実施例では、ビデオデータ（動画データ）を例にとって説明する。

【００２１】図１において、１０１はビデオデータの作成および配信を行なうビデオサーバコンピュータ、１０２はビデオデータを格納する補助記憶装置、１０３および１０３’はクライアントコンピュータ、１０４はビデオサーバコンピュータ１０１とクライアントコンピュータ１０３が接続されるネットワーク環境である。以下の説明では、１つのサーバコンピュータと１つ以上のクライアントコンピュータからなるクライアント・サーバシステムの場合を用いて説明するが、第１のコンピュータから第２のコンピュータへの２つのコンピュータ間でのデータの配信にも適用可能であることはいうまでもない。

【００２２】（第１の実施例）まず、第１の実施例について図２～図６を用いて説明する。図２は、記憶装置に格納する圧縮ビデオデータファイルのファイル構造の説明図である。図２において、２０３は圧縮ビデオデータファイルのヘッダ情報、２０４は本実施例で取り上げる画像データファイル、２０５はＥＯＦ（ＥＯＦ：End of File）を示す。また、２０１は本発明の特徴である圧縮ビデオデータファイルのタイムスタンプであり、２０２は、タイムスタンプ２０１と対応する圧縮ビデオデータファイルの内部識別アドレスである。なお、本実施例で取り上げる圧縮率の異なる他の画像ファイル（圧縮画像ファイルＢおよび圧縮画像ファイルＣ）構造も図２と同様である。内部識別アドレス２０２は、ファイル毎にタイムスタンプ１０２に対応して設けられるものであるが、ファイルの品質（圧縮率）が異なればそれに伴って異なる値を有する。

【００２３】図３は、同一画像ファイルから生成された圧縮率の異なる３種類の圧縮ビデオデータファイルのヘッダ情報の説明図である。同図（ａ）は低圧縮画像ファイルＡのヘッダ情報を、同図（ｂ）は中圧縮画像ファイルＢのヘッダ情報を、同図（ｃ）は高圧縮画像ファイルＣのヘッダ情報を示している。３０１はタイムスタンプ情報、３０２は、インデックスに対応する図２に示すファイルの内部識別アドレスである。

【００２４】図４は、圧縮率の異なる３つの画像ファイルとタイムスタンプと内部識別アドレスの関係を説明するための図である。同図（ａ）は、低圧縮画像ファイルＡとタイムスタンプと内部識別アドレスの関係を、同図（ｂ）は中圧縮画像ファイルＢとタイムスタンプと内部識別アドレスの関係を、同図（ｃ）は高圧縮画像ファイルＣとタイムスタンプと内部識別アドレスの関係を、それぞれ示している。本例では、説明を簡単にするために、同図（ａ）に示す低圧縮画像ファイルＡを１／２に圧縮したものを中圧縮ファイルＢとして同図（ｂ）に示し、さらにこれを１／２に圧縮したものを高圧縮画像ファイルＣとして同図（ｃ）に示すとともに、タイムスタンプ，内部識別アドレスと圧縮画像ファイルＡ～Ｃの内容の関係がわかりやすいように画像ファイル中に「い」、「ろ」、「は」・・・などを便宜的に示した。

【００２５】図５は、ビデオサーバコンピュータ１０１に保持される、通信速度と該通信速度に最適化された圧縮画像ファイルとの対応図である。図５における通信速度を表わす記号（ｍ、ｎ）の大小関係は、ｍ＜ｎとする。同図に示すように、通信速度が低速の場合は（～ｍ）、低品質である高圧縮画像ファイルＣを、通信速度が高速の場合は（ｎ～）、高品質である低圧縮画像ファイルＡを配信するようにする。

【００２６】図６および図７は、第１の実施例の動作を説明するためのフローチャートである。まず、ビデオデータを配信するビデオサーバコンピュータ１０１の動作を、図６を用いて詳細に説明する。

【００２７】図６において、クライアントコンピュータ１０３からのデータ要求に従い、該当する記憶装置内のビデオデータ（システムには初期配信ファイルが設定済とする。本実施例では、初期配信ファイルは「中圧縮画像ファイルＢ」とする）の配信を開始し、かつ配信時間の計測を開始する（ステップ６０１）。

【００２８】クライアントコンピュータ１０３から低品質データの受信要求（後述する図７のステップ７０６参照）があった場合（ステップ６０３）、図５の対応図に従い、現在送信中のファイル（ファイルＢ）より１段階品質の劣る「高圧縮画像ファイルＣ」を送信ファイルとして確定する（ステップ６０４、６０５）。

【００２９】次に現在時点の配信時間を測定する（ステップ６０６）。本実施例では、この時の測定時間が４ｍｓであったと仮定し、図３に示すヘッダ情報より、「ファイルＢ」の４ｍＳの開始内部識別アドレスは「iiii」と確定する（ステップ６０７）。すなわち、画像「い」、「ろ」は配信済みとする。ビデオサーバコンピュータ１０１は即座に配信中の「中圧縮画像ファイルＢ」の配信を中止し、内部識別アドレス「iiii」から「高圧縮画像ファイルＣ」の画像「は」、「に」、・・・の配信を開始する（ステップ６０８）。

【００３０】逆に、クライアントコンピュータ１０３より高品質データの受信要求（後述する図７のステップ７０７参照）があった場合（ステップ６０３：Ｙ）、図５の対応図に従い、現在配信中の「中圧縮画像ファイルＢ」より１段階品質の高い「低圧縮画像ファイルＡ」を次送信ファイルとして確定する（ステップ６０４、６０５）。以下の動作は同様である。すなわち、ビデオサーバコンピュータ１０１は即座に配信中の「中圧縮画像ファイルＢ」の配信を中止し、内部識別アドレス「iiii」から「低圧縮画像ファイルＡ」の画像「は」、「に」、・・・の配信を開始する（ステップ６０８）。

【００３１】なお、現時点での配信データが「高圧縮画像ファイルＣ」であった場合にさらに低品質の高圧縮の

画像ファイルが要求された場合、図５より１段階品質の劣るビデオデータは存在しないことがわかる。また、現時点での配信データが「低圧縮画像ファイルＡ」であった場合にさらに高品質の低圧縮画像ファイルが要求された場合にも、図５より１段階品質の高いビデオデータは存在しないことがわかる。このような場合は、データの存在しない旨のメッセージを送信し、現時点でのデータ配信を続行する（ステップ６０９）。

【００３２】また、ビデオサーバコンピュータ１０１は、ビデオデータの終端すなわち図２に示す「ＥＯＦ」まで配信を行った場合（ステップ６０２：Ｙ）、データの配信を終える。

【００３３】次に、ビデオデータを受信するクライアントコンピュータ１０３の動作を、図７を用いて詳細に説明する。図７において、先ず、ビデオサーバコンピュータ１０１に対するビデオデータ要求により、ビデオサーバから送信されたデータの受信を開始し、同時に損失パケット監視タイマをリセットする（ステップ７０１）。

【００３４】損失パケット数がシステムに既設定済の数を超過した場合（ステップ７０２：Ｙ）、クライアントコンピュータ側の通信回線に十分な帯域が確保されていないと判断し、ビデオサーバに低品質データの要求メッセージを送信する（ステップ７０６）。損失パケット数がシステムに既設定済の数を超過しない場合（ステップ７０２：Ｎ）、損失パケットの発生を常に監視し（ステップ７０３）、損失パケットが発生した場合（ステップ７０３：Ｙ）、損失パケット監視タイマをリセットする（ステップ７０４）。

【００３５】この損失パケット監視タイマが、システムに既設定済の一定時刻を超過した場合、すなわち損失パケットが一定時間発生しなかった場合（ステップ７０３：Ｎ，７０５：Ｙ）、クライアントコンピュータ１０３側の通信回線に十分な帯域が確保されており現在受信中のビデオデータよりも高品質なデータ（低圧縮のデータ）の受信が可能と判断し、ビデオサーバコンピュータ１０１に高品質データの要求メッセージを送信する（ステップ７０７）。ステップ７０８では、ビデオサーバコンピュータ１０１からの配信データに従い今までと異なる品質の配信データを受信し、同時に損失パケット監視タイマをリセットする。

【００３６】ここで、図６のステップ６０９に示すデータ無しのメッセージを受信した場合、そのメッセージに従い、低品質データ無しの場合はステップ７０６の低品質データ要求メッセージ送信を、また、高品質データ無しの場合はステップ７０７の高品質データ要求メッセージ送信を中止する。なお、クライアントコンピュータ１０３はビデオデータの終端をしめす「ＥＯＦ」まで受信した場合（ステップ７０９：Ｙ）、受信動作を終了する。

【００３７】最後に、ビデオデータフォーマットについて詳述する。本実施例における配信ビデオデータのフォーマットは、図２に示すようにヘッダ情報部分（２０３）とデータ部分（２０４）とから構成され、ヘッダ部分には、図３に示すような、タイムスタンプ毎のアドレスが保持されている。ビデオサーバによりビデオデータを圧縮する際に、ヘッダ部分を生成し付加する。なお、図２および図３における２０１と３０１、２０２と３０２は同値である。

【００３８】以上、第１の実施例は、オリジナルなビデオデータを基に高品質（低圧縮）から低品質（高圧縮）まで、品質の異なる複数のビデオデータをビデオサーバの記憶装置に記憶しておき、クライアントコンピュータからの配信要求に対し、クライアントコンピュータにおける受信状態に応じて、最適な品質のビデオデータを動的に切替えながら配信するものである。

【００３９】（第２の実施例）次に説明する第２の実施例は、ビデオサーバに保持するビデオデータは、オリジナルなもの１種類のみとし、サーバから配信するビデオデータの圧縮を、クライアントコンピュータにおける受信状態に応じて動的に最適化するものである。

【００４０】以下、本第２実施例のビデオサーバ側の処理を、図８を用いて詳細に説明する。同図において、まず、クライアントコンピュータからのデータ要求に従い、該当する記憶装置内のオリジナルビデオデータをビデオサーバに取り出し（ステップ８０１）、圧縮を行いながら（システムには初期圧縮レートが設定済とする。）送信する（ステップ８０３）。クライアントコンピュータ１０３より低品質データ要求または高品質データ要求のメッセージ受信があった場合（ステップ８０４）、圧縮レートを変更する（ステップ８０５）。

【００４１】なお、ビデオサーバコンピュータ１０１はビデオデータの終端まで配信した場合（ステップ８０２）、配信動作を終了する。

【００４２】ビデオデータを受信するクライアントコンピュータの動作は、第１の実施例と同様のため詳細な説明は省略する。

【００４３】なお、上記の如き、ビデオサーバコンピュータが行う各処理手順およびクライアントコンピュータが行う各処理手順を、ＣＤ－ＲＯＭ，ＤＶＤ，あるいはＦＤなどの記録媒体に一緒にまたは別々に記録して市場に流通させることができる。利用者は、この記録媒体をビデオサーバコンピュータとクライアントコンピュータにインストールすることにより、本発明を簡単に利用することが可能になる。

【００４４】

【発明の効果】以上詳細に説明したように、本発明によれば、ビデオサーバにより配信されるビデオデータは、受信するクライアントコンピュータのネットワーク接続環境に従い動的に変化させることが実現できる。これにより、クライアントコンピュータは常に最適化されたビ

デオデータを見掛け上切れ目なく受信することが可能となる。

【図面の簡単な説明】

【図１】本発明の第１の実施例および第２の実施例における共通のハードウエア構成を示すブロック図である。

【図２】記憶装置に格納する圧縮ビデオデータファイルのファイル構造の説明図である。

【図３】同一画像ファイルから生成された圧縮率の異なる３種類の圧縮ビデオデータファイルのヘッダ情報の説明図である。

【図４】圧縮率の異なる３つの画像ファイルとタイムスタンプと内部識別アドレスの関係を説明するための図である。

【図５】ビデオサーバコンピュータに保持される、通信速度と該通信速度に最適化された圧縮画像ファイルとの対応図である。

【図６】第１の実施例におけるビデオサーバコンピュータの動作を説明するためのフローチャートである。

【図７】第１の実施例におけるクライアントコンピュータの動作を説明するためのフローチャートである。

【図８】第２の実施例におけるビデオサーバコンピュータの動作を説明するためのフローチャートである。

【符号の説明】

１０１：ビデオデータの作成および配信を行なうビデオサーバコンピュータ（第１のコンピュータ）

１０２：ビデオデータを格納する記憶装置

１０３，１０３’：ネットワークと接続されるクライアントコンピュータ（第２のコンピュータ）

１０４：ビデオサーバコンピュータとクライアントコンピュータが接続されるネットワーク環境

１０５：プログラム記録媒体（ＣＤ－ＲＯＭ）

１０６：プログラム記録媒体（ＣＤ－ＲＯＭ）

２０１：圧縮ファイルのタイムスタンプ

２０２：圧縮ファイルのタイムスタンプに対応した内部識別アドレス

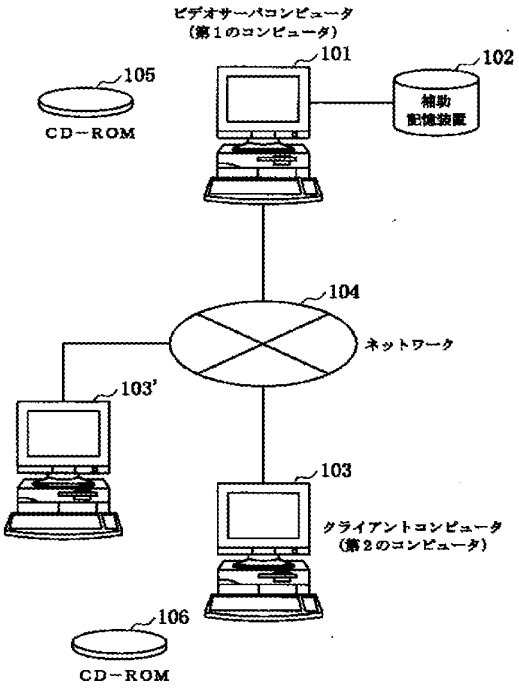
２０３：圧縮ファイルのファイルのヘッダ情報

２０４：本実施例で取り上げるファイルＡのファイルフォーマット

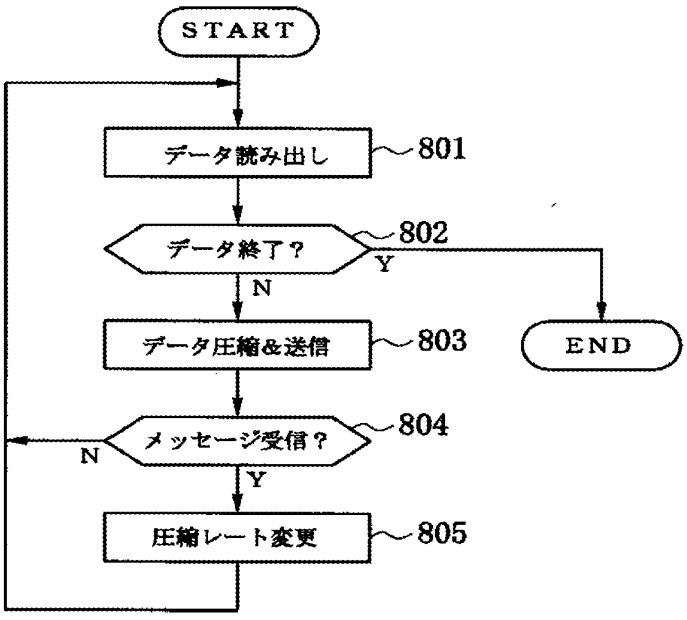
３０１：圧縮ファイルヘッダのタイムスタンプ情報

３０２：圧縮ファイルヘッダのタイムスタンプ情報に対応する内部識別アドレス

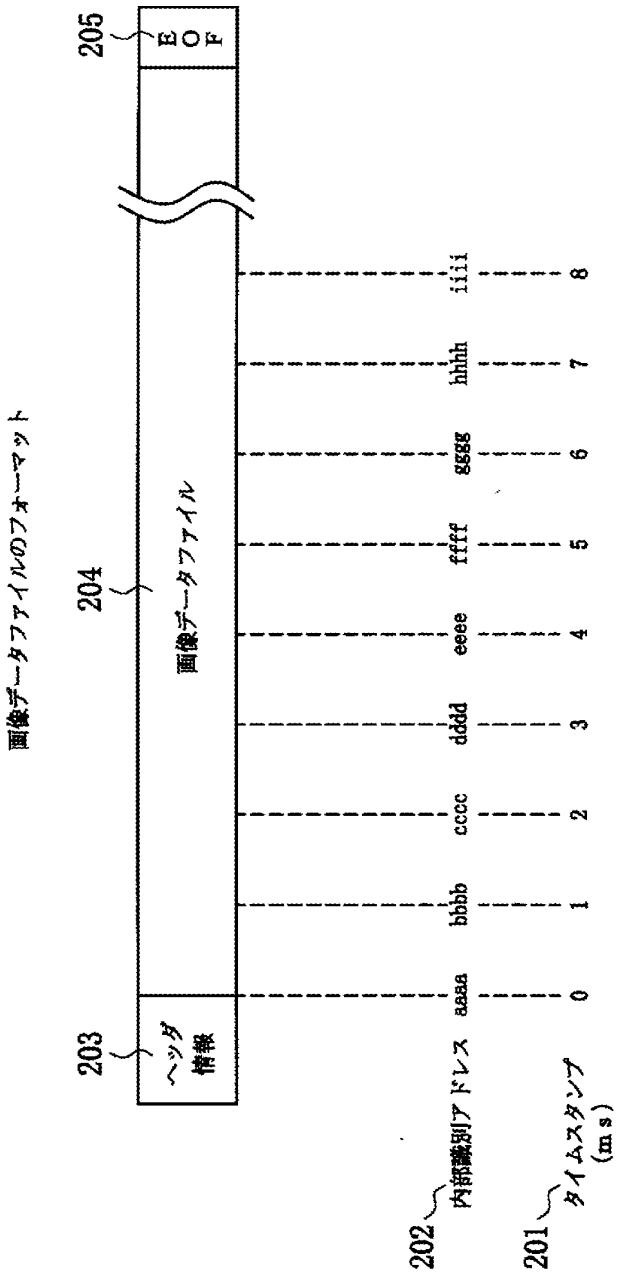
【図１】



【図８】



【図２】


画像データファイルのフォーマット
205
EOF
204
画像データファイル
203
ヘッダ情報
202
内部識別アドレス
201
タイムスタンプ (ms)
aaaa
bbbb
cccc
dddd
eeee
ffff
gggg
hhhh
iiii
0
1
2
3
4
5
6
7
8

【図３】

ヘッダ情報の構造

301 タイムスタンプ	302 内部識別アドレス
0	a a a a
1	b b b b
2	c c c c
3	d d d d
4	e e e e
5	f f f f
6	g g g g
7	h h h h
8	i i i i
:	:

低圧縮
画像ファイル（A）
（a）

301 タイムスタンプ	302 内部識別アドレス
0	a a a a
1	c c c c
2	e e e e
3	g g g g
4	i i i i
5	k k k k
6	m m m m
7	o o o o
8	q q q q
:	:

中圧縮
画像ファイル（B）
（b）

301 タイムスタンプ	302 内部識別アドレス
0	a a a a
1	e e e e
2	i i i i
3	m m m m
4	q q q q
5	u u u u
6	y y y y
7	:
8	:
:	:

高圧縮
画像ファイル（C）
（c）

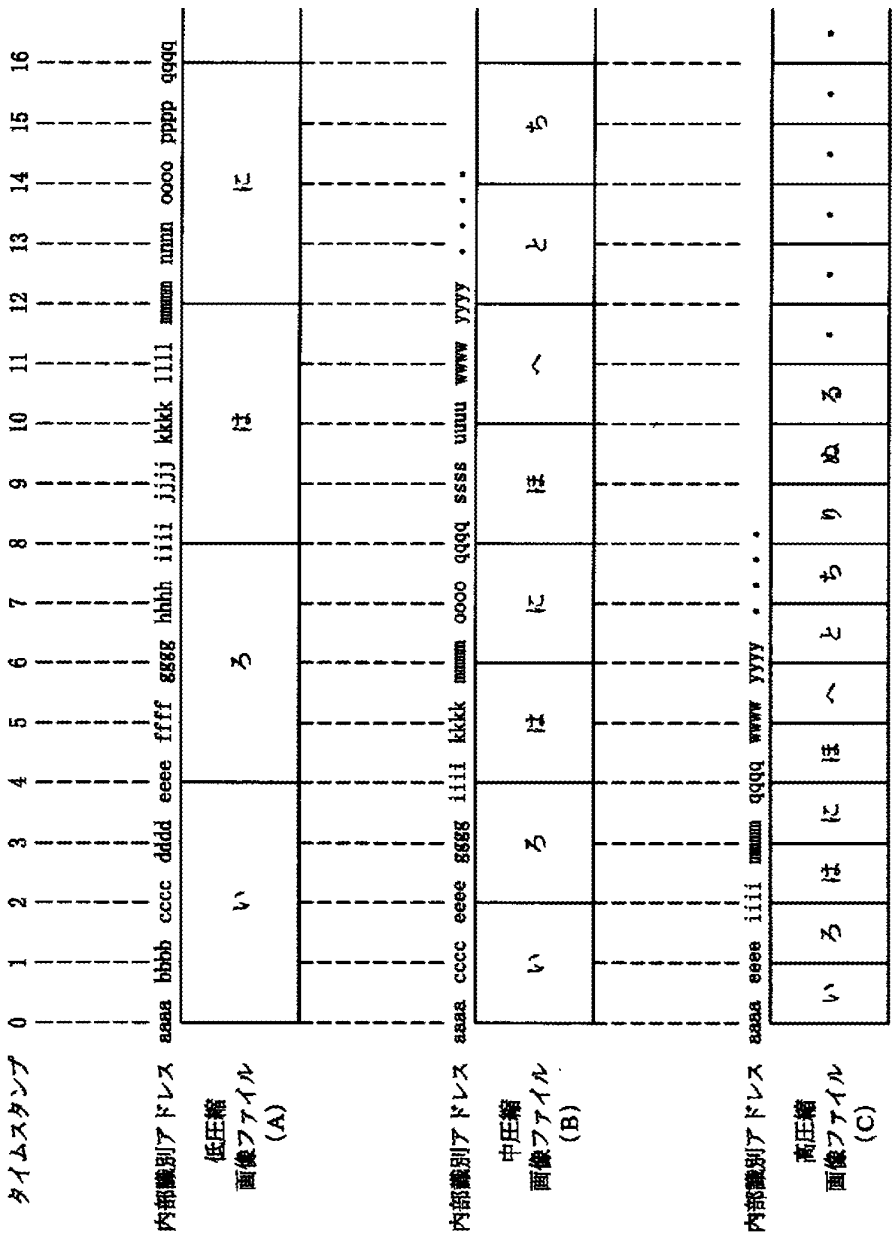
【図５】

通信速度と対応圧縮ファイル

項番	通信速度（ｂｐｓ）	ファイル名
1	～m	圧縮画像ファイルC
2	m～n	圧縮画像ファイルB
3	n～	圧縮画像ファイルA

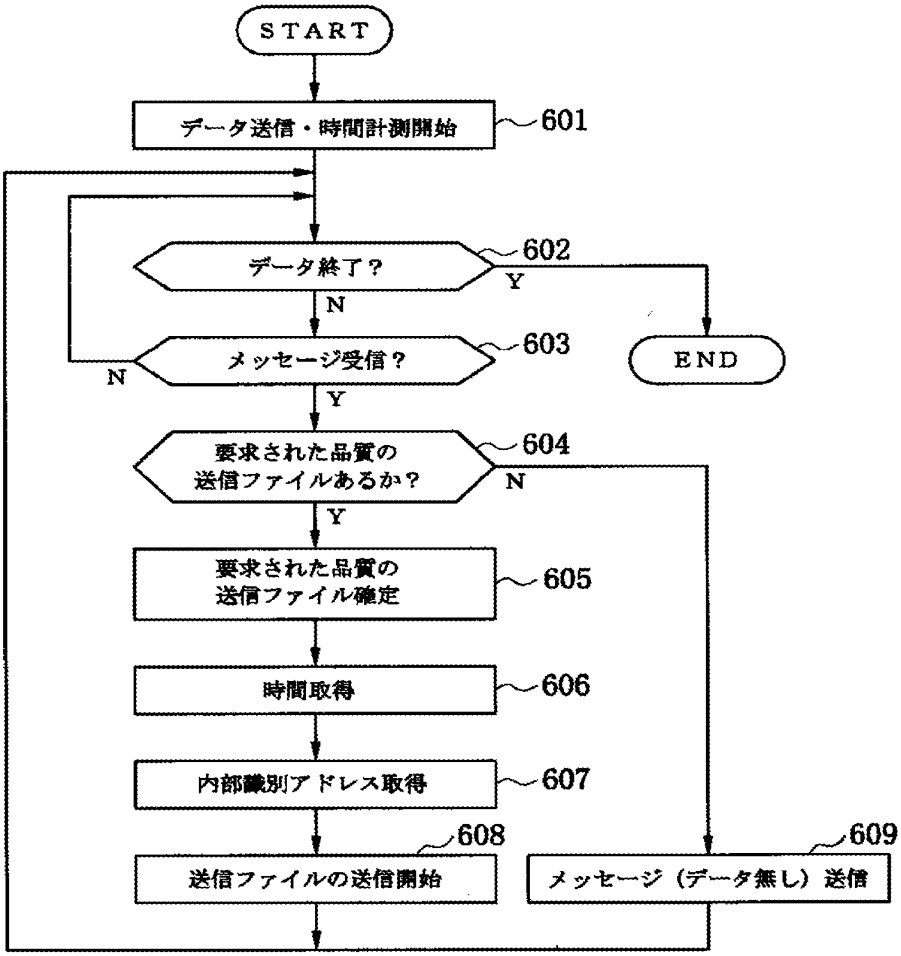
通信速度の大小関係　m＜n

【図４】


タイムスタンプ
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
内部識別アドレス
aaaa bbbb cccc dddd eeee ffff gggg hhhh iiii jjjj kkkk llll mmmm nnnn oooo pppp qqqq
低圧縮
画像ファイル
(A)
い
ろ
は
に
内部識別アドレス
aaaa cccc eeee gggg iiii kkkk mmmm oooo qqqq ssss uuuu wwww yyyy
中圧縮
画像ファイル
(B)
い
ろ
は
に
ほ
へ
と
ち
り
ぬ
る
内部識別アドレス
aaaa eeee iiii mmmm qqqq wwww yyyy
高圧縮
画像ファイル
(C)
い
ろ
は
に
ほ
へ
と
ち

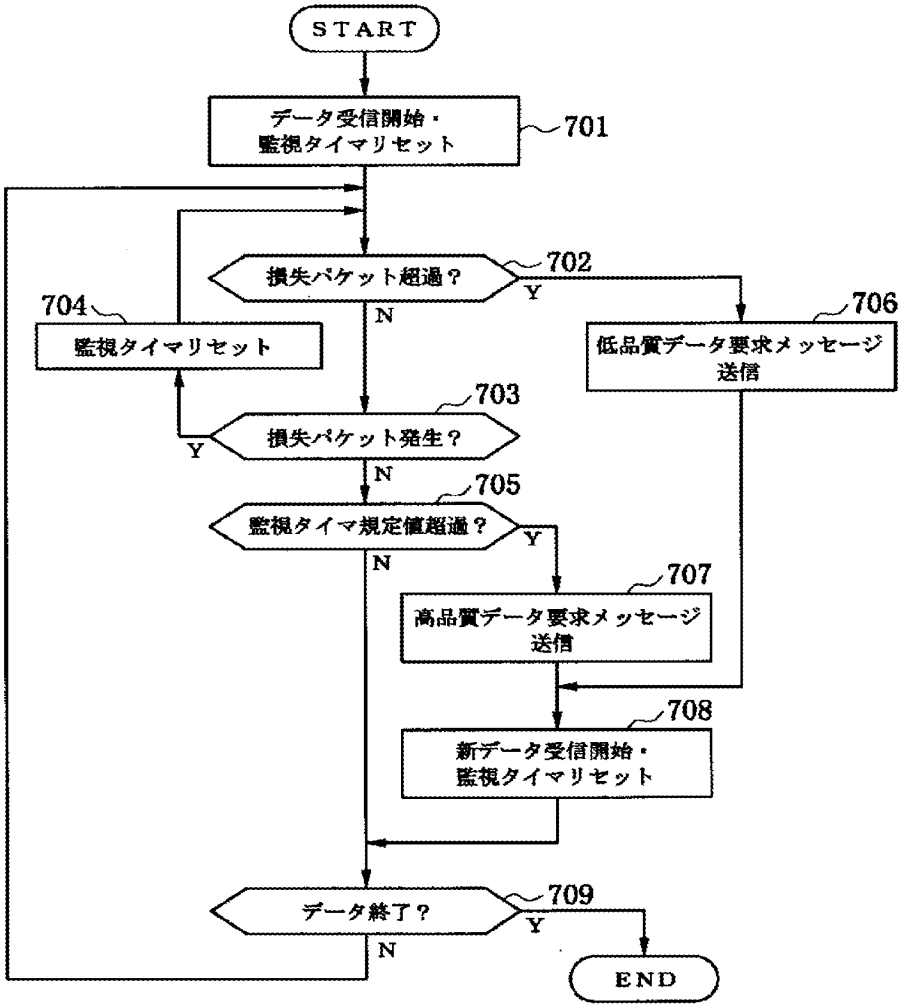
【図６】

（ビデオサーバコンピュータの処理）



【図７】

(クライアントコンピュータの処理)



フロントページの続き

(72)発明者　二郷　正樹
東京都渋谷区道玄坂一丁目16番５号　株式
会社日立情報システムズ内

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KA12 KB06 KB11 KC28 KC53
KC59 KC60 KH28
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UA02 UA38
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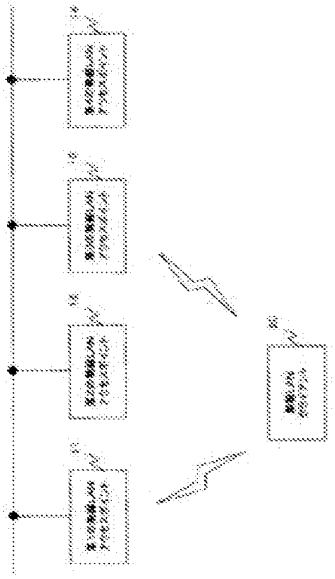
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(71)Applicant : NEC INFRONTIA CORP
(72)Inventor : HODOSHIMA TAKESHI

(54) SYSTEM, METHOD AND PROGRAM OF HIGH-SPEED ROAMING OF WIRELESS LAN

(57)Abstract:
PROBLEM TO BE SOLVED: To attain high-speed roaming in a wireless LAN network.
SOLUTION: In a LAN system including: a plurality of wireless LAN access points; and a wireless LAN client to be connected to the wireless LAN access points, the wireless LAN access points are the ones existing on the same local area network, used channels and BSSIDS of the wireless LAN access points set to the same ESSID are recognized as wireless LAN access point information, held as data, and the wireless LAN client utilizes the wireless LAN access point information when the above connection is performed.



Webgroup CZ a.s. Ex. 1002, Page 1091 of 1406

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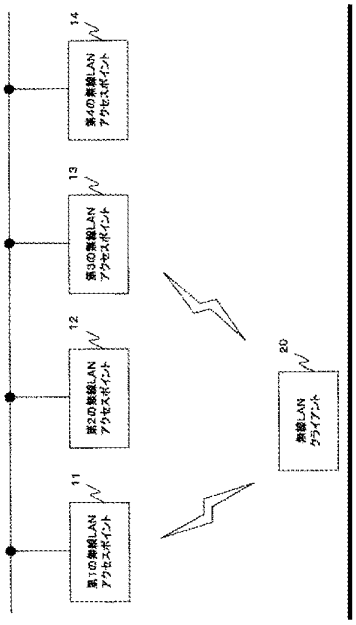
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(71)出願人　000227205
ＮＥＣインフロンティア株式会社
神奈川県川崎市高津区北見方２丁目６番１号
(74)代理人　100130029
弁理士　永井　道雄
(74)代理人　100166338
弁理士　関口　正夫
(74)代理人　100152054
弁理士　仲野　孝雅
(72)発明者　程島　健
神奈川県川崎市高津区北見方２丁目６番１号　ＮＥＣインフロンティア株式会社内

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(54)【発明の名称】無線ＬＡＮの高速ローミングシステム、高速ローミング方法及び高速ローミングプログラム

(57)【要約】
【課題】無線ＬＡＮネットワークにおいて高速ローミングを実現する。
【解決手段】複数の無線ＬＡＮアクセスポイントと、当該無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントと、を有する無線ＬＡＮシステムにおいて、前記無線ＬＡＮアクセスポイントは同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として認識しデータとして保持し、前記無線ＬＡＮクライアントは前記接続を行う際に前記無線ＬＡＮアクセスポイント情報を利用する。
【選択図】図１



【特許請求の範囲】
【請求項1】
複数の無線ＬＡＮアクセスポイントと、当該無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントと、を有する無線ＬＡＮシステムにおける接続方法において、
前記無線ＬＡＮアクセスポイントは同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として認識しデータとして保持し、前記無線ＬＡＮクライアントは前記接続を行う際に前記無線ＬＡＮアクセスポイント情報を利用することを特徴とする接続方法。
【請求項2】
前記無線ＬＡＮアクセスポイントは、前記無線ＬＡＮクライアントと接続された際に、自らが保持している前記無線ＬＡＮアクセスポイント情報を無線ＬＡＮクライアントに受け渡すことを特徴とする請求項１に記載の接続方法。
【請求項3】
前記無線ＬＡＮクライアントは最初に前記無線ＬＡＮアクセスポイントに接続を試みる際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、当該スキャンをしたチャンネルの中から最良の無線ＬＡＮアクセスポイントを選択し接続することを特徴とする請求項１又は２に記載の接続方法。
【請求項4】
前記最低限のチャンネルのスキャンは、前記無線ＬＡＮクライアントが、前記無線ＬＡＮアクセスポイント情報の中から自分の接続可能なＥＳＳＩＤを持つ無線ＬＡＮアクセスポイントのチャンネルを抽出し、当該抽出したチャンネルのみを前記最低限のチャンネルと判断することにより行われることを特徴とする請求項１乃至３の何れか１項に記載の接続方法。
【請求項5】
複数の無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントが行う接続方法であって、
前記無線ＬＡＮアクセスポイントに最初に接続を試みる際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、接続された際に前記無線ＬＡＮアクセスポイントから、当該無線ＬＡＮアクセスポイントと同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として受け取り、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、その中から最良の無線ＬＡＮアクセスポイントを選択し接続することを特徴とする接続方法。
【請求項6】
複数の無線ＬＡＮアクセスポイントと、当該無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントと、を有する無線ＬＡＮ接続システムにおいて、
前記無線ＬＡＮアクセスポイントは同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として認識しデータとして保持し、前記無線ＬＡＮクライアントは前記接続を

行う際に前記無線ＬＡＮアクセスポイント情報を利用することを特徴とする接続システム。

【請求項7】

前記無線ＬＡＮアクセスポイントは、前記無線ＬＡＮクライアントと接続された際に、自らが保持している前記無線ＬＡＮアクセスポイント情報を無線ＬＡＮクライアントに受け渡すことを特徴とする請求項６に記載の接続システム。

【請求項8】

前記無線ＬＡＮクライアントは最初に前記無線ＬＡＮアクセスポイントに接続を試みる際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、当該スキャンをしたチャンネルの中から最良の無線ＬＡＮアクセスポイントを選択し接続することを特徴とする請求項６又は７に記載の接続システム。

【請求項9】

前記最低限のチャンネルのスキャンは、前記無線ＬＡＮクライアントが、前記無線ＬＡＮアクセスポイント情報の中から自分の接続可能なＥＳＳＩＤを持つ無線ＬＡＮアクセスポイントのチャンネルを抽出し、当該抽出したチャンネルのみを前記最低限のチャンネルと判断することにより行われることを特徴とする請求項６乃至８の何れか１項に記載の接続システム。

【請求項10】

複数の無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントにおいて、

前記無線ＬＡＮアクセスポイントに最初に接続を試みる際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、接続された際に前記無線ＬＡＮアクセスポイントから、当該無線ＬＡＮアクセスポイントと同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として受け取り、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、その中から最良の無線ＬＡＮアクセスポイントを選択し接続することを特徴とする無線ＬＡＮクライアント。

【請求項11】

複数の無線ＬＡＮアクセスポイントと、当該無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントと、を有するシステムに搭載される無線ＬＡＮ接続プログラムにおいて、

前記無線ＬＡＮアクセスポイントは同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として認識しデータとして保持し、前記無線ＬＡＮクライアントは前記接続を行う際に前記無線ＬＡＮアクセスポイント情報を利用するシステムとしてコンピュータを機能させることを特徴とする接続プログラム。

【請求項12】

前記無線ＬＡＮアクセスポイントは、前記無線ＬＡＮクライアントと接続された際に、自らが保持している前記無線ＬＡＮアクセスポイント情報を無線ＬＡＮクライアントに受け渡すことを特徴とする請求項１１に記載の接続プログラム。

【請求項13】

前記無線ＬＡＮクライアントは最初に前記無線ＬＡＮアクセスポイントに接続を試みる

際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、当該スキャンをしたチャンネルの中から最良の無線ＬＡＮアクセスポイントを選択し接続することを特徴とする請求項１１又は１２に記載の接続プログラム。

【請求項14】

前記最低限のチャンネルのスキャンは、前記無線ＬＡＮクライアントが、前記無線ＬＡＮアクセスポイント情報の中から自分の接続可能なＥＳＳＩＤを持つ無線ＬＡＮアクセスポイントのチャンネルを抽出し、当該抽出したチャンネルのみを前記最低限のチャンネルと判断することにより行われることを特徴とする請求項１１乃至１３の何れか１項に記載の接続プログラム。

【請求項15】

複数の無線ＬＡＮアクセスポイントと接続される無線ＬＡＮクライアントに搭載される接続プログラムにおいて、

前記無線ＬＡＮアクセスポイントに最初に接続を試みる際は前記ローカルエリアネットワーク上に存在する前記無線ＬＡＮアクセスポイントの全チャンネルをスキャンし、当該スキャンをした中から最良の条件の無線ＬＡＮアクセスポイントを選択し接続し、接続された際に前記無線ＬＡＮアクセスポイントから、当該無線ＬＡＮアクセスポイントと同一のローカルエリアネットワーク上に存在する無線ＬＡＮアクセスポイントであって同一のＥＳＳＩＤに設定されている無線ＬＡＮアクセスポイントの使用チャンネル及びＢＳＳＩＤを同一ネットワークの無線ＬＡＮアクセスポイント情報として受け取り、前記無線ＬＡＮクライアントが前記無線ＬＡＮアクセスポイントと圏外から再接続を試みる際、或いは、ローミングする際には、前記受け取った無線ＬＡＮアクセスポイント情報を基に、最低限のチャンネルをスキャンし、その中から最良の無線ＬＡＮアクセスポイントを選択し接続する無線ＬＡＮクライアントとしてコンピュータを機能させることを特徴とする接続プログラム。

【発明の詳細な説明】

【技術分野】

【0001】

本発明は、無線ＬＡＮに関し、より詳細には無線ＬＡＮのローミング又は再接続に関する。

【背景技術】

【0002】

近年無線ＬＡＮの機器の低価格化等の影響もあり、無線ＬＡＮが一般に広く普及している。また、無線ＬＡＮを構築する際に１つのローカルエリアネットワーク内に多数の無線ＬＡＮアクセスポイントを敷設するといったことも一般的に行われている。

【0003】

このような環境下において無線ＬＡＮクライアントは、１つのローカルエリアネットワーク内の全ての無線ＬＡＮアクセスポイントを対象として、接続可能な無線ＬＡＮアクセスポイントを検索する。

【0004】

そして、無線ＬＡＮクライアントは、検索の結果に基づいて最良と判断した無線ＬＡＮアクセスポイントに対して接続動作をする（例えば特許文献１参照）。

【図面の簡単な説明】

【0016】

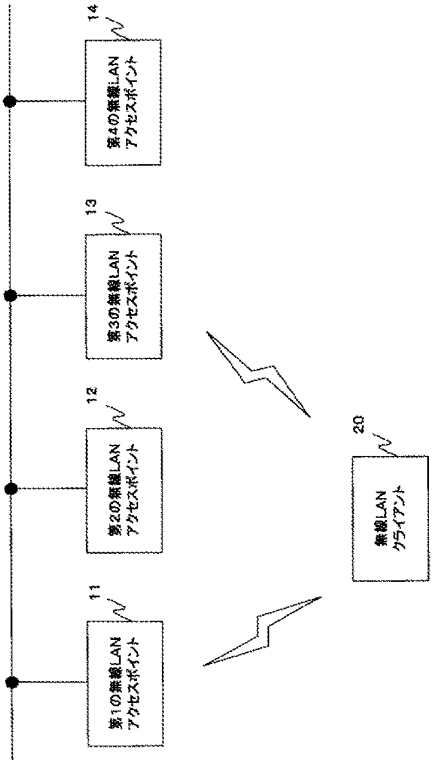
【図1】本発明の実施形態における無線ＬＡＮネットワークの基本的構成の例を表す図である。

【図2】本発明の実施形態における各機器の設定の例を表す図である。

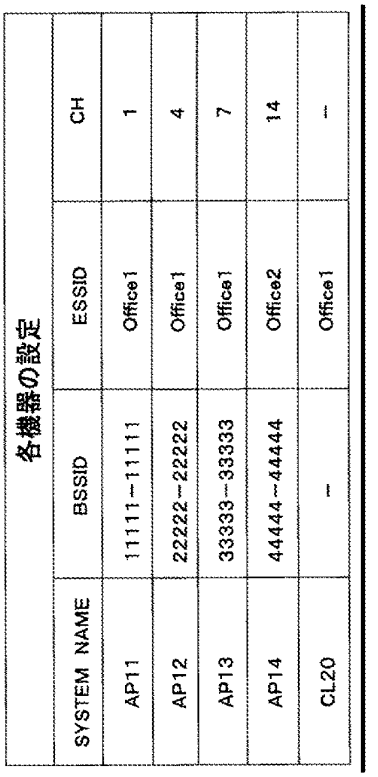
【図3】本発明の実施形態における無線ＬＡＮアクセスポイント情報の例を表す図である

。
【図4】本発明の実施形態における無線ＬＡＮクライアントの無線ＬＡＮアクセスポイント接続動作を表すフローチャートである。
【符号の説明】
【0045】
１１　第１の無線ＬＡＮアクセスポイント
１２　第２の無線ＬＡＮアクセスポイント
１３　第３の無線ＬＡＮアクセスポイント
１４　第４の無線ＬＡＮアクセスポイント
２０　無線ＬＡＮクライアント

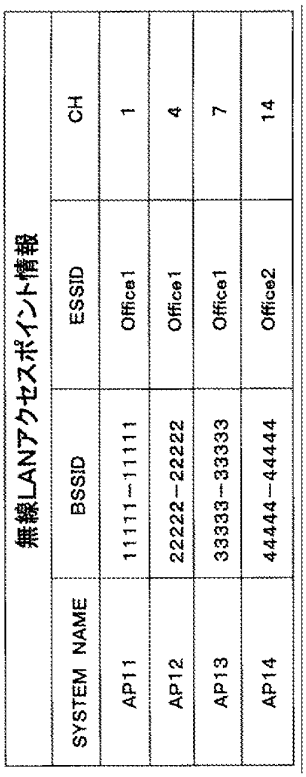
【図1】


11
第1の無線LAN
アクセスポイント
12
第2の無線LAN
アクセスポイント
13
第3の無線LAN
アクセスポイント
14
第4の無線LAN
アクセスポイント
20
無線LAN
クライアント

【図2】


各機器の設定
SYSTEM NAME
BSSID
ESSID
CH
AP11
11111--11111
Office1
1
AP12
22222--22222
Office1
4
AP13
33333--33333
Office1
7
AP14
44444--44444
Office2
14
CL20
--
Office1
--

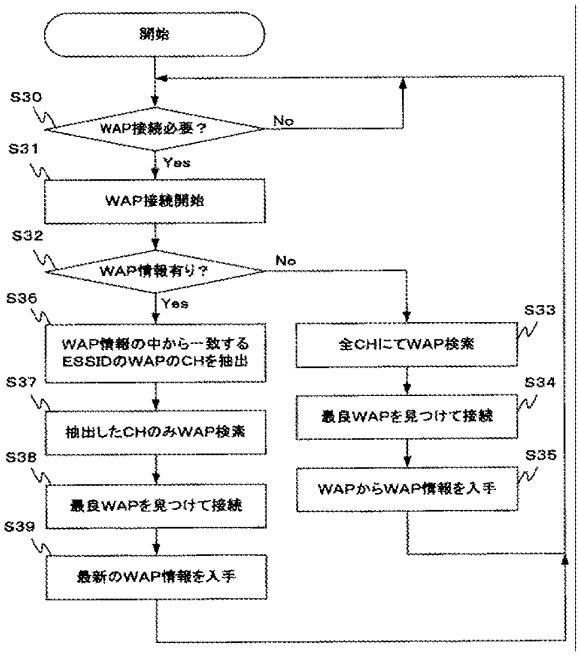
【図3】



無線LANアクセスポイント情報

SYSTEM NAME	BSSID	ESSID	CH
AP11	11111－11111	Office1	1
AP12	22222－22222	Office1	4
AP13	33333－33333	Office1	7
AP14	44444－44444	Office2	14

【図4】


開始
S30
WAP接続必要？
No
Yes
S31
WAP接続開始
S32
WAP情報有り？
No
Yes
S36
WAP情報の中から一致する
ESSIDのWAPのCHを抽出
S37
抽出したCHのみWAP検索
S38
最良WAPを見つけて接続
S39
最新のWAP情報を入手
S33
全CHにてWAP検索
S34
最良WAPを見つけて接続
S35
WAPからWAP情報を入手

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(71) Applicant *(for all designated States except US)*: **STREAMCENTER, INC.** [US/US]: 1512 Wellington Place, Aberdeen, NJ 07747 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **MOGHE, Pratyush** [US/US]; 3002 Cricket Circle, Edison, NJ 08820 (US).

(74) Agents: **DIPPERT, William, H.** et al.; Cowan, Liebowitz & Latman, P.C., 1133 Avenue of the Americas, 35th Fl., New York, NY 10036 (US).

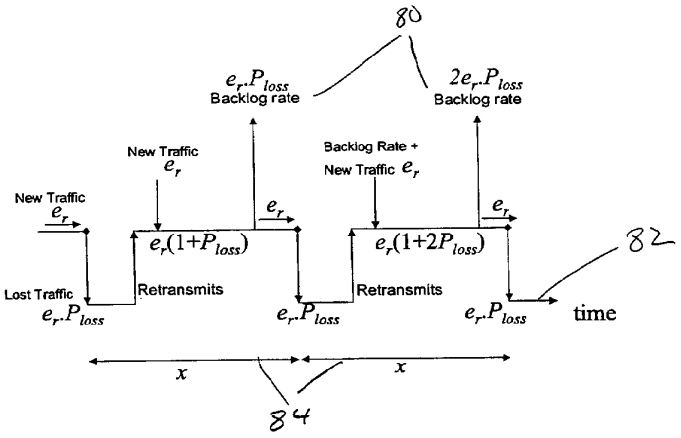
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(54) Title: APPARATUS AND METHOD FOR PREDICTABLE AND DIFFERENTIATED DELIVERY OF MULTIMEDIA STREAMING ON THE INTERNET



(57) Abstract: The inventive method detects network congestion which interferes with streaming of multimedia audio and video packets from and reacts to it and guarantees delivery of packets. The streaming of the multimedia audio and video packets is performed when a server process executing on a sending computing device sends the packets to a player process executing on a receiving computing device via a network, such as the Internet. The detection of the network congestion is performed by communicating configuration information including network parameters from a service manager via the network to the at least one sending computing device and to the at least one receiving computing device. The network congestion (80) is then confirming by transmitting and retracting network probes. At least one buffer management technique is executed to limit degradation in the streaming of the packets. The end of the network congestion is detected by transmitting and retracting said network probes and the rate of streaming of the packets is configured accordingly (82, 84).

WO 01/67264 A1

APPARATUS AND METHOD FOR PREDICTABLE AND DIFFERENTIATED DELIVERY OF MULTIMEDIA STREAMING ON THE INTERNET

TECHNICAL FIELD

This invention relates to the field of multimedia audio and video streaming on the Internet, and more particularly, to an apparatus and method for predictable and differentiated delivery of multimedia streaming on the Internet.

BACKGROUND OF THE INVENTION

Multimedia streaming involves broadcast of audio and video information from content providers called streaming servers or senders via the Internet to clients or receivers on user computing devices called streaming players. Real-time delivery of the multimedia streaming on the Internet is inherently uncontrollable and consequently unpredictable. When an Internet delivery path is congested, packets of multimedia streaming are typically dropped, thus causing degraded audio and video playback to be received by the streaming players. Typically, manifested forms of congestion can be classified into two types: instantaneous and sustained (longer-term). Instantaneous congestion is caused by random variations in the arrival patterns of packets of multimedia streaming at different Internet routers and switches, and due to the varying sizes of these packets.

These variations cause varying amounts of delay as the packets of multimedia streaming travel from the streaming server to the streaming receiver. If the delay accumulates beyond a certain point, the packets of multimedia streaming can get lost. This type of congestion typically causes sporadic delays and losses of over hundreds of milliseconds to a few seconds, and is hence referred to as "instantaneous congestion." In contrast, sustained congestion is longer-term and results during periods of excessive demand by the streaming players, e.g., demand for multimedia streaming from popular websites over the network paths on the Internet. During these periods, packet traffic surges can overwhelm the packet buffers in network routers, which are network traffic routing and forwarding computing devices, and packets of multimedia streaming can get

lost in bursts. This is similar to a rush-hour traffic scenario on highways at peak hours. Unlike instantaneous congestion, sustained congestion can last from tens of seconds up to a few minutes.

It is well known that instantaneous congestion is an easy problem to solve. The client or the streaming player can buffer incoming packets of multimedia streaming for a short duration before playback. This reduces the effect of short-term delay between packets of multimedia streaming. Additionally, by requesting that a lost packet be immediately retransmitted, the streaming player can counter the loss of packets of multimedia streaming due to instantaneous congestion. Several existing streaming systems use these techniques, i.e., short-term buffering along with retransmits of lost packets, to isolate the streaming player from the effects of instantaneous congestion. Examples of these systems include the Robust-User Datagram Protocol (UDP) feature in the Real system from Real Networks and the NetShow 3.0 MediaPlayer from Microsoft.

The problem of sustained congestion is harder to solve. This difficulty relates to the fact that the Internet delivery lacks a uniform real-time control. Several standardization and research efforts have proposed ways to introduce such control; however, none have succeeded in creating a global Internet standard. The referred to standardization and research efforts include the following:

1. L. Kleinrock, "On Flow Control in Computer Networks", International Conference on Communications (ICC'78), pages 27.2.1-27.2.5;
2. D.E. Comer, R. S. Yavatkar, "A Rate-based Congestion Avoidance and Control Scheme for Packet Switched Networks", The 10th International Conference on Distributed Computing Systems, pages 390-397, 1990;
3. K.K. Ramakrishnan, R. Jain, "A Binary Feedback Scheme for Congestion Avoidance in Computer Networks", ACM Transactions on Computer Systems, Vol. 8, No. 2, May 1990, Pages 158-181; and
4. D. Mitra, "Asympotically Optimal Design of Congestion Control for High Speed Data Networks", IEEE Transactions on Communications, Vol. 40, No. 2, February 1992.

For example, the RSVP effort, described in Braden, R., Zhang, L., Berson, S., Herzog, S., and Jamin, S., "Resource Reservation Protocol (RSVP) - Version 1

Webgroup CZ a.s. Ex. 1002, Page 1104 of 1406

Functional Specification", RFC 2205, Proposed Standard, September 1997, seeks to add "quality of service" control within each network router and switch within the Internet. Another effort that seeks to create fast paths on the Internet is the "differentiated service" effort within the Internet Engineering Task Force (IETF) described in the following publications:

1) Nichols, K., Jacobson, V. and Zhang, L., "A Two-bit Differentiated Services Architecture for the Internet", Internet Draft, December 1997;
2) Ferguson, P., "Simple Differential Services: IP TOS and Precedence, Delay Indication, and Drop Preference", Internet Draft, November 1997; and
3) Clark, D. and Wroclawski, J., "An Approach to Service Allocation in the Internet", Internet Draft, July 1997.

The problem with these approaches is that they require structural changes throughout the Internet. This requirement assumes an explicit cooperation between various managers of the equipment comprising the Internet, which is an impractical assumption. Consequently, these efforts have stalled or are expected to have limited success. An alternative approach is to offer "adaptive applications". This approach proposes that application content be adapted based on the level of congestion. Methods based on this approach degrade the "experience" of an application in a controlled manner, but do not attempt to guarantee predictability or isolation from congestion effects. This approach is discussed in I. Busse, B. Deffner, H. Schulzrinne, "Dynamic QoS Control of Multimedia Applications based on RTP", May 30, 1995 and Real Networks, "White Paper on SureStream Technology", Available at http://www.real.com/devzone/library/whitepapers/surestrm.html.

What is needed is a "delivery framework" that will isolate streaming players from the effect of sustained congestion by providing a "predictable" delivery. Furthermore, there is also a need for a "differentiated streaming" framework that will provide for multiple levels of delivery isolation to the streaming players, without requiring structural changes in the Internet, as in K. Nichols et al., P. Ferguson and D. Clark, discussed above.

Webgroup CZ a.s. Ex. 1002, Page 1105 of 1406

SUMMARY OF THE INVENTION

The object of the present invention is to achieve a particular level of delivery isolation on particular streaming players. This level of delivery isolation may be based on factors like an importance "value" associated with particular streaming players, or the price the user of the streaming players are charged, etc. As an example, the streaming server may place specific streaming players in the high "value" category based on the demographic information on their owners, while other streaming players may be placed in the low "value" category.

Another object of the present invention is to ensure that the high value users of streaming players always receive consistent, predictable delivery of streaming content, even if there is an excessive user demand. If there is a situation of sustained congestion, wherein not all users can be satisfied, the content provider might want to ensure that the high value users are promised predictable delivery.

Accordingly, the present invention provides a method and an apparatus for predictable and differentiated streaming on the Internet. The system consists of software and random-access memory-based buffers installed at the streaming server and at the streaming players along with a service manager at a separate location. The method prescribes the manner in which the system is used to achieve predictable and differentiated delivery of streaming multimedia packets.

The invention is based on streaming multimedia packets between the software on the streaming server and the software on the streaming. The buffer sizes in the computing devices of the streaming player and of the streaming server are initialized based on the configuration information provided by the service manager software at the start of the execution of the inventive method. This configuration information includes:

a) the expected duration of sustained congestion periods,

b) the worst-case packet loss rate during the sustained congestion period,

c) the encoded bit-rate of streaming source information, and etc.

During the delivery of the streaming multimedia packets, the software on the streaming server relays the streaming packets to the software on the streaming player, which stores the packets in a playout buffer before playing them out. The playout buffer takes care of

Webgroup CZ a.s. Ex. 1002, Page 1106 of 1406

delay variation that may arise due to instantaneous congestion on the network path. In case of short-term losses caused by instantaneous congestion, the software on streaming player immediately requests the server-end software to retransmit the lost information.

Predictable Delivery Method

To deal with sustained congestion ("congestion") the invention incorporates the following method. The software on the streaming player uses estimation techniques based on probes to detect and confirm the onset of sustained congestion. Once the congestion status is verified, the streaming player software informs the streaming server software about this event. The streaming server software then modifies the manner in which it streams packets to the streaming player software. In particular, the streaming server software ensures that the transmission rate of packets never exceeds the encoded bit-rate of the streaming source. Furthermore, it gives preemptive priority to the retransmitted packets over new packets. This creates a backlog of new packets at one of the streaming server buffers.

Meanwhile, the streaming player software continuously monitors the status of received packets and detects the end of congestion through estimation techniques based on probes. Once the end of congestion is confirmed, the streaming player software informs the streaming server software about this event. The streaming server software then begins to stream its backlog of new packets to the streaming player software. The transmission rate of this stream is increased based on the estimation information from the streaming player software along with feedback obtained from other streaming players in the network. This rate is carefully selected to ensure that the network is not flooded back into congestion. The buffer sizing at the streaming player and at the streaming server is based on the configuration information and ensures that the user experiences an uninterrupted playback during sustained congestion. This assumes that the configuration information is the "worst-case" scenario. If the actual service parameters turn out to be worse than the configuration information, the streaming player software contacts the service manager after the service. The configuration information at the service manager is now updated in a persistent manner with the actual worst-case parameters.

Webgroup CZ a.s. Ex. 1002, Page 1107 of 1406

In one preferred embodiment, this update happens as follows. At the next service invocation, the buffers are sized based on the updated configuration information. The method thus automatically learns the worst-case behavior from the actual behavior of the network each time. Eventually, the method can guarantee a predictable delivery based on a non-interrupted playout in most cases. Various other embodiments are also possible, wherein the buffer size is fixed, but the encoding bit-rate of the stream is modified to choose the largest encoding bit-rate that leads to an uninterrupted playback.

Differentiated Streaming Method

The method for differentiated streaming involves identical operations as the predictable streaming method, except for the mechanism for streaming the backlog of packets from the streaming server software. For differentiated streaming, the streaming server software transmits the stream based on the "value" associated with the particular user, in addition to the information used for predictable streaming.

Accounting Delivery Service

Additionally, the methodology of the mentioned invention is utilized to offer the inventive method as an "accountable delivery service" to a large number of content providers, i.e., streaming servers, and users, i.e., streaming players. Such a service may deliver performance contract-based services to users of the streaming players on the Internet.

The service manager plays a central role in this service, by keeping and exchanging the state of several streaming players, delivery paths, and content providers/streaming servers in its database. The method of the present invention tracks the "actual" delivered viewing/listening experience of users of streaming servers by computing the delivery statistics including but not restricted to metrics that quantify "pauses or interruptions", "content throughput", and "content loss". In addition to the features of predictability and differentiation, the delivery service can also answer the question of "service feasibility". That is, at the beginning of a session, the service manager can estimate, based on the historical and instantaneous information, whether a

particular user can receive an "expected quality experience." While the present invention does not describe the details of this service, it should be obvious to those skilled in the art to build such a service around the framework of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which the reference characters refer to like parts throughout and in which:

Figure 1 is a schematic diagram of the devices and programs comprising the invention.

Figure 2 is a schematic diagram of the components of the devices utilized by the invention.

Figure 3 is a schematic diagram of the operation of the invention during normal streaming.

Figure 4 is a schematic diagram of the operation of the invention during congestion.

Figure 5 is a schematic diagram of the recovery scheduling operation of the invention after congestion.

Figure 6 is a diagram of the modeling the backlog operation of the invention during congestion.

Figure 7 is a state transition diagram for streaming player module (normal streaming).

Figure 8 is a state transition diagram for streaming server module (normal streaming).

Figure 9 is diagram of a congestion processing protocol at the streaming player module (during and after congestion).

Figure 10 is a diagram of an congestion processing protocol at the streaming server module (during and after congestion).

Webgroup CZ a.s. Ex. 1002, Page 1109 of 1406

DETAILED DESCRIPTION OF THE INVENTION

Architecture

The invention, shown in Figure 1, comprises at least one computing device 10 for executing a service manager process 12, at least one computing device 14 for executing streaming server process 16, and at least one computing device 18 for executing streaming player process 20. The service manager process 12 is shown as residing on the computing device 12 only for the clarity of presentation. It may be obvious to those skilled in the art that the service manager process 12 may reside on any computing devices 14 and 18. Furthermore, server processes 16 may be present on the computing devices 18 alongside player processes 20, and vice versa the player processes 20 may be present on the computing devices 14 alongside server processes 16. Each computing device 10, 14 and 18 are connected to a network 22 and establish data paths amongst each other. In the preferred embodiment, the network is the Internet.

The streaming server process 16 transmits a single multimedia stream to each streaming player process 20 and the streaming player process 20 receives that single multimedia stream. The streaming server process consists of three buffers:

a) Output buffer 24, used to transmit new packets from the server process 16 to the player process 20;

b) Backup buffer 26 , for maintaining temporary copies of the packets transmitted to the player process 20; and

c) Retransmit buffer 28, for maintaining retransmit requests received from the player process 20. The streaming player process 20 may comprise a player buffer 29.

Before a streaming session begins, the Service Manager process 12 downloads configuration information via the network 22 to both the computing device 14 for the use of the streaming server process 16 and to the computing device 18 for the use of the streaming player process 20. At the end of each streaming session, the configuration information on the computing device 10 is updated for the future use of the Service Manager process 12 via the network 22 by both the streaming server process 16 on the computing device 14 and the streaming player process 20 on the computing device 18.

The computing devices 10, 14, and 18 may take the configuration of any computer ranging from mainframes and personal computers (PCs) to digital telephones and hand held devices, e.g., palm pilots™. In one illustrative embodiment of this invention shown in Figure 2, such computing devices may comprise a bus 30, which is connected directly to each of the following:

1. a central processing unit (CPU) 32;
2. a memory 34;
3. a system clock 36;
4. a peripheral interface 38;
5. a video interface 40;
6. an input/output (I/O) interface 42;
7. a communications interface 44; and
8. a multimedia interface 46.

The common bus 30 is further connected

1. by the video interface 40 to a display 50;
2. by the I/O interface 42 to a storage device 52, which may illustratively take the form of memory gates, disks, diskettes, compact disks (CD), digital video disks (DVD), etc.;
3. by the multimedia interface 46 to any multimedia component 56;
4. by peripheral interface 38 to the peripherals 58, such as the keyboard, the mouse, navigational buttons, e.g., on a digital phone, a touch screen, and/or writing screen on full size and hand held devices, e.g., a palm pilot ™;
5. by the communications interface 44, e.g., a plurality of modems, to a network connection 60, e.g., an Internet Service Provider (ISP) and to other services, which is in turn connected to the network 22, whereby a data path is provided between the network 22 and the computing devices 10, 14, and 18 (Figure 1) and, in particular, the common bus 30 of these computing devices; and
6. furthermore, by the communications interface 44 to the wired and/or the wireless telephone system 54.

Normal Conditions

Turning now to Figure 3, the normal streaming operation is shown when there are either zero, i.e., no losses, or sporadic streaming losses, i.e., loss occurring due to instantaneous burst of streaming packets. The overall streaming sequence works as follows. Packets streamed from the streaming server process 16 are queued up in the streaming server output buffer 24 for transmission. The server process 16 is responsible for transmitting streaming packets 70 to the computing device 18 executing the player process 20. Periodically, this process 16 checks the output buffer 24 and the retransmit buffer 28 to determine if there are streaming packets 70 awaiting transmission or any requests form the player process. Any remaining streaming packets in the output buffer 24 are then transmitted. If retransmission requests are found, any streaming packets 70 requested for retransmission and found in the backup buffer 26 are transmitted. When streaming packets 70 are transmitted, a temporary backup copy of the transmitted streaming packets 70 is kept in the backup buffer.

The streaming player process 20 receives the streaming packets 70 and stores them at the tail-end of the player buffer 29. Periodically after a user-defined interval, the player process 20 examines the received streaming packets 70 to see if any streaming packets 70 are missing. If packets are missing, the player process 20 sends a request 72 to the server process 16 to retransmit the missing packets. After assuring that all the streaming packets 70 are received, the received streaming packets 70 are forwarded from the head-end of the player buffer to the streaming player process 20.

Congested Conditions

The invention detects congestion early on, and then may take steps so that the impact of congestion on the stream is minimized. A correctly configured framework can keep a stream completely transparent of sustained congestion, thus providing an effect equivalent to a "reservation." Two principles are at the basis of this framework, detection/reaction to congestion and congestion recovery.

1. Detecting and reacting to congestion

Webgroup CZ a.s. Ex. 1002, Page 1112 of 1406

The invention detects congestion through probes launched by the player process 20. The probes are discussed in detail later. Once congestion is confirmed, the server process 16 reacts by using a technique called "constant bit-rate emulation." This name derives from the fact that the server process 16 tries to maintain a constant upper bound on the rate at which the streaming packets 70 are streamed to the player process 20. Typically, the upper bound is set equal to the encoding bit rate of the stream. In effect, the server process 16 emulates a constant bit-rate by substituting new server packets with packets that have been requested 72 for retransmission. Please recall that in congestion, the server has a large number of retransmit requests 72 issued from the player process 20. Figure 4 shows the flow of streaming packets 70 during this congestion situation. Two important reasons motivate the constant bit-rate emulation method:

a) The method demonstrates a "network-friendly" yet efficient behavior. The method is network-friendly, since it conserves bandwidth during congestion by lowering the upper bound of its streaming transmission rate. Additionally, the method is efficient for the following reasons. First, the upper bound on the transmission rate is set equal to the maximum encoding bit-rate of the source stream; this is not a restrictive setting. Unlike other schemes that voluntarily reduce the source rate during congestion, the present invention only reduces the transmission rate by the amount of incurred loss. This decision has an important implication in practice. Most practical congestion-processing algorithms will incur errors and delays in estimating and reacting to the start of congestion or end of congestion. Consequently, there will be temporary periods in which these algorithms "think" that the network is congested, when in practice, the network has cleared out of congestion. In situations like this, estimation errors do not degrade the streaming throughput. In fact, the invention delivers a throughput better or equal to the throughput of any other scheme, if there is no loss of streaming packets 70.

b) Assuming most connections sharing the network with streaming are using the Transmission Control Protocol (TCP), the constant bit-rate of the invention in congestion allows the TCP traffic on the same path to accurately sense the available bandwidth (most Internet or Web traffic uses TCP). An alternative design with

adapting bit-rate would confuse most other TCP connections and cause each to keep oscillating their TCP windows. If all TCP connections maintain a steady window-size, the performance of the network is much smoother in congestion. This behavior can drain out the congestion faster and reduce the estimation errors.

2. Detecting End-of-Congestion and Recovery from congestion

The invention detects the end of congestion through probes launched by the player process 20. Once the player process 20 confirms that congestion is over, the server process 16 enters a phase called "recovery scheduling". Figure 4 shows a recovery scheduling after congestion. To understand this phase, recall that in the previous state of congestion, the server transmits packets at a constant rate. By substituting new packets with older lost packets, the server is in effect creating a backlog of new packets in its output buffer. The idea in recovery scheduling is to exhaust the substantial backlog that may build up at the server output queue. Clearly, this backlog must not be cleared by flooding the network. Such action may cause significant losses in the intermediate switch buffers. In addition, if thousands of streams of packets 70 flood the backlog at the same time, this may cause certain network points to get congested again. Recovery scheduling is a procedure that configures the rate of streaming the backlog based on the network parameters. Additionally, recovery scheduling can also take into account the "premium" placed on the particular player process 20. The latter consideration allows the server process 16 to stream backlog of streaming packets at different priorities. "Higher value" users can receive backlog sooner than "lower value" users. This is the basic principle behind differentiated streaming.

Buffer Design

As described previously, the configuration information is downloaded to the computing devices 14 and 16 at the beginning of each streaming session. This configuration information includes the following parameters:

(1) Worst-case duration of congestion, $c*x$, where x is a sampling or retransmission interval, and c is a number of sampling intervals in a congestion period.

(2) Worst-case of loss of streaming packets 70 during congestion defined by P_{loss}

(3) Encoding bit-rate of the stream of streaming packets 70 defined by e_r

(4) Averaged and minimum service rate, SR_{avg} and SR_{min}. This is the rate at which streaming packets 70 are actually transferred from the server process 16 to the player process 20. SR_{min} is the minimum rate across the path via the Internet 22 from the server process 16 to the player process 20.

(5) Path bottleneck link bandwidth B_{min} and the hop link capacities, where B_{min} is the minimum physical bandwidth across all the hops, i.e., the routing devices between the server process 16 and the player process 20.

The parameters indicated in the list above may be obtained through historical measurements of the relevant values and through measurements made on streaming packets 70 at the computing device 14 of the server process 16. The parameters are in turn used to design the sizes of the buffers 24, 26, 28 and 29 of server process 16 and the player process 20. One preferred embodiment of achieving this is described immediately below. That embodiment ignores the upper bounds limits on the buffer sizes related to the available random-access memory 34 (Figure 2) in the computing devices 14 and 18.

Player Buffer-size (b_c)

The buffer on the computing device 18 used by the streaming player process 20 plays out the streaming packets 70 at the maximum rate of e_r bits per second. During sustained congestion, the packet loss is approximately P_{loss}, and the maximum transmission rate from the server, as explained above is e_r. It follows that the rate of the player buffer 29 fill rate equals to $e_r * (1 - P_{loss})$ bits per second. Thus, the net drain on the player buffer 29 proceeds at the rate of $e_r * P_{loss}$ bits per second. To prevent the player buffer 29 from draining out completely within the congestion period $c * x$, the buffer-size of the player buffer 29 should satisfy the constraint defined as:

$$\frac{b_c}{e_r * P_{loss}} \geq c * x \quad \text{or} \quad b_c \geq c * x * e_r * P_{loss} \qquad \text{(Equation 1)}$$

Streaming Server Output Buffer-size (b_o)

Recall that the streaming server output buffer holds the backlog of new packets created during the congestion period. Consequently, the size of this buffer is dictated by the worst-case amount of backlog during the congestion period. To calculate the worst-case backlog of the streaming packets 70, a simple model may be built up. Figure 6 shows the approximate amount of backlog as a function of time 82 during sustained congestion. As indicated, the backlog rate 80 after two retransmission intervals 84 is $2 * e_r * P_{loss}$. By extension, after c retransmission intervals 84, the backlog rate 80 will be $cx * e_r * P_{loss}$. This establishes the constraint on the size of the output buffer 14 (Figure 1) in the memory 34 (Figure 2) of the computing device 14 (Figure 1) executing streaming server process 16 (Figure 1).

$$b_o \geq c * x * e_r * P_{loss} \qquad \text{(Equation 2)}$$

Server Backup Buffer-size (b_{backup})

The backup buffer 26 (Figure 1) holds temporary copies of the server packets that have been transmitted to the player process 20 (Figure 1). The copies must be held until the server is sure that the packets have been successfully received in the player buffer 29 (Figure 1). To estimate the size of this backup buffer 26 (Figure 1) again, an operational model is built. First, the transmission rate in packets per seconds is defined as R_p. At the start of the first retransmit 84, the approximate rate of loss of the streaming packets 70 (Figure 3) is $P_{loss} * R_p$. Assuming the loss affects new as well as retransmitted streaming packets 70 (Figure 3) equally, the approximate rate of loss for older unsuccessful streaming packets 70 (Figure 3) at the second retransmit 84 is $P_{loss}^2 * R_p$. Supposing now that the number of retransmits that will reduce the loss rate for older

packets to a negligibly small number, e.g., 0.1 packets for every retransmission interval is defined by m. This implies that:

$$P_{loss}^{m} * R_p \leq \frac{0.1}{x}, \quad \text{or that} \quad m \geq \frac{\log\left(0.1/R_p * x\right)}{\log P_{loss}}$$

Alternatively, if s is the packet size, the above equation may be expressed as:

$$m \geq \frac{\log\left(0.1 * s/e_r * x\right)}{\log P_{loss}}$$

The minimum required buffer size may be defined as equal to $m * x$. Consequently, the size constraint of the backup buffer 26 (Figure 1) is

$$b_{backup} \geq m * x \quad \geq x * \frac{\log\left(0.1 * s/e_r * x\right)}{\log P_{loss}} \qquad \text{(Equation 3)}$$

The detailed operational method underlying the invention is captured through a protocol called "Streaming Congestion Protocol" (SCP). In the section below the SCP sequences during different phases of streaming are described. Figures 6 and 7 show the detailed operational sequence at the streaming server process 16 (Figure 3) and the streaming player process 20 (Figure 3) during normal streaming of the streaming packets 70 (Figure 3). The operational sequences are described with the help of state diagrams. A state diagram shows various states and transitions between states. Each state captures a specific operational state, and the transitions between states capture the events that cause the operational states to change. Figure 7 shows the state diagram of events at the streaming server process 16 (Figure 1). Figure 8 shows the corresponding state diagram at the streaming player process 20.

Processing during and after congestion

Please refer to Figure 9, by default, the streaming player process 20 is in a normal state 100. The player process 20 may keep a track of the packet loss of a received stream at a periodic interval that may be user determined. If the amount of loss exceeds a

threshold, e.g., Threshold1, across a time-window of some number of seconds which may also be user determined, e.g., TW1, the player process 20 moves into the Likely Congestion state 102. At this point, the streaming player process 16 (Figure 1) launches congestion probes to determine whether the congestion symptoms are verified. These probes form a part of a test called confirm congestion test. If the test indicates that congestion is confirmed, the process moves to a Congestion Confirmed state 104. Immediately, the streaming player process 20 contacts its server counterpart and informs it about the new state change along with some other relevant information.

Note that the transition from a Likely Congested state 102 to Congestion Confirmed State 104 can happen in two other ways. First, the player process 20 may actually receive a Remote Congestion Confirmed report in state 106 from its server process 16 (Figure 1) indicating that some other player process 20 on a related network path is in the Congestion Confirmed state. If this happens, the player immediately moves to the Congestion Confirmed State 104 itself. If the player process 20 has already started conducting congestion probes before this notification, the player process 20 may halt them at the instant it receives the notification. Alternatively, the player process 20 may receive a Local Congestion Confirmed report in state 102 reporting that some other local player process 20 on the same streaming player module has verified congestion. If the Remote or local Congestion Confirmed reports have verified congestion within a past time-window not exceeding the time defined as Tcc, the player process 20 moves to a confirmed congestion state 104.

Once the streaming player process 20 (Figure 1) enters the congestion confirmed state 104, it periodically monitors the loss of the received stream of streaming packets 70 (Figure 3). If the packet loss is less than a second user defined threshold, e.g., Threshold2, across a second user defined time-window, e.g., TW2 seconds, the player process 20 enters the likely end-of-congestion (EOC) state 106. At this point, the player process 20 launches an EOC probe test that either confirms or invalidates the EOC decision. If the EOC probe test confirms congestion, the streaming player process 20 enters the EOC state 108 and sends an EOC report 110 to its server process 16 (Figure 1) counterpart. With this transition, the process re-enters the normal state 100. Note that

during transitions from the EOC state 110 back to the Normal State 100, the streaming player process 20 also needs to continually process the arriving packets in step 120 (Figure 7), check and request for retransmission of missing packets in step 122 (Figure 7), and forward packets to the streaming player for playback in step 124 (Figure 7). These activities are indicated in Figure 7 and are not shown in Figure 9 for purposes of clarity.

Figure 10 shows the SCP state-diagram of the server process 16. After initialization, the server process 16 enters the normal state 130. If the server process 16 receives a report from its streaming player process 20 (Figure 1) indicating congestion, the server moves to the Confirmed Congestion or Confirmed Congestion State 132. At this point, the server process 16 shares the Confirmed Congestion status information with other server processes 16 running on the same computing device 14 (Figure 1) in the Propagate Confirmed Congestion state 134, and potentially also from other computing device 14 (Figure 1) through interaction with the service manager 12 (Figure 1) via the network 22 (Figure 1). The idea behind this is to have selected server processes report the congestion to their player process so that these player processes can avoid doing the Confirmed Congestion probing test. This cuts down on the congestion reaction time and significantly cuts down the probing traffic. In general, each server process that receives the Confirmed Congestion status in the Receive the Confirmed Congestion status state 140 from other server processes 16, first determines whether the Confirmed Congestion status is relevant to its target player process 20 (Figure 1). If this is the case, the server processes notify their player process 20 (Figure 1). Notification is done through a special signaling scheme involving reliable transport protocol (RTP) messages, as discussed in Schulzrinne, Casner, Frederick, Jacobson, "RTP: A Transport Protocol for Real-time Applications", RFC 1889, Internet Engineering Task Force.

The streaming server process 16 will then make transitions from the Confirmed Congestion State 132. Starting with the Confirmed Congestion state 132, the server process 16 transmits streaming packets 70 (Figure 3) at a constant bit-rate. The server process 16 moves to the Recovery Scheduling State 136 as soon as it receives an End-of-congestion or EOC report from the player process 20 (Figure 1) targeted for the reception of

Webgroup CZ a.s. Ex. 1002, Page 1119 of 1406

its content. Thereafter the server process 16 changes its mode of transmission, using recovery scheduling to drain its backlogged output buffer 24 (Figure 1) in an intelligent way. As soon as the backlog is over, the server process 16 moves back to the normal state 130.

While in the Normal State 130 the server process 16 may receive and filter information from other server processes 16 by entering the Receive Confirmed Congestion State 140. It may also notify the player processes 20 (Figure 1) about the confirmed congestion status through the in-band RTP signaling, by entering the Confirmed Congestion Notification state 138 from where the process 16 will return to the Normal state 130.

The server process 16 also needs to continually process the departing packets in step 150 (Figure 8), check and process the requests for retransmission of missing packets in step 152 (Figure 8), and backup packets to the backup buffer 26 (Figure 1) for playback. These activities are indicated in Figure 8 and are not shown in Figure 10 for purposes of clarity.

Recovery scheduling algorithm

Supposing that the server process 16 (Figure 1) streams of streaming packets 70 (Figure 3) are classified into K number of priority classes. Class 1 being the highest priority and class "K" being the lowest priority. Each priority class "j" is associated with a weighting function α^j, where $0 < \alpha^K < \alpha^{K-1} < .. \alpha^j < .. < \alpha^1 = 1$. Considering the server process 16 (Figure 1) with priority equaling to "j", the rule for transmission rate e_t of this process is:

$$e_t = \min(\alpha^j \times SR_{min}, \alpha^j \times \frac{B - \lambda_{other}}{\sum_{i=1}^{i=K} \alpha^i n^i}) \quad \text{(Equation 4)}$$

In equation 4, all the terms are measured at the service bottleneck hop between the computing device 14 executing the server process 16 and the computing device 18 executing the player process 16. B is the bottleneck link capacity at the bottleneck hop.

λ_{other} is the aggregate packet rate carried at the hop from traffic not utilizing the inventive method. This rate can be estimated by obtaining the aggregate packet rate of the streaming packets 70 (Figure 3) of the inventive method λ_{SME} from the service manager, and using the fact that $\lambda_{other} = B \times \rho - \lambda_{SME}$, where $\rho = 1 - \frac{SR_{\min}}{B}$ is the utilization of the bottleneck hop. The parameter n^i is defined as the number of priority "i" streams carried at the bottleneck hop. The hop is a section of a network between two network-computing devices such as routers. This parameter may be obtained from the service manager 12 (Figure 1). The logic behind this equation is as follows. The first term indicates that the new transmission rate should be set equal to the minimum service rate along the path, in order to recover from the backlog. The second term takes into account the result of increasing the transmission rate on the utilization at the bottleneck hop. In other words, since the maximum utilization can be 100%, each computing device 14 executing server process 16 must carefully weigh the effects of increasing the transmission rate. The best rate is the maximum rate that does not congest the bottleneck bandwidth during recovery. Hence the min operator. Finally, the priorities within the equation 4 provide for differentiated streaming.

Congestion Estimators

Earlier on, we described the congestion estimation tests as part of the SCP algorithm. In principle, congestion can be estimated in a variety of ways, and the invention is not restricted to any one particular method of congestion estimation. A particular embodiment of the invention for estimating congestion based on a mix of passive and active probes will now be described. This method comprises a set of rules configured around the results of the probes. A specific congestion test e.g., an end of congestion test or a confirmed congestion test mentioned in earlier sections, combines these rules in a particular way.

The following are some of a variety of methods that may be used to compute the bottleneck bandwidth on a path between the streaming player 20 (Figure 1) and the

Webgroup CZ a.s. Ex. 1002, Page 1121 of 1406

streaming server 16 (Figure 1). These methods are shown here for exemplary purposes only and not to indicate that only these methods must be used with the present invention.

Capacity Probe

This method is described in detail in Van Jacobson, "pathchar - A tool to infer characteristics of Internet paths", MSRI, April 21, 1997; and R. L. Carter and M.E. Crovella, "Measuring Bottleneck Link Speed in Packet-switched Networks", TR-96-006, Boston University Computer Science Department, March 15, 1996. This method is initiated by the player process 20 (Figure 1) at various stages of a streaming session. The steps of this exemplary method are as follows:

1. Do a traceroute and get hop identities marked by IP addresses.
2.

a) For every hop from one onwards, send a series of ICMP timestamp requests (type 13) from the player to the hop. Packet sizes of queries are changed in steps of 1024, 512, 256, 128, and 64, where each queries are sent out with a spacing of 3 seconds between them.

b) For every hop i between the player and the server, the player must record the ICMP timestamp response (type 14) and compute the time difference between the hop i transmit time t_i and the player receive instant t_1.

c) Denote the time difference by $\tau_{i1} = t_i - t_1$.

d) Take four measurements for timestamp differences by varying packet size through five values. Discard the minimum and the maximum, and take average of the remaining two. Let s' and s'' denote the packet sizes of two selected queries to hop i. Let $\tau_{i1'}$ and $\tau_{i1''}$ denote the measurements for the respective packet sizes.

e) Calculate $X_{i1} = \frac{\tau_{i1'} - \tau_{i1''}}{s' - s''}$

$$B_{i,i-1} = \frac{1}{X_{i1} - \left(\sum_{k=1}^{i-2} \frac{1}{B_{i-k,i-k-1}} \right)}$$

It can be proved that link capacity can be computed recursively.

The path bottleneck bandwidth $B_{min} = \min_i B_{i,i-1}$. (Equation 5)

Service Rate Probe

The "Service Rate probe" computes the approximate service rate of transferring packets between the server and the player, as discussed in Van Jacobson, "pathchar - A tool to infer characteristics of Internet paths", MSRI, April 21, 1997; and R. L. Carter and M.E. Crovella, "Measuring Bottleneck Link Speed in Packet-switched Networks", TR-96-006, Boston University Computer Science Department, March 15, 1996. The minimum service rate is the least service rate on the path, while the average service rate is the "expected" service rate on the path. . The steps of this exemplary method are as follows:

1. Obtain the hop list through traceroute. Suppose there are n-1 hops between the player and the server.
2. Periodically, the player initiates a cycle. In each cycle, the player sends n-1 queries, each spaced by ¼ second. The player forms timestamp differences between query responses from consecutive hops. The results are sent back to the server.
3. The server uses results from several cycles along with the link capacities to calculate the service rate.
   a) First, the server calculates $\tau_{m,m-1}^{min} = \min(\tau_{m,1} - \tau_{m-1,1})$ where the min operator works over all collected cycle results. We approximate $\tau_{m,m-1}^{min}$ to be the base-line delay between node m and node m-1.
   b) Denote the maximum queuing delay between node m and node m-1 by $q_{m,m-1}^{max}$, where node is a computing device, e.g., a computer or a router connected to the network.

Webgroup CZ a.s. Ex. 1002, Page 1123 of 1406

c) Then, $q_{m,m-1}^{max} = max\left(\tau_{m,m-1} - \tau_{m,m-1}^{min}\right)$

d) Denote the average queuing delay between node m and node m-1 by $q_{m,m-1}^{avg}$.

e) Then, $q_{m,m-1}^{avg} = avg\left(\tau_{m,m-1} - \tau_{m,m-1}^{min}\right)$

Finally, the minimum service rate is:

$$SR_{m,m-1}^{min} = \frac{s}{\frac{s}{B_{m,m-1}} + q_{m,m-1}^{max}},$$

and the average service rate is:

$$SR_{m,m-1}^{avg} = \frac{s}{\frac{s}{B_{m,m-1}} + q_{m,m-1}^{avg}} \qquad \text{(Equation 6)}$$

Congestion Detection Rule (CC Test)

A robust but responsive congestion detection mechanism is an essential part of the inventive method. It is important to respond quickly to congestion; this can reduce the congestion period and hence make it easier for the recovery scheduling to do its job in a shorter period of time. Ultimately this can allow the method to work with a reduced buffer size and hence a reduced connect lag. It is equally important to robustly distinguish a sustained congestion condition. False detection can lead to reduced throughput and performance. Recall that the inventive method treats sustained congestion by reducing the throughput of the newer packets, so that the throughput of older retransmitted packets is maximized.

The present invention uses the following congestion detection rule:

1. Packet losses exceeding a threshold for a consecutive time-window of duration T_s. T_s is set to 10 seconds by default.
2. If condition 1 is triggered, three short service rate probes are sent, spaced 2 seconds apart, from the player to the SR_{min} hop. Responses are averaged to form

Webgroup CZ a.s. Ex. 1002, Page 1124 of 1406

SR_{avg}.

The player process 20 (Figure 1) computes the expected utilization $\rho = 1 - \frac{SR_{avg}}{B}$. If condition 1 is satisfied and the utilization from condition 2 is more than a specified utilization threshold, e.g., 95%, the player process 20 (Figure 1) declares sustained congestion (Confirmed Congestion), and asks the server to enter the constant bit-rate emulation mode. An alternative method may consists of a simple rule where if packet losses exceed a threshold for N_1 consecutive sampling time-windows, the player process 20 (Figure 1) declares sustained congestion and asks the server to enter the constant bit-rate emulation mode. By default, N_1 is set to 1, and time-window is set equal to 1 second.

End of Congestion Rule (EOC Test)

The end of congestion rule is analogous to the congestion detection rule:

1. No packet losses for a consecutive time-window of duration T_e. T_e is set equal to 10 seconds by default.
2. If condition 1 is triggered, three short service rate probes are sent, spaced 2 seconds apart, from the player to the SR_{min} hop. Responses are averaged to form SR_{avg}. The player computes the expected utilization $\rho = 1 - \frac{SR_{avg}}{B}$.

If condition 1 is satisfied and the utilization from condition 2 is less than a specified threshold, e.g., 90%, the player declares sustained congestion to be over, and asks the server to transition to the state of recovery scheduling. An alternative method may consists of a simple rule where if in a state of sustained congestion, no packet losses are manifest for N_2 consecutive sampling time-windows, the player declares sustained congestion to be over, and asks the server to transition to the state of recovery scheduling. By default, N_2 may be set equal to five, and the sampling time-window is set equal to 1 second.

Webgroup CZ a.s. Ex. 1002, Page 1125 of 1406

Thus, an apparatus and method for predictable and differentiated delivery of multimedia streaming on the Internet is provided. One skilled in the art will appreciate that the present invention can be carried out in other ways and practiced by other than the described embodiments, yet not departing from the spirit and essential characteristics depicted herein. The present embodiments therefore should be considered in all respects as illustrative, and the present invention is limited only by the claims that follow.

Webgroup CZ a.s. Ex. 1002, Page 1126 of 1406

CLAIMS

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent is:

1. A method of streaming of multimedia audio and video packets from at least one sending computing device to an at least one receiving computing device via a network, said method comprising the steps of:

a) at a start of said streaming communicating configuration information from a service manager via the network to both an at least one sending computing device for use by an at least one server process and an at least one receiving computing device for use by an at least one player process, said at least one sending computing device comprising an at least one retransmit buffer, an at least one output buffer, an at least one backup buffer and said at least one server process, said at least one receiving computing device, comprising an at least one player buffer and an at least one player process;

b) queuing same packets in the at least one output buffer and to the at least one backup buffer;

c) determining if there are packets in the at least one output buffer and transmitting the packets from the at least one output buffer to the at least one receiving computing device via the network;

d) receiving the packets on the at least one receiving device and storing them in the at least one player buffer;

e) determining if there are omissions in the packets stored in the at least one player buffer and forwarding retransmission requests to the at least one sending computing device and storing them in the at least one retransmit buffer; and

f) determining if there are said retransmit requests in the at least one retransmit buffer and transmitting the packets from the at least one backup buffer to the at least one receiving computing device via the network.

Webgroup CZ a.s. Ex. 1002, Page 1127 of 1406

2. The method of claim 1 wherein, the network is Internet.

3. The method of claim 2 wherein, a size of the at least one player buffer is $\geq c*x*e_r*P_{loss}$, where c is a number of sampling intervals in a congestion period, x is a sampling or retransmission interval, $c*x$ is a worst-case duration of congestion, e_r is an encoding bit-rate of a stream of the packets and P_{loss} is a worst case of loss of the packets.

4. The method of claim 3 wherein, a size of the at least one output buffer is $\geq c*x*e_r*P_{loss}$.

5. The method of claim 4 wherein, a size of the at least one backup buffer is $\geq m*x \geq x*\frac{\log\left(0.1*s/e_r*x\right)}{\log P_{loss}}$, where m is a number of retransmits that will reduce the loss rate for older packets to a negligibly small number, and $m*x$ is a minimum required size of the at least one player buffer.

6. A method of detecting and reacting to a network congestion which interferes with streaming of multimedia audio and video packets from at least one sending computing device to an at least one receiving computing device via a network, said method comprising the steps of:

a) communicating configuration information including network parameters from a service manager via the network to the at least one sending computing device and to the at least one receiving computing device, the at least one sending computing device comprising at least one server process, the at least one receiving computing device comprising at least one player process;

b) confirming the network congestion by transmitting and retracting network probes;

Webgroup CZ a.s. Ex. 1002, Page 1128 of 1406

c) executing at least one congestion control technique to limit degradation in the streaming of the packets;

d) detecting an end of the network congestion by transmitting and retracting said network probes;

e) configuring a rate of streaming of the packets according to said network parameters

7. The method of claim 6, wherein said at least one congestion control technique is the constant bit-rate emulation.

8. The method of claim 7, wherein said at least one congestion control technique only reduces a transmission rate of the packets by the amount of incurred loss of the packets.

9. The method of claim 7, further comprising the steps of:
detecting an end of congestion;
computing available bandwidth in the network; and
transmitting packets according to said bandwidth.

10. The method of claim 9, wherein some of the at least one player process are differentiated and protected from effects of said network congestion to a greater than others by receiving a stream backlog sooner.

11. The method of claim 10, wherein some of the at least one player process are differentiated and protected from effects of said network congestion to a greater than others by receiving a stream backlog sooner according to a rule for transmission rate of the packets

$$e_t = \min(\alpha^j \times SR_{min}, \alpha^j \times \frac{B - \lambda_{other}}{\sum_{i=1}^{i=K} \alpha^i n^i})$$

, where e_t indicates said transmission rate of packets, α^j is a weighting function, for class $\{1 \ldots K\}$.

Webgroup CZ a.s. Ex. 1002, Page 1129 of 1406

12. The method of claim 11, wherein said detecting of said end of the network congestion is performed according to the expected utilization $\rho = 1 - \frac{SR_{avg}}{B}$, where SR_{avg} is the average rate at which the packets are transferred from the at least one server process to the at least one player process and B is a bottleneck link capacity at a bottleneck hop.

13. The method of claim 12, wherein said network probes compute an approximate service rate of transferring the packets from said at least one server process to said at least one player process according to the following equation:

$$SR^{min}_{m,m-1} = \frac{s}{\frac{s}{B_{m,m-1}} + q^{max}_{m,m-1}}, \text{ and } \quad SR^{avg}_{m,m-1} = \frac{s}{\frac{s}{B_{m,m-1}} + q^{avg}_{m,m-1}},$$

where SR_{avg} and SR_{min} are averaged and minimum service rate, $q^{max}_{m,m-1}$ is the maximum queuing delay between a node m and a node m-1.

14. A method of guaranteed delivery of streaming multimedia audio and video packets from at least one sending computing device to an at least one receiving computing device via a network, said method comprising the steps of:

a) continuously processing arriving packets;

b) keeping track of loss of the packets at the at least one receiving computing device, said at least one receiving computing device comprising one or more player processes;

c) determining if said loss exceeds a first threshold during a first interval;

d) verifying congestion symptoms;

e) communicating said verified congestion symptoms to the at least one sending computing device, said at least one sending computing device comprising one or more server processes;

Webgroup CZ a.s. Ex. 1002, Page 1130 of 1406

f) monitoring said loss and determining if said loss exceeds a second threshold during a second interval to determine an end of congestion; and

g) verifying congestion symptoms.

15. The method of claim 14, wherein said step of keeping track is performed at user define intervals.

16. The method of claim 15, wherein said first threshold, said second threshold, said first interval, and said second interval are user defined.

17. The method of claim 16, wherein said congestion symptoms are verified by receiving a remote congestion confirmed report.

18. The method of claim 17, wherein said congestion symptoms are verified by performing a congestion probe.

Webgroup CZ a.s. Ex. 1002, Page 1131 of 1406

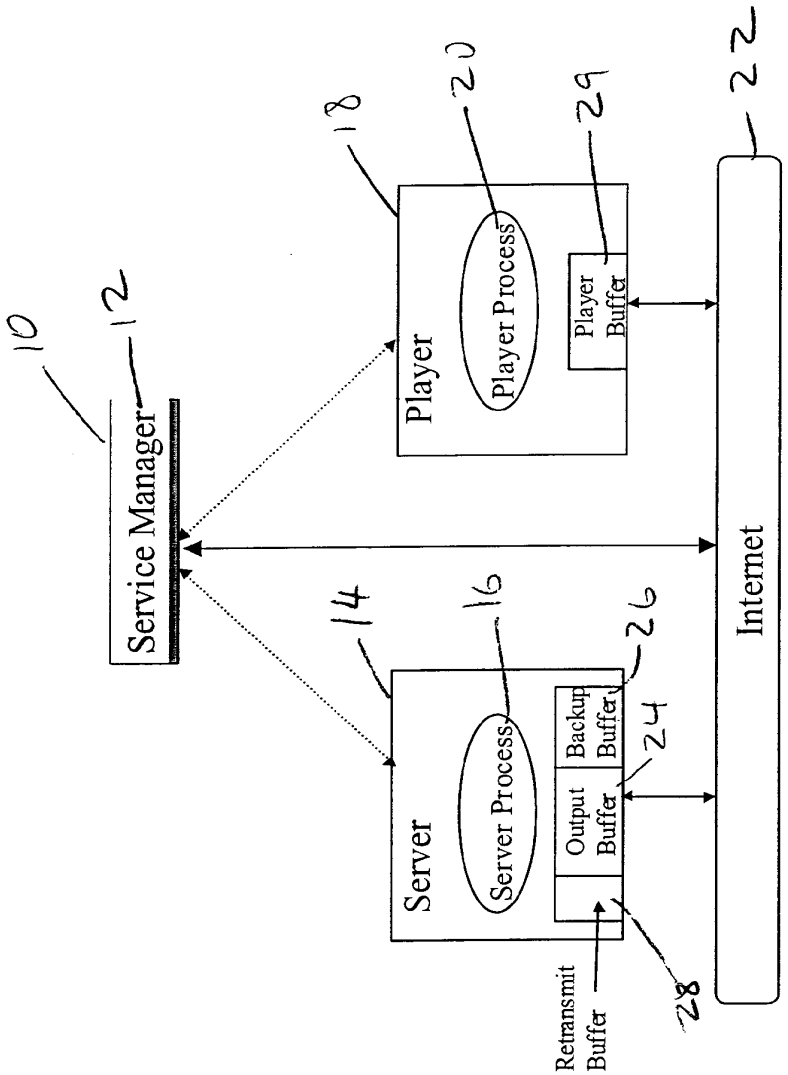

10
12
Service Manager
18
Player
20
Player Process
29
Player Buffer
22
Internet
14
Server
16
Server Process
26
Backup Buffer
24
Output Buffer
28
Retransmit Buffer

Figure 1

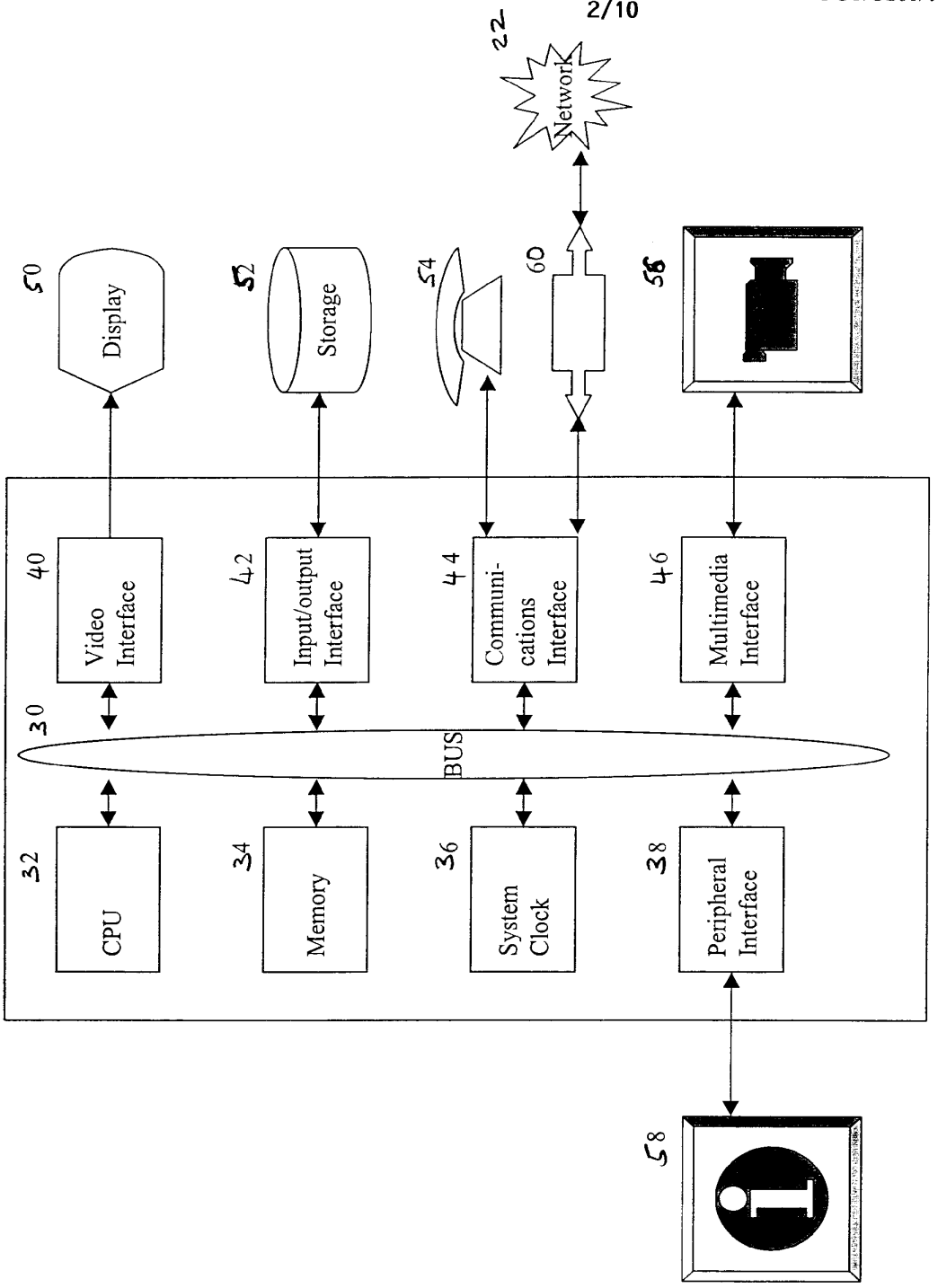

22
Network
50
Display
52
Storage
54
60
56
40
Video Interface
42
Input/output Interface
44
Communi-cations Interface
46
Multimedia Interface
30
BUS
32
CPU
34
Memory
36
System Clock
38
Peripheral Interface
58

Figure 2

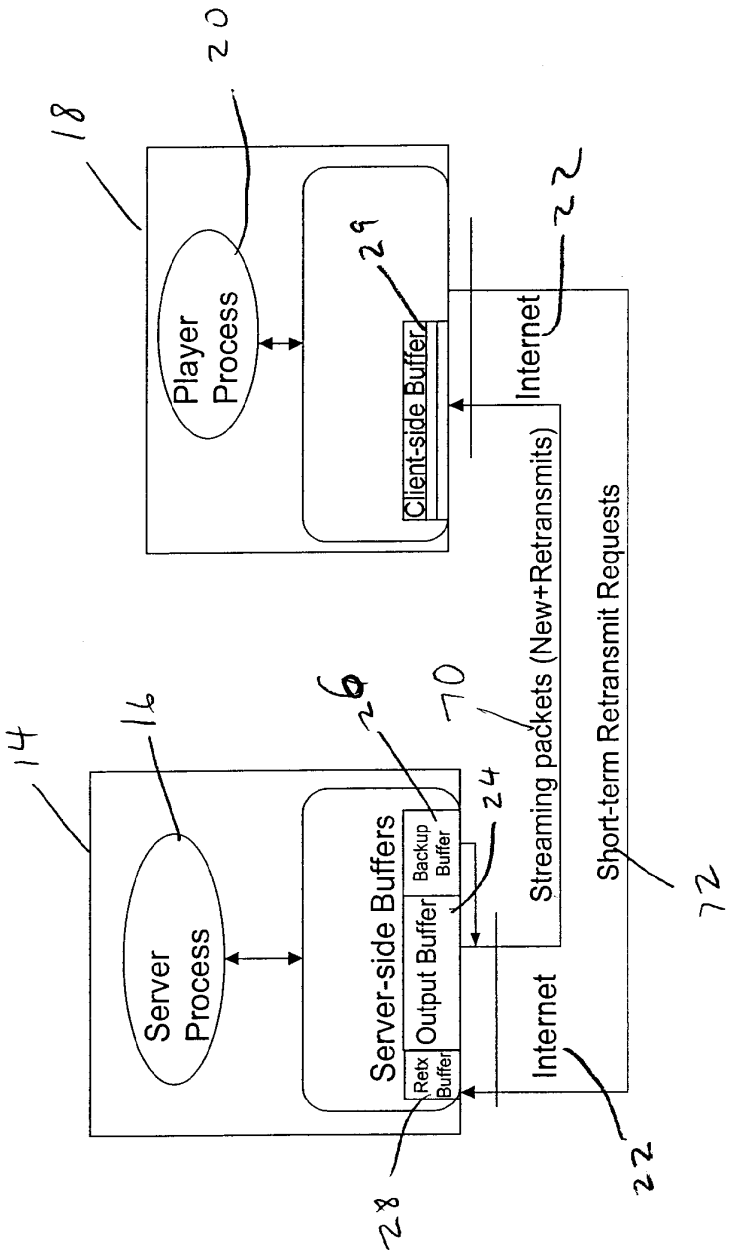

18
20
Player Process
29
Client-side Buffer
Internet
22
14
16
26
70
Server Process
Server-side Buffers
Backup Buffer
Output Buffer
Retx Buffer
24
Streaming packets (New+Retransmits)
Short-term Retransmit Requests
72
Internet
22
28

Figure 3

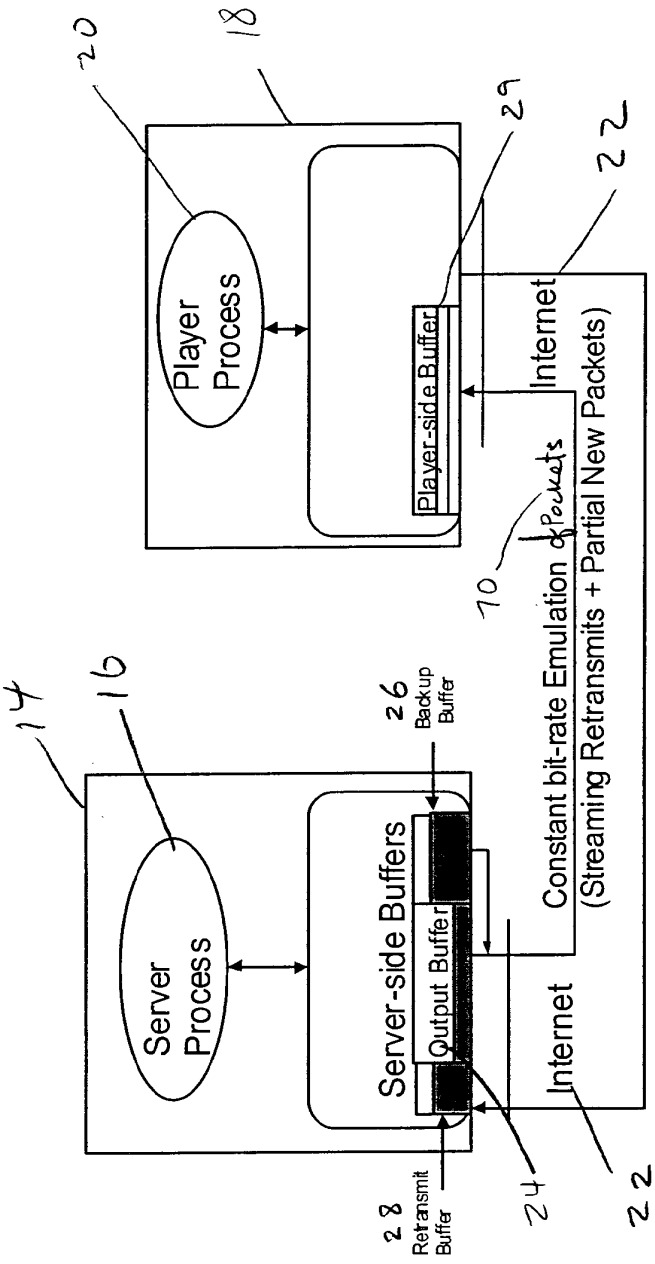

20
18
Player Process
29
Player-side Buffer
22
Internet
70
Packets
Constant bit-rate Emulation of
(Streaming Retransmits + Partial New Packets)
Retransmit Requests
72
14
16
26
Backup Buffer
Server Process
Server-side Buffers
Output Buffer
Internet
28
Retransmit Buffer
24
22

Figure 4

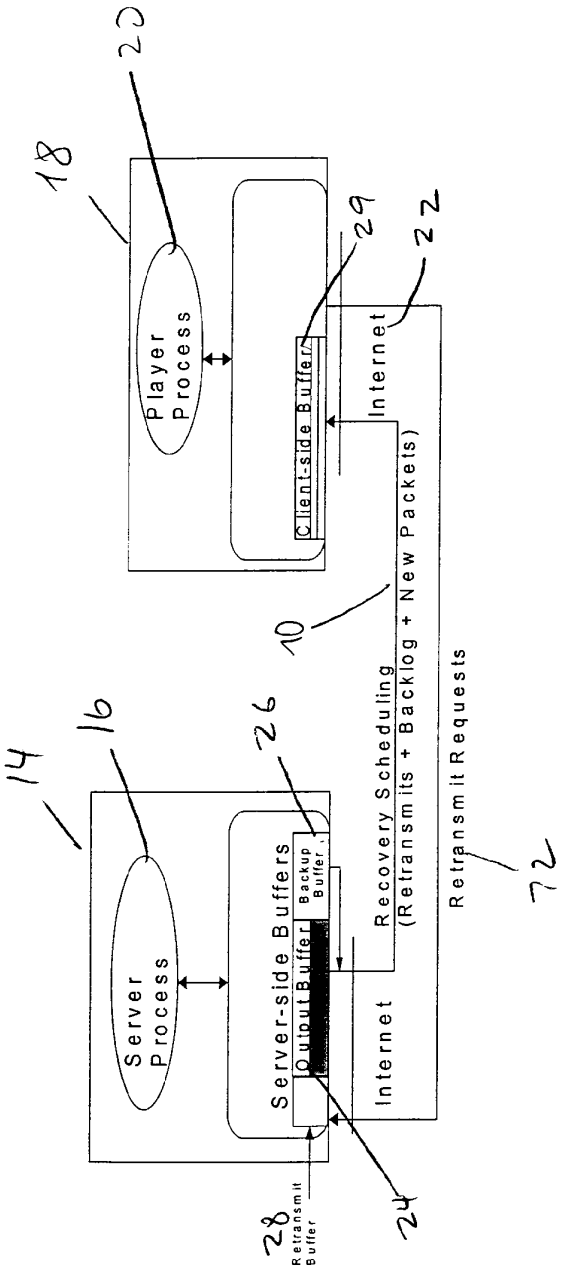

18
20
Player Process
Client-side Buffers
29
22
Internet
10
Recovery Scheduling
(Retransmits + Backlog + New Packets)
Retransmit Requests
72
14
16
Server Process
Server-side Buffers
Output Buffer
Backup Buffer
26
Internet
28
Retransmit Buffer
24

Figure 5

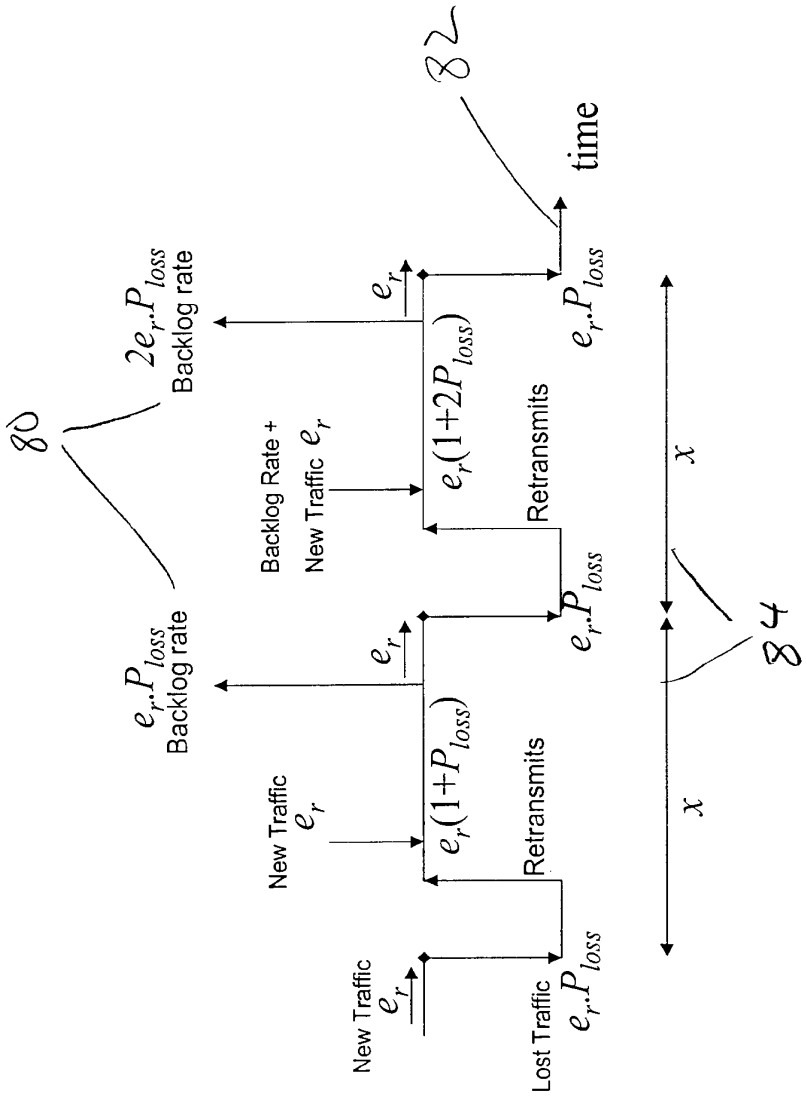

80
82
84
time
$2e_r..P_{loss}$ Backlog rate
$e_r..P_{loss}$ Backlog rate
Backlog Rate + New Traffic e_r
New Traffic e_r
$e_r(1+2P_{loss})$
$e_r(1+P_{loss})$
Retransmits
Retransmits
New Traffic e_r
Lost Traffic $e_r..P_{loss}$
$e_r..P_{loss}$
$e_r..P_{loss}$
e_r
e_r
e_r
x
x

Figure 6

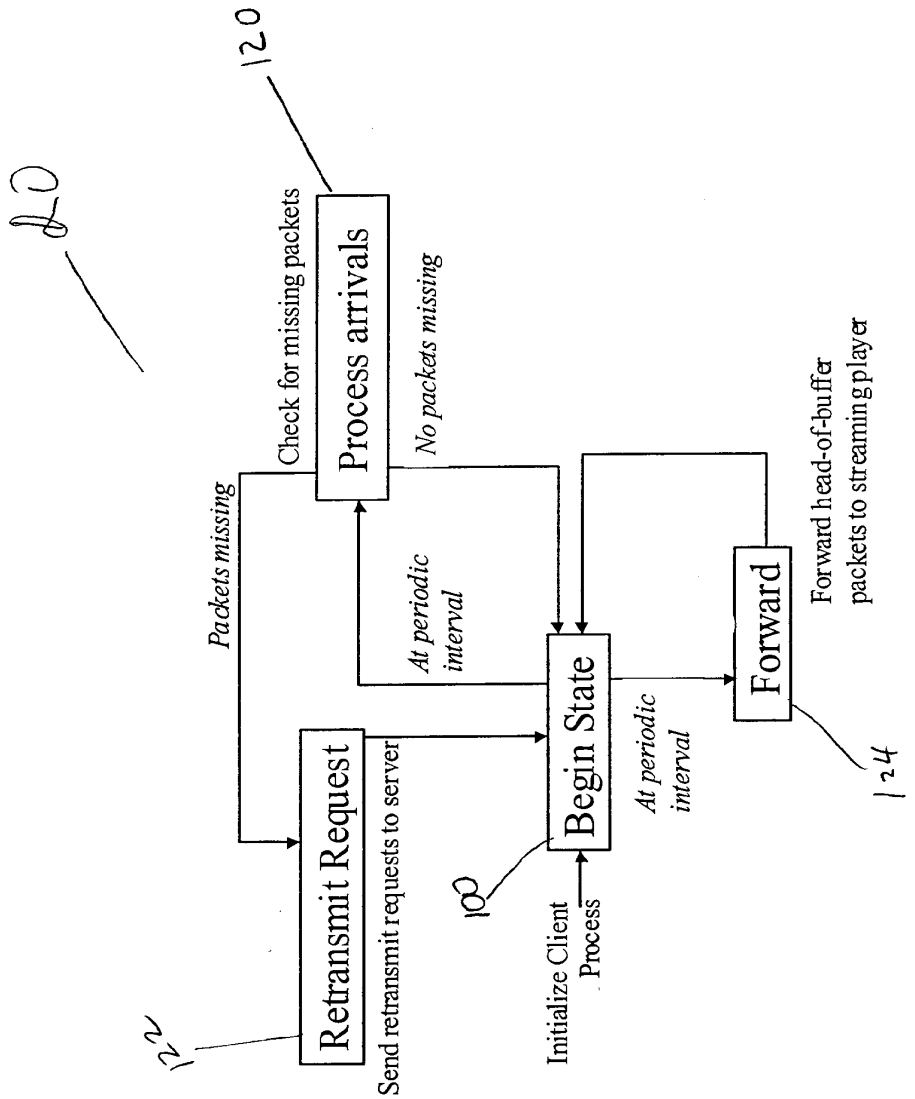

10
120
Process arrivals
Check for missing packets
No packets missing
Packets missing
At periodic interval
Begin State
Initialize Client Process
102
At periodic interval
Forward
Forward head-of-buffer packets to streaming player
124
Retransmit Request
Send retransmit requests to server
122

Figure 7

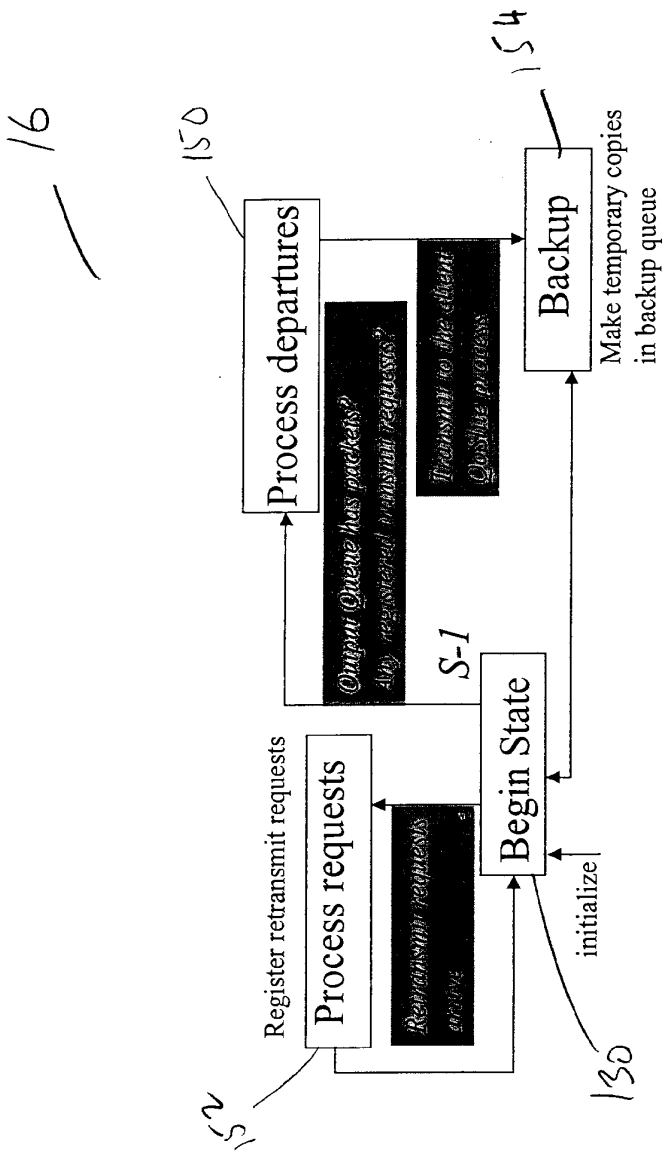

16
150
154
Process departures
Backup
Make temporary copies in backup queue
Output Queue has packets? Any unserviced retransmit requests?
Transmit to the client QoSlite process
S-1
Begin State
Process requests
Register retransmit requests
Retransmit requests arrive
initialize
152
130

Figure 8

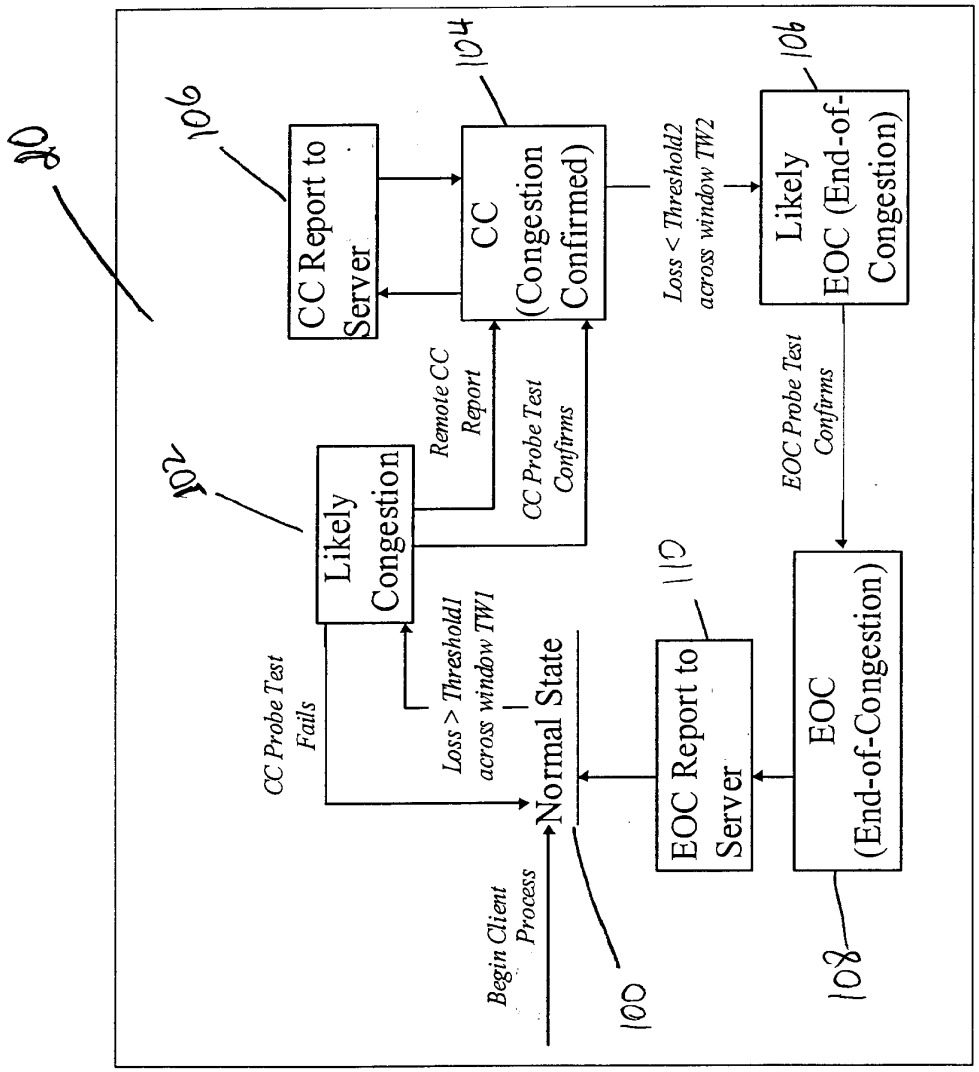

98
100
102
104
106
108
110
112
Normal State
Likely Congestion
CC (Congestion Confirmed)
Likely EOC (End-of-Congestion)
EOC (End-of-Congestion)
CC Report to Server
EOC Report to Server
Begin Client Process
CC Probe Test Fails
Loss > Threshold1 across window TW1
Remote CC Report
CC Probe Test Confirms
Loss < Threshold2 across window TW2
EOC Probe Test Confirms

Figure 9

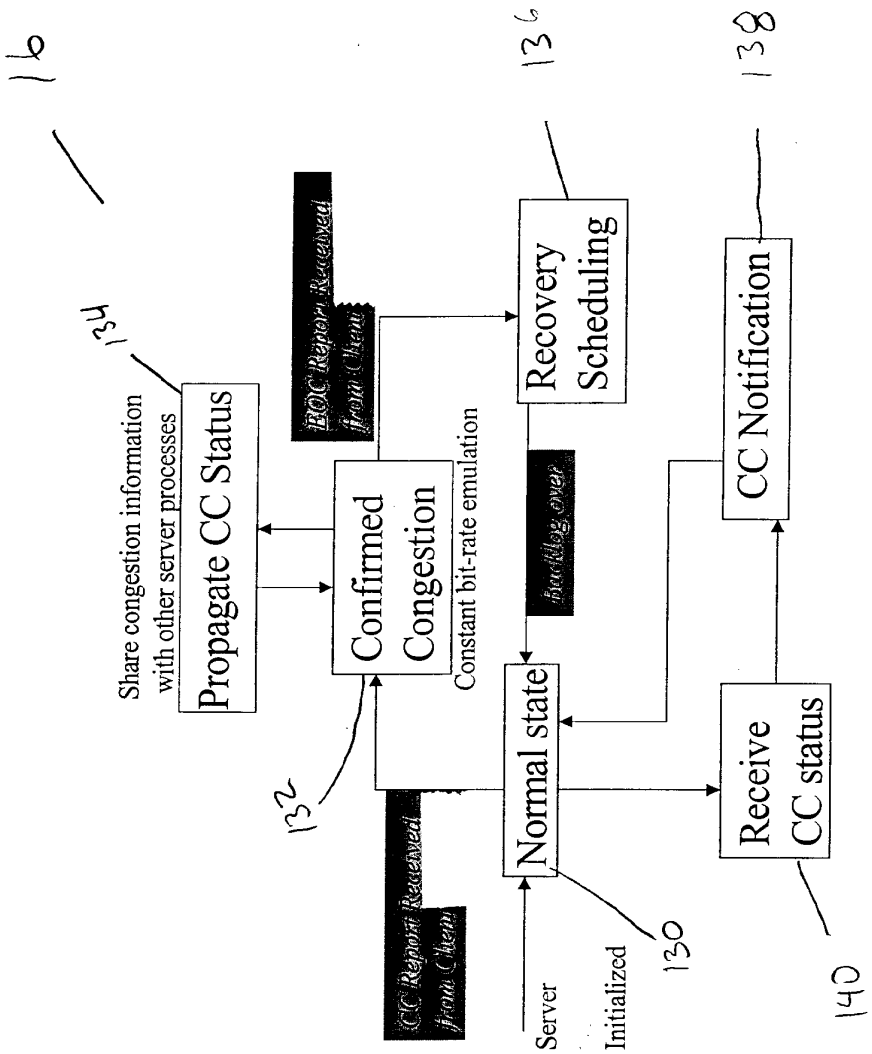

Propagate CC Status
Share congestion information with other server processes
Confirmed Congestion
Constant bit-rate emulation
Recovery Scheduling
CC Notification
Normal state
Receive CC status
Server Initialized
CC Report Received From Client
EOC Report Received From Client
Buffering over

Figure 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/40264

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	US 6,031,818 A (LO et al) 29 February 2000, col. 2, line 54-col. 5, line 28.	1, 2
X,P	US 6,018,515 A (SORBER) 25 January 2000, col. 4, line 18-col. 10, line 65.	6-10, 14-18
A, P	US 6,014,706 A (CANNON et al) 11 January 2000, see all.	1-18
A	US 5,339,392 A (RISBERG et al) 16 August 1994, see all.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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(71) Applicant *(for all designated States except US)*: **THOMSON LICENSING S.A.** [FR/FR]; 46, Quai A. Le Gallo, F-92648 Boulogne (FR).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **BOYCE, Jill, MacDonald** [US/US]; 3 Brandywine Court, Manalapan, NJ 07726 (US). **RAMASWAMY, Kumar** [IN/US]; 71 Sayre Drive, Princeton, NJ 08540 (US).

(74) Agents: **TRIPOLI, Joseph, S.** et al.; Thomson Licensing Inc., Suite #200, Two Independence Way, Princeton, NJ 08540 (US).

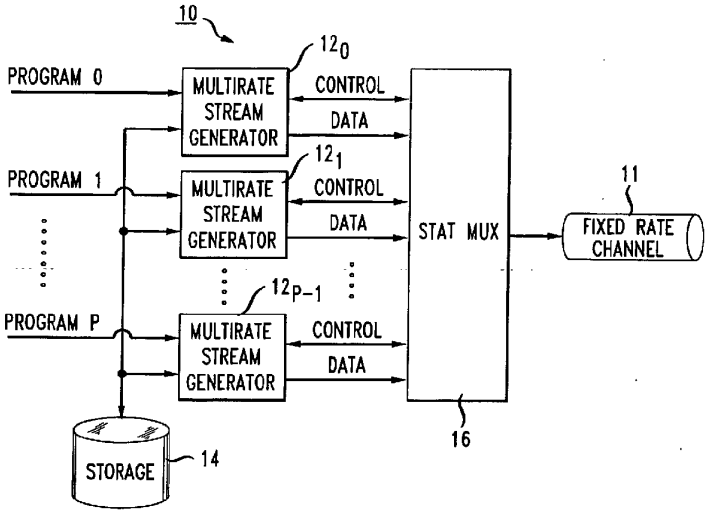
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[Continued on next page]

(54) Title: VIDEO ON DEMAND SERVER SYSTEM AND METHOD



(57) Abstract: A Video-on-Demand Server architecture (100, 200, 300) transmits a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel (11). For each program, a generator (120-12P-1, 110, 210) generates a plurality of different bit rate representations for each program. Each generator also provides control information at each of a plurality of successive time windows T for each bit rate representation. The control information provides a bit rate and a quality measure during each time window T. The control information enables a statistical multiplexer (16, 160, 260) to select a bit rate representation for each program during each time window T to maximize the quality of the selected representations while not exceeding the total available channel capacity.

WO 2004/025405 A2

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

VIDEO ON DEMAND SERVER SYSTEM AND METHOD

TECHNICAL FIELD

This invention relates to a technique for efficiently providing video on demand while maintaining bandwidth constraints of a fixed channel.

BACKGROUND ART

Present day Video-on-Demand (VoD) systems typically transmit Constant Bit Rate (CBR) video. Transmitting CBR video does not achieve the same efficiency as transmitting variable bit rate (VBR) video for equivalent long-term average bit rates. Transmitting multiple pre-recorded VBR-encoded video programs over a constant bandwidth channel has problems since the sum of the instantaneous bitrates required by each program can sometimes exceed the total available bitrate. On the other hand, broadcast applications employing real-time encoders use statistical multiplexing to exploit the instantaneous bitrate variations between multiple programs being carried on the same carrier or transponder. The encoders operate in real time to enable the system to constrain the total combined bit rate for all programs so as not to exceed the channel capacity over a given time window. Each video program has an associated complexity measure. A central controller dynamically adjusts the bit rate allocated to each video program based upon the relative complexities.

There now exist devices known as "video transraters" that operate to reduce the bit rate of video streams within a common compression standard, such as MPEG 2 for example. Present day transraters often experience difficulties when converting between constant and variable bit rates. Such transraters also can experience difficulties when trying to alter the bit rate for bit streams that have many scene changes, or a large number of I-Pictures.

Scalable video encoding, which permits dividing a video signal into a base layer and one or more enhancement layers, can also address bit rate issues. Several methods of scalable video encoding exist, including spatial, SNR, temporal, data partitioning, fine grain scalability (FGS), frequency scalability. The MPEG-2 and MPEG-4 video compression standards include several scalability methods. Using scalable encoding requires both the transmitter and receiver have the same ability to implement different coding algorithms, thus introducing additional complexity.

Thus, there exists a need for a technique for managing variable bit rate video on demand that obviates the disadvantages of the prior art.

BRIEF SUMMARY OF THE INVENTION

Briefly, in accordance with present principles, there is provided a method for transmitting a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel. For each program, at least two, and preferably, a plurality of different bit rate representations are generated. Control information is provided at each of a plurality of successive time windows for each bit rate representation. The control information provides a bit rate and a quality measure during each time window. The control information enables selection during each time window of a bit rate representation for each program to maximize the quality of the selected representations while not exceeding the total available channel capacity in that time window.

BRIEF SUMMARY OF THE DRAWING

FIGURE 1 depicts a block schematic of first preferred embodiment of a Video-on-Demand server architecture in accordance with the present principles;

FIGURE 2 depicts a block schematic of second preferred embodiment of a Video-on-Demand server architecture in accordance with the present principles; and

FIGURE 3 depicts a block schematic of third preferred embodiment of a Video-on-Demand server architecture in accordance with the present principles.

DETAILED DESCRIPTION

Before proceeding to describe the technique of the present principles, the following terminology will prove helpful:

T is the time interval over which the system optimization is being contemplated

C is the total channel capacity available in time frame T

P is the total number of programs

$p \in (0, P\text{-}1)$, is the index of a particular program

$N[p]$ is the total number of representations of program p

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p

$r[p, x]$ is the bit rate of representation x of program p during T

$q[p, x]$ is the quality of representation x of program p during T

FIGURE 1 depicts a first preferred embodiment of a Video-on-Demand server architecture 10 in accordance with the present principles for transmitting pre-encoded CBR and/or VBR audio/video programs over a fixed bandwidth channel 11 having a total channel capacity, C. The server architecture 10 includes a plurality of multirate stream generators 12_0, $12_1 \ldots 12_{P-1}$, where P is an integer greater than zero corresponding to the number of separate input streams. The stream rate generators 12_0-12_{P-1} each pre-code a corresponding one of the programs Program 0, Program 1...Program *P-1* at a plurality of different bit rates. Stated another way, each multirate stream generator pre-codes the corresponding program to yield at least two or more different bit rate representations. A representation can include a particular stored encoded bit stream, or a combination of various portions of different encoded bit streams. A storage device 14, typically in the form of a single disc drive, a Redundant Array of Inexpensive Discs (RAID), or a plurality of RAIDs, serves to store the pre-coded representations generated by the multirate stream generators 12_0-12_{P-1}.

Each of the multirate stream generators 12_0-12_{P-1} generates control information for each time window T of for the corresponding one of Programs 0 to *P-1*, respectively. The control information for each time window T for each representation of each program includes an indication of the bit rate of that representation and a quality measure, such as the peak signal-to-noise ratio (PSNR) of the representation. A central statistical multiplexer ("stat mux") 16 receives the control information for each representation. At each successive time window T, the stat mux 16 selects a representation for each program to maximize the quality of the transmitted programs while maintaining the total bit rate at or below the total capacity C of the channel 11.

The lowest bit rate representation for each program should not exceed a prescribed value such that the sum of the lowest bit rates for all programs will not exceed the channel capacity for each interval T. In this way, at least one representation of each program can undergo transmission over the channel 11. Requiring the lowest bit rate representation for each program to have a peak bit rate of C/P or less can achieve this constraint. Other methods exist that meet the constraint $\sum_{p=0}^{P-1} r[p,0] \le C$ for all time windows T of all programs. Typically, advance knowledge does not exist as to when playback of particular programs will commence. Therefore,

enforcing capacity restraints becomes easiest by requiring that the bit rate limit of the lowest bit rate representation be the same for all time windows T of a particular program.

The process for the maximization of the overall combined quality can occur in several different ways. In all cases, the constraint $\sum_{p=0}^{P-1} r[p,n[p]] \le C$ must remain met for all time windows T of all programs. A minimax approach can satisfy the constraint by choosing *n[p]* for each $p \in (0, P\text{-}1)$ to maximize the quality of the minimum quality program (i.e., minimizing the maximum distortion.)

The minimax approach can be implemented by sorting the control information for each representation of each program so that the quality and bit rate index increases monotonically increasing with the index. The change in bit rate for each step (referred to as the "delta (Δ)"bit rate) is then stored. The stat mux 16 begins with the lowest index for each program representation and computes the total capacity S. The stat mux 16 the selects the program representation at the lowest quality and checks if adding its delta bit rate to S exceeds C. If the addition of the representation does not exceed C, the index for that representation is incremented, and process is repeated. Once C is exceeded, the representation with the next to lowest quality is checked to see if adding its delta bit rate to S exceeds C. The process is repeated until no increment in any representation can be made without exceeding the channel capacity C. Alternatively, the total quality of all programs could be optimized by maximizing the sum of the individual program qualities which involves solving the following constrained optimization problem:

$$\max_{n[.]} \sum_{p=0}^{P-1} q[p,n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p,n[p]] \le C$$

It is also possible to optimize the product of the individual program qualities in the following manner:

$$\max_{n[.]} \prod_{p=0}^{P-1} q[p,n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p,n[p]] \le C$$

A weighted average can also be used, in order to provide different classes of service for different viewers.

The multirate stream generators 12_0-12_{P-1} can use several different methods, or a combination of methods to form multiple representations of each program. In all cases, a random access point, such as an intra-coded (I) frame should occur at the beginning of each time window T, for each representation, so that for each time window T a different representation can be

chosen without causing drift. Each representation can use either CBR or VBR coding as long as the capacity of the lowest bit rate representation meets the total channel capacity constraint.

In a first method, a multirate video encoder encodes each program at several different bit rates into several independent bit streams. Each different bit rate bit stream serves as a different representation. FIGURE 2 depicts an architecture 100 for carrying out this method. As seen in FIG. 2, a multirate video encoder 110 serves to encode a corresponding program to yield a plurality of different rate representations. A separate one of transport packetizers 112_0, $112_2 \ldots 112_{P-1}$ each packetizes a corresponding representation. The multirate encoding performed by the multirate encoder 110, and the packetization performed by the packetizers 112_0-112_{P-1} occurs once, not necessarily in real time, prior to storage in a storage device 140 similar in construction to the storage device 14 of FIG. 1.

Selection of the representations stored in storage device 140 for output in real time occurs in response to a signal received from a selector block 150. The selector block 150 identifies the stored representation for output in response to a request from the stat mux 160 for a particular representation. Upon receipt of the signal from the selector block 150, the storage device 140 supplies the selected packetized representations to the stat mux 160 for output.

In a second method, portions of the several different bit streams are combined to yield additional representations of a program. The presence of random access points at the same location in all bit streams of a program (as would naturally occur at scene changes) or the use of fixed group-of-pictures structures, permits the combination of compressed data from different bit rate streams at random access boundaries to form new representations. No need exists to store each representation independently, as long as the ability exists to generate each representation from the data that is stored. Consider the following example where T is one second, the data is coded at 30 fps, and I frames are inserted every 15 frames, yielding three different bit rate bit streams, designated as Bit stream 0, Bit stream 1, and Bit Stream 2, respectively. Each bit stream constitutes a separate representation. An additional representation can be formed which uses Bitstream 0 for the first 15 frames and Bitstream 1 for the second 15 frames, and so on.

Assuming alignment of the random access points with the transport packets, the server architecture 100 of FIG. 2 works well when the transport packetization occurs in advance. FIGURE 3 depicts a VoD server architecture 200 better suited when the random access points do not necessarily align with the transport packets. Referring to FIG. 3, VoD server architecture 200 includes multirate video encoder 210 for generating a plurality of different bit rate

representations for storage in a storage device 240 similar to the storage devices 14 and 140. The representations stored in the storage device 140 exist as un-packetized bit streams.

Selection of the representations stored in storage device 240 for output in real time occurs in response to a signal received from a selector block 250. The selector block 250, similar in nature to the selector block 150 of FIG. 2, identifies the stored representation for output in response to a request from a static mixer/multiplexer 260 for a particular representation. Upon receipt of the signal from the selector block 250, the storage device 240 supplies the selected packetized representations to the static mixer/multiplexer. A packetizer 212 packetizes the output stream of the static mixer/multiplexer 260 for output on the channel (not shown).

Representations also can be formed by switching between stored bit streams for non-reference pictures, such as for video codecs (not shown) that include pictures that are not used as reference pictures for predicting other pictures, such as MPEG-2 B frames or JVT non-stored pictures. Each non-reference picture can be selected from a different stored bitstream without affecting the quality of subsequently coded pictures, as the non-stored pictures are not used for prediction. Complete elimination of a non-reference picture in a representation can also occur. Each non-reference picture could be switched individually, or groups of non-reference pictures could be switched together, allowing for many possible total bit rate representations. The multirate stream signal generators 12_0-12_{P-1} of FIG. 1 can choose to limit the number of possible representations to send to the stat mux 16 of FIG. 1 to choose those with significant differences in quality and bit rate. It is not necessary for each representation to be independently stored in storage, but a table listing the location and length of each coded frame can be stored to simplify generation of the representation when needed. It is also possible to store multiple bit rate bit streams only for the non-stored pictures and only store a single version of the reference (I and P) pictures, which can significantly reduce storage requirements.

With the VoD server architectures 100 and 200 of FIGS. 2 and 3, respectively, the stat mux 160 and the static mixer/multiplexer 260 generate a bit stream corresponding to the selected representation. If individual pictures are not transport packet aligned, the architecture 200 of FIG. accomplishes transport packetization after the generation of the bit stream for a particular representation. Otherwise, the VoD server architecture 100 of FIG. 2 FIG. 2 will work well.

In accordance with another aspect of the present principles, scalable video coding can occur by the use of a scalable video encoder (not shown) to form a base layer and one or more enhancement layers. Any type of scalability that which employs the base layer for motion compensated reference picture prediction in order to avoid drift can be used, such as frequency

scalability, FGS, SNR scalability or temporal scalability. The lowest bit rate representation corresponds to the base layer. The peak bit rate of the base layer must be such that when the bit rates of all programs' base layers are summed, the channel capacity C is not exceeded for each time window T. Other higher bit rate representations will correspond to the base layer plus some portion of the enhancement layer. This approach requires that the video decoder support the type of scalability used. The VoD server architecture 100 of FIG. 2 is used upon inclusion of an entire enhancement layer in a particular representation. The VoD server architecture 200 of FIG. 3 is used if portions of an enhancement layer are used in a representation.

For systems which use encryption for contents right management, the VoD server architecture 100 of FIG. 2 does not require any decryption or encryption in real time, as encryption is added to the transport packetization process done in non-real time and entire encrypted transport packets are stored and transmitted. The VoD server architecture 200 of FIG. 3 requires that encryption be performed along with transport packetization in real-time.

VoD programs generally include both audio and video. As audio bit rates are generally significantly lower than video bit rates and are also generally at a fixed bit rate, there is less advantage to be gained by selecting from different pre-encoded audio bit streams by the stat mux 16 and 160 of FIGS 1 and 2, and the static mixer/multiplexer 260 of FIG. 3. A user likely will find the switching of audio quality during the viewing of a single program disturbing. The total channel capacity C can be considered to be totally consumed by the video channel; assuming that a single bit rate audio stream is also sent for each program. Alternatively, the above-described methods can also be applied to audio, where multiple representations of audio programs with different bit rates and qualities can be generated.

A video player (not shown) that works with the VoD server architectures of the present principles will contain a video decoder (not shown) and some storage for buffering. For the particular program being received, the data can arrive at a non-uniform data rate, but with the requirement that the data corresponding to time unit T will arrive any time within the T time window. The video player must have the capability of buffering and delaying for T. An upper limit on the maximum bit rate that can be transmitted for a given representation of a program for a time window T can be pre-determined to limit the decoder complexity and decoder buffer size. The decoding buffer is generally a requirement of a video decoder, e.g. MPEG-2 levels sets buffer size particular requirements, and the combination of T and the bitrate may be chosen to meet it.

Fast forward and fast reverse tracks for each program can also be stored at the VoD server. They can be stored at a single bit rate, or at several different bit rates, and allowed to adapt as is done for the normal play program.

Determination of the time window T length is based on several factors. T should be as large as possible to get the most statistical multiplexing gain, but small enough to constrain the delay at the video player for start-up and switching between normal play and trick play streams. T should be small enough to meet decoder requirements.

The foregoing describes a system and method for efficiently providing video on demand while maintaining bandwidth constraints of a fixed channel.

CLAIMS

1. A method for transmitting a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel, comprising the steps of:

generating at least two different bit rate representations of each program;

providing control information at each of a plurality of successive time windows T for each representation of each program, the control information for each successive window indicating a bit rate and quality measure for a representation of a corresponding program; and

during each time window T, selecting a representation for each program such to maximize the quality of the selected representations while not exceeding a total available capacity for the channel.

2. The method according to claim 1 wherein the step of generating at least two different bit rates representation further comprises the step of generating for each program a lowest bit rate representation having a peak bit rate not greater than C/P where C is the total channel capacity in time T and P is the total number of programs.

3. The method according to claim 1 wherein the step of providing the control information further comprises the step of establishing the peak signal-to-noise ratio (PSNR) as the quality measure embodied in the control information.

4. The method according to claim 1 wherein the selecting step further comprises the step of selecting a representation for each program which meets the constraint $\sum_{p=0}^{P-1} r[p, n[p]] \leq C$ for all time windows wherein:

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p] - 1)$ is the index of a particular representation of program p; and

$r[p, x]$ is the bit rate of representation x of program p during T

5. The method according to claim 4 further comprising the step of choosing each program's representation n[p] $\in$ (0, N[P]-1) to maximize the quality of the program p that had the minimum quality.

6. The method according to claim 5 further comprising the steps of:

(a) sorting the quality information for with the bit rate and quality measure monotonically increasing with an index value;

(b) storing each bit rate increment (delta) and quality value for each index value;

(c) beginning with a lowest index value, computing total capacity S for program representations selected thus far for such index value;

(d) selecting a program representation at a lowest quality measure;

(e) checking whether the bit rate increment of the selected program at the lowest quality, when added to the representations selected thus far, exceeds total channel capacity, and if not

(f) incrementing the index value; and

(g) repeating steps (c)-(f).

7. The method according to claim 1 wherein the selecting step further comprises the step of selecting the representation for each program such to maximize a sum of individual program qualities by solving $\max_{n[.]} \sum_{p=0}^{P-1} q[p,n[p]]$; subject to $\sum_{p=0}^{P-1} r[p,n[p]] \leq C$

wherein ,

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p;

$r[p, x]$ is the bit rate of representation x of program p during T; and

$q[p, x]$ is the quality of representation x of program p during T.

8. The method according to claim 1 wherein the selecting step further comprises the step of selecting the representation for each program such to maximize a product of individual program qualities by solving

$$\max_{n[.]} \prod_{p=0}^{P-1} q[p,n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p,n[p]] \leq C$$

where,

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p;

$r[p, x]$ is the bit rate of representation x of program p during T; and

$q[p, x]$ is the quality of representation x of program p during T.

9. The method according to claim 8 further comprising the step of applying a weighted average to provide different classes of service for different viewers.

10. A system for transmitting a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel, comprising the steps of:

means for generating at least two different bit rate representations of each program;

means providing control information at each of a plurality of successive time windows T for each representation of each program, the control information for each successive window indicating a bit rate and quality measure for a representation of a corresponding program; and

means for selecting during each time window T a representation for each program such to maximize the quality of the selected representations while not exceeding a total available capacity for the channel.

11. The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a plurality of multirate stream generators, each associated with a corresponding one of the plurality of pre-coded programs.

12. The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a multirate video encoder for encoding at least two bit rate representations of each pre-coded program.

13. The system according to claim 10 wherein the generating means and control information providing means collectively comprise:

a multirate video encoder for encoding at least two bit rate representations of each pre-coded program; and

a plurality of transport packetizers, each serving to packetize the bit rate presentations for each pre-coded program.

14. The system according to claim 10 wherein the selecting means includes a static multiplexer.

15. The system according to claim 12 wherein the selecting means comprises:

a static multiplexer; and

a transport packetizer for packetizing the selecting representation.

16. The system according to claim 10 wherein the selecting means generates for each program a lowest bit rate representation having a peak bit rate not greater than C/P where C is the total channel capacity in time T and P is the total number of programs.

17. The system according to claim 10 wherein control information providing means establishes quality measure in accordance with a peak signal-to-noise ratio (PSNR).

18. The system according to claim 10 wherein the selecting means selects a representation for each program which meets the constraint $\sum_{p=0}^{P-1} r[p, n[p]] \leq C$ for all time windows where:

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p; and

$r[p, x]$ is the bit rate of representation x of program p during T.

19. The system according to claim 18 wherein the selecting means chooses each program's representation n[p] $\in$ (0, N[P]-1) to maximize the quality of the program p that had the minimum quality.

20. The system according to claim 10 wherein the selecting means selects the representation for each program such to maximize a sum of individual program qualities by solving:

$$\max_{n[.]} \sum_{p=0}^{P-1} q[p,n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p,n[p]] \le C$$

where,

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p;

$r[p, x]$ is the bit rate of representation x of program p during T; and

$q[p, x]$ is the quality of representation x of program p during T.

21. The system according to claim 10 wherein the selecting means selects the representation for each program such to maximize a product of individual program qualities by solving:

$$\max_{n[.]} \prod_{p=0}^{P-1} q[p,n[p]]; \text{ subject to } \sum_{p=0}^{P-1} r[p,n[p]] \le C$$

where,

C is the total channel capacity available in time frame T;

P is the total number of programs;

$p \in (0, P\text{-}1)$, is the index of a particular program;

$N[p]$ is the total number of representations of program p;

$n[p] \in (0, N[p]-1)$ is the index of a particular representation of program p;

$r[p, x]$ is the bit rate of representation x of program p during T; and

$q[p, x]$ is the quality of representation x of program p during T.

22. The system according to claim 10 wherein a weighted average is applied to provide different classes of service for different viewers.

ABSTRACT OF THE DISCLOSURE

A Video-on-Demand Server architecture (100, 200, 300) transmits a plurality of pre-coded programs having different bit rates across a fixed bandwidth channel (11). For each program, a generator (12_0-12_{P-1}, 110, 210) generates a plurality of different bit rate representations for each program. Each generator also provides control information at each of a plurality of successive time windows T for each bit rate representation. The control information provides a bit rate and a quality measure during each time window T. The control information enables a statistical multiplexer (16, 160, 260) to select a bit rate representation for each program during each time window T to maximize the quality of the selected representations while not exceeding the total available channel capacity.

FIG. 1

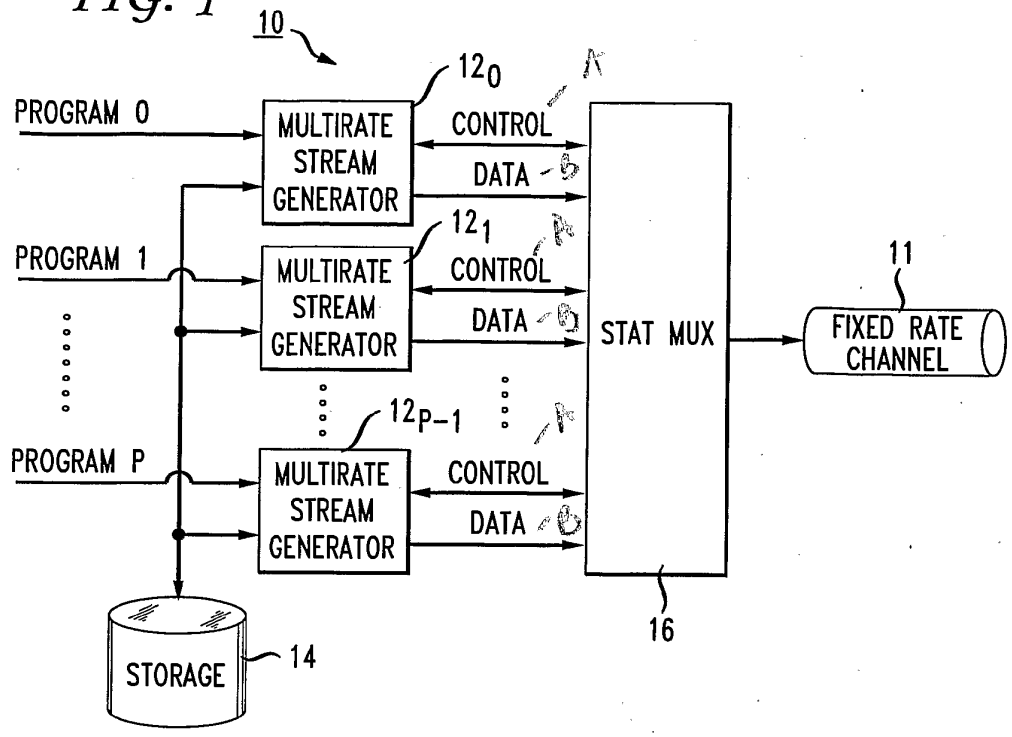

10
PROGRAM 0
PROGRAM 1
PROGRAM P
MULTIRATE STREAM GENERATOR
MULTIRATE STREAM GENERATOR
MULTIRATE STREAM GENERATOR
12_0
12_1
12_{P-1}
CONTROL
DATA
CONTROL
DATA
CONTROL
DATA
STAT MUX
11
FIXED RATE CHANNEL
16
STORAGE
14

FIG. 2

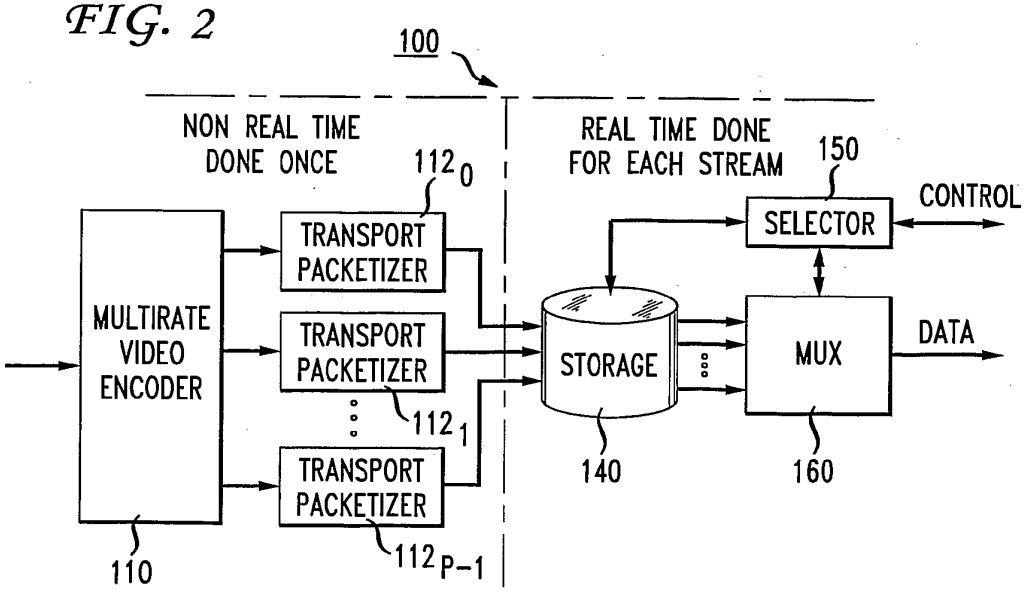
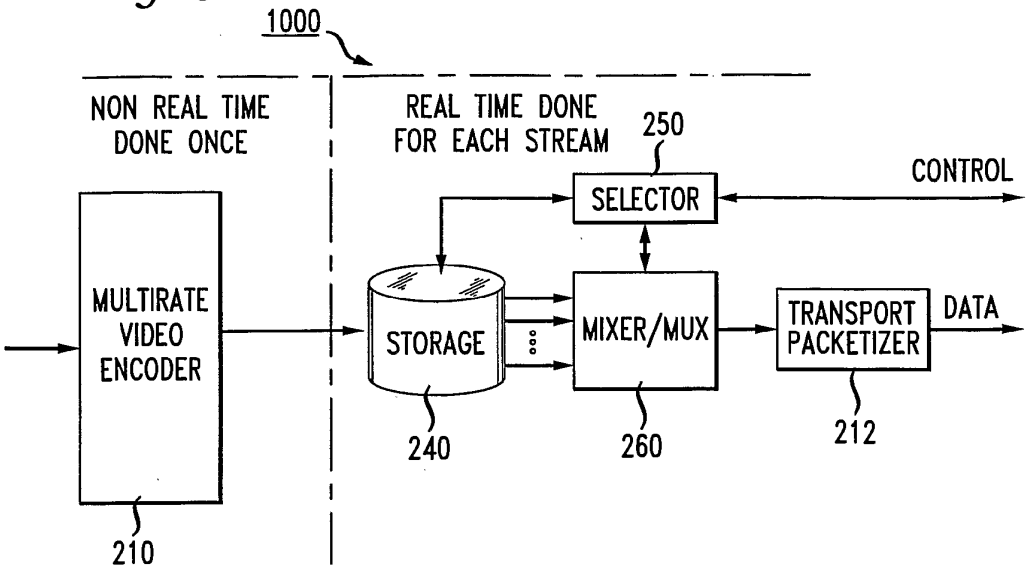

100
NON REAL TIME DONE ONCE
REAL TIME DONE FOR EACH STREAM
MULTIRATE VIDEO ENCODER
110
TRANSPORT PACKETIZER
TRANSPORT PACKETIZER
TRANSPORT PACKETIZER
112_0
112_1
112_{P-1}
STORAGE
140
SELECTOR
150
CONTROL
MUX
160
DATA

FIG. 3


1000
NON REAL TIME
DONE ONCE
REAL TIME DONE
FOR EACH STREAM
250
CONTROL
SELECTOR
MULTIRATE
VIDEO
ENCODER
STORAGE
MIXER/MUX
TRANSPORT
PACKETIZER
DATA
210
240
260
212

PCT
New International Application
Inventory of Unscannable or Missing Items

Serial Number

Check This Column if Item Is Present	Item	Check This Column if Item Is Missing on Filing
	Return Receipt Postcard	
	Check (amount $_____)	
	PCT EASY Diskette	
	DNA Diskette	
	Exhibit	
	Express Mail Label or Envelope	
	Applicant Supplied Priority Document	
	Other (specify)	XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX
XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX	Cover Letter	
XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX XXXXXXXXXXXX	Other (specify)	

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(71) Applicant *(for all designated States except US)*: **NETWORK FOUNDATION TECHNOLOGIES, LLC** [US/US]; 2215 Cooktown Road, Ruston, LA 71270 (US).

(72) Inventors: **O'NEAL, Mike**; 2215 Cooktown Road, Ruston, LA 71270 (US). **TALTON, John P.**; 2215 Cooktown Road, Ruston, LA 71270 (US).

(74) Agents: **LANDA, Adam B.** et al.; Greenberg Traurig, MetLife Building, 200 Park Avenue, New York, NY 10166 (US).

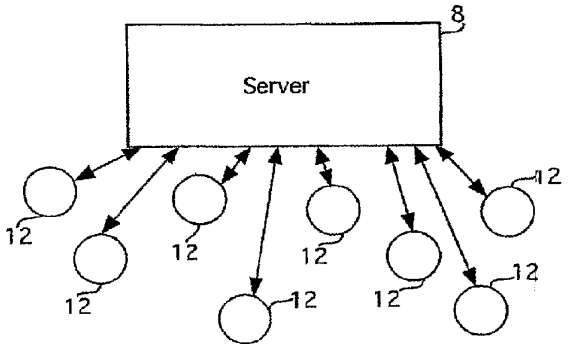
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(54) Title: SYSTEMS FOR DISTRIBUTING DATA OVER A COMPUTER NETWORK AND METHODS FOR ARRANGING NODES FOR DISTRIBUTION OF DATA OVER A COMPUTER NETWORK



PRIOR ART

(57) Abstract: Various embodiments of the present invention relate to a system for distributing data (e.g., content data) over a computer network and a method of arranging receiver nodes in a computer network such that the capacity of a server is effectively increased (e.g., the capacity of a server may be effectively multiplied many times over; the capacity of the server may be effectively increased exponentially). In one embodiment the present invention may take advantage of the excess capacity many receiver nodes possess, and may use such receiver nodes as repeaters. The distribution system may include node(s) having database(s) which indicate ancestor(s) and/or descendant(s) of the node so that reconfiguration of the distribution network may be accomplished without burdening the system's primary server. An embodiment of the present invention may include a process for configuring a computer information distribution network having a primary server node and user nodes docked in a cascaded relationship, and reconfiguring the network in the event that a user node departs from the network. In one example (which example is intended to be illustrative and not restrictive), the process may include the steps of providing a new user node (or connection requesting user node) with a connection address list of nodes within the network, having the new user node (or connection requesting user node) go to (or attempt to go to) the node at the top of the connection address list, determine whether that node is still part of the distribution network, and connect thereto if it is, and if it is not, to go to (or attempt to go to) the next node on the connection address list. In another example (which example is intended to be illustrative and not restrictive), when a user node departs from the distribution network, a propagation signal may be transmitted to the nodes below it in the network, causing them to move up in the network in a predetermined order. In another example (which example is intended to be illustrative and not restrictive), the present invention may provide a decentralized approach which provides, to each new user node (or connection requesting user node) a path back to the root server.

WO 2006/010113 A2

SYSTEMS FOR DISTRIBUTING DATA OVER A COMPUTER NETWORK AND METHODS FOR ARRANGING NODES FOR DISTRIBUTION OF DATA OVER A COMPUTER NETWORK

FIELD OF THE INVENTION

This patent application is related to and claims the benefit of the filing date of U.S. Provisional Patent Application Serial No. 60/586,952 for "Systems for Distributing Data Over A Computer Network And Methods For Arranging Nodes For Distribution Of Data Over A Computer Network", filed July 9, 2004.

Various embodiments of the present invention relate to systems for distributing data (e.g., content data) over a computer network and methods of arranging nodes for distribution of data (e.g., content data) over a computer network. In one example (which example is intended to be illustrative and not restrictive), the systems and methods of the present invention may be applied to the distribution of streaming audiovisual data over the Internet.

For the purposes of the present application the term "node" (e.g., as used in the phrase a first node communicates with a second node) is intended to refer to a computer system (or sometimes just "computer") configured to send and/or receive data over a computer network (e.g., a computer network including the Internet, a local-area-network, a wide-area-network, a wireless network). Since a "node" in a computer network would not exist but for a computer system being available on such node, the terms "node" and "computer system" (or sometimes just "computer") may be used interchangeably (i.e., the term "node" should be understood to include an available computer system (or sometime just "computer").

Further, for the purposes of the present application the term "upstream" (e.g., as used in the phrase a first computer system sends data via an upstream connection to a second computer system) is intended to refer to the communication path between a first computer system and the Internet when the first computer system is sending data to a second computer system via the Internet.

Further still, for the purposes of the present application the term "downstream" (e.g., as used in the phrase a first computer system receives data via a downstream connection from a second computer system) is intended to refer to the communication path between a first computer system and the Internet when the first computer system is receiving data from a second computer system via the Internet.

Further still, for the purposes of the present application the term "uptree" (e.g., as

used in the phrase a first node sends data via an uptree connection to a second node) is intended to refer to the network topology communication path between a first node and a second node when a first node is sending data to a second node which is higher up on the network topology tree (that is, closer to the root server).

Further still, for the purposes of the present application the term "downtree" (e.g., as used in the phrase a first node sends data via a downtree connection to a second node) is intended to refer to the network topology communication path between a first node and a second node when a first node is sending data to a second node which is lower down on the network topology tree (that is, closer to the leaves).

Further still, for the purposes of the present application the term "docked" (e.g., as used in the phrase a child node docks with a parent node) is intended to refer to forming a connection between nodes via which data may flow in at least one direction (e.g., at least uptree or downtree).

Further still, for the purposes of the present application the term "apparent available capacity" (e.g., as used in the phrase apparent available capacity to transmit content data) is intended to refer to a nominal capacity (e.g., a node's presumed capacity based upon a design specification but not necessarily actually tested in the network).

BACKGROUND OF THE INVENTION

In a computer network such as the Internet, each node in the network has an address. A computer system resident at a particular address may have sufficient bandwidth or capacity to receive data from, and to transmit data to, many other computer systems at other addresses. An example of such a computer system is a server, many commercial versions of which can simultaneously exchange data with thousands of other computer systems.

A computer system at another location may have only sufficient bandwidth to effectively exchange data with only one other computer system. An example of such a system is an end user's personal computer connected to the Internet by a very low speed dialup modem. However, even typical personal computers connected to the Internet by higher speed dialup modems may have sufficient bandwidth that they may exchange data essentially simultaneously in an effective manner with several other computer systems. Moreover, an end user's personal computer system may have even greater bandwidth when connected to the Internet by ISDN lines, DSL (e.g., ADSL) lines, cable modems, T1 lines or even higher capacity links. As discussed more fully below, various embodiments of the present invention

Webgroup CZ a.s. Ex. 1002, Page 1165 of 1406

may take advantage of the availability of such higher capacity end user systems (e.g., those computer systems capable of essentially simultaneously exchanging data with multiple computer systems).

In a typical situation, as shown in FIG. 1, a content provider distributes its data by making the data available on a server node 8 simultaneously to a plurality of users at user nodes 12 (of note, the terms "server", "root server" and "primary server" may be used interchangeably throughout the present application to refer to the same device (i.e., the highest level parent node in a given network). The double-headed arrows show the two-way communication between each end user's computer system and the server. Essentially the content provider's server transmits a separate stream of signals to each receiver node. To accommodate additional users, the content provider would typically either add equipment to increase capacity or it would engage a mirror site to accomplish essentially the same result as adding equipment. The capacities of the end user computers is of virtually no consequence in such a system.

Another system for distributing data is the Napster™ music file exchange system provided by Napster, Inc. of Redwood City, Calif. A schematic of the Napster™ music file exchange system (as its operation is presently understood) is illustrated in FIG. 2.

More particularly, it is believed that in the Napster™ system a copy of the music data is not kept on the server. The server 9 instead maintains a database relating to the various music files on the computers of users who are logged onto the server 9. When a first user 12a sees that a desired music file is available from a second logged on user 12b, the first user causes his computer to query the server 9 for the second user's node address and a connection is made between the first and second user's computers through which the first user's computer notifies the second user's computer of the desired file and the second user's computer responds by transmitting a copy of the desired music file directly to the first user's computer. It is further believed that a first user attempting to download a particular file from a second user must start completely over again if the second user cancels its transmission or goes off line during the data transfer.

In another area, engineers have developed what is known as "streaming media." In summary, streaming media is a series of packets (e.g., of compressed data), each packet representing moving images and/or audio.

To help understand streaming media in more detail, it is helpful to review the traditional Internet distribution method. Each node (whether it is a server node or a user node) in a computer network has a unique identification (sometimes referred to as an "IP" address)

associated with it. On the Internet, the unique address may be referred to as a Uniform Resource Locator ("URL"). A user desiring to obtain data from a particular server enters that server's URL into the user's browser program. The browser program causes a connection request signal to be sent over the Internet to the server. If the server has the capacity to accept the connection, the connection is made between the server and the user node (files requested by the user are typically transmitted by the server in full to the user node and the browser program may store the files in buffer memory and display the content on the user's computer system monitor - some files may be more permanently stored in the computer system's memory for later viewing or playing.) The connection with the server is typically terminated once the files have been received at the user node (or the connection may be terminated a short time thereafter). Either way, the connection is usually of a very short time duration.

With streaming media, the contact between the server and user nodes is essentially continuous. When a connection between a server node and user node is made and streaming media is requested, the server sends streaming media packets of data to the user node. A streaming media player installed on the user's computer system (e.g., software, such as RealMedia™ from RealNetworks, Inc. of Seattle, Wash.,) causes the data to be stored in buffer memory. The player decompresses the data and begins playing the moving images and/or audio represented by the streaming media data on the user's computer system. As the data from a packet is played, the buffer containing that packet is emptied and becomes available to receive a new packet of data. As a result, the memory assets of a user's computer are not overly taxed. Continuous action content, such as, for example, the display of recorded motion picture films, videos or television shows may be distributed and played in essentially "real time," and live events, such as, for example, concerts, football games, court trials, and political debates may be transmitted and viewed essentially "live" (with only the brief delays needed for compression of the data being made available on the server, transmission from the server to the user node, and decompression and play on the user's computer system preventing a user from seeing the event at the exact same moment in time as a person actually at the event). And, when the systems are working as designed, the server node and user node may stay connected to each other until all the packets of data representing the content have been transmitted.

SUMMARY OF THE INVENTION

Various embodiments of the present invention relate to a system for distributing data (e.g., content data) over a computer network and a method of arranging receiver nodes in a computer network such that the capacity of a server is effectively increased (e.g., the capacity of a server may be effectively multiplied many times over; the capacity of the server may be effectively increased exponentially). In one embodiment the present invention may take advantage of the excess capacity many receiver nodes possess, and may use such receiver nodes as repeaters. The distribution system may include node(s) having database(s) which indicate ancestor(s) and/or descendant(s) of the node so that reconfiguration of the distribution network may be accomplished without burdening the system's primary server. An embodiment of the present invention may include a process for configuring a computer information distribution network having a primary server node and user nodes docked (i.e., connected) in a cascaded relationship, and reconfiguring the network in the event that a user node departs from the network. In one example (which example is intended to be illustrative and not restrictive), the process may include the steps of providing a new user node (or connection requesting user node) with a connection address list of nodes within the network, having the new user node (or connection requesting user node) go to (or attempt to go to) the node at the top of the connection address list, determine whether that node is still part of the distribution network, and connect thereto if it is, and if it is not, to go to (or attempt to go to) the next node on the connection address list. In another example (which example is intended to be illustrative and not restrictive), when a user node departs from the distribution network, a propagation signal may be transmitted to the nodes below it in the network, causing them to move up in the network in a predetermined order. In another example (which example is intended to be illustrative and not restrictive), the present invention may provide a decentralized approach which provides, to each new user node (or connection requesting user node) a path back to the root server.

Of note, various embodiments of the present invention may be applied to the transmission (e.g., the "appointment" transmission) of audiovisual content such as, for example (which example is intended to be illustrative and not restrictive), live or pre-recorded concerts, football games, court trials, political debates, motion picture films, videos or television shows. Such transmission of audiovisual content may be made with acceptable levels of quality, wherein "acceptable levels of quality" may vary depending upon the end users and the type of transmission. Further, such transmission of audiovisual content may be

carried out using streaming media transmissions intended to reach large audiences, in much the way that television shows transmitted over television cable and broadcast media reach large audiences (in this regard, the present invention may enable a server to transmit streaming media to the large number of users which would be essentially simultaneously logging on to view a particular audiovisual presentation under this television-type "large audience" transmission).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing of a prior art computer information distribution network;

FIG. 2 is a schematic drawing of another prior art computer information distribution network;

FIG. 3 is a schematic drawing of an embodiment of a computer information distribution network formed pursuant to the present invention;

FIG. 4 is a schematic drawing of another embodiment of a computer information distribution network formed pursuant to the present invention;

FIG. 5 is a schematic drawing of another embodiment of a computer information distribution network formed pursuant to the present invention;

FIG. 6 is a schematic drawing of a particular topology of a computer information distribution network formed pursuant to an embodiment of the present invention;

FIG. 7 is a schematic drawing of a particular topology of the computer information distribution network formed pursuant to an embodiment of the present invention as shown in FIG. 6 (after the occurrence of an event);

FIG. 8 is a schematic drawing of another topology of a computer information distribution network formed pursuant to an embodiment of the present invention;

FIG. 9 is a schematic drawing of the topology of the computer information distribution network formed pursuant to an embodiment of the present invention as shown in FIG. 8 (after the occurrence of an event);

FIG. 10 is a flow diagram of an embodiment of the present invention showing a Server Connection Routine which may be performed when a prospective child node seeks to join the distribution network;

FIG. 11 is a flow diagram of an embodiment of the present invention showing a Prospective Child Node's Request to Server for a Connection Routine;

FIGS. 12A-12E are schematic drawings showing varying topologies of the computer information distribution network formed pursuant to an embodiment of the present invention under several circumstances;

FIG. 13 is a block diagram of an embodiment of the present invention showing the memory blocks into which the software used may partition a user node's memory;

FIG. 14 is a flow diagram of an embodiment of the present invention showing a Prospective Child Node's Connection Routine - the routine which a new user node (or connection requesting user node) may go through in attempting to connect to a distribution chain (or tree) after receiving a connection address list;

FIG. 15 is a flow diagram of an embodiment of the present invention showing a Prospective Child Node's Connection Routine With Return to Server Subroutine;

FIG. 16 is a flow diagram of an embodiment of the present invention illustrating a Prospective Parent Node's Connection Routine;

FIG. 17 is a flow diagram of an embodiment of the present invention illustrating a Server's Connection Instruction Routine;

FIG. 18 is a flow diagram of an embodiment of the present invention illustrating a Fully Occupied Parent's Connection Instruction Routine;

FIG. 19 is a flow diagram of an embodiment of the present invention illustrating a Multi-Node Selection Subroutine;

FIGS. 20A and 20B are together a flow diagram of an embodiment of the present invention illustrating a Universal Connection Address Routine;

FIG. 21 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention before a new node will be added using the Universal Connection Address Routine;

FIG. 22 is a schematic drawing of a topology of the computer information distribution network of an embodiment of the present invention when a new node is added using the Universal Connection Address Routine;

FIG. 23 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention before a reconfiguration event;

FIG. 24 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention shown in FIG. 23 after a reconfiguration event;

FIG. 25 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention, slightly different from the topology shown in FIG. 23, before a reconfiguration event;

FIG. 26 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention shown in FIG. 25 after a reconfiguration event;

FIG. 27 is a flow diagram of an embodiment of the present invention showing a Child Node's Propagation Routine;

FIG. 28 is a schematic drawing of another topology of a computer information distribution network of an embodiment of the present invention before a reconfiguration event;

FIG. 29 is a schematic drawing of a topology of a computer information distribution network of an embodiment of the present invention shown in FIG. 28 after a reconfiguration event;

FIG. 30 is a schematic drawing of another topology of a computer information distribution network of an embodiment of the present invention before a "complaint" regarding communications;

FIG. 31 is a flow diagram of an embodiment of the present invention showing a Grandparent's Complaint Response Routine.

FIGS. 32, 33A-33C, 34A-34C, 35A, 35B and 36 relate to "Registration Process" examples according to the present invention;

FIGS. 37 and 38 relate to a "Firewall Request / Firewall Status" example according to the present invention;

FIGS. 39A, 39B and 40 relate to a "Propagate Path / Down" example according to the present invention;

FIGS. 41A, 41B and 42 relate to a "Propagate NTM / Up" example according to the present invention;

FIGS. 43 and 44 relate to a "Banned List" example according to the present invention;

FIG. 45 relates to a "Node Interlacing" example according to the present invention; and

FIGS. 46A-46C relate to various distribution network topology examples according to the present invention.

Webgroup CZ a.s. Ex. 1002, Page 1171 of 1406

Among those benefits and improvements that have been disclosed, other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying figures. The figures constitute a part of this specification and include illustrative embodiments of the present invention and illustrate various objects and features thereof (of note, the same reference numeral may be used to identify identical elements throughout the figures).

DETAILED DESCRIPTION OF THE INVENTION

Detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely illustrative of the invention that may be embodied in various forms. In addition, each of the examples given in connection with the various embodiments of the invention are intended to be illustrative, and not restrictive. Further, the figures are not necessarily to scale, some features may be exaggerated to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

Referring now to FIG. 3, an illustration of a linear propagation arrangement 10 of a computer network according to an embodiment of the present invention is shown. In this embodiment, the primary server node (or simply, server) 11 provides content data (e.g., streaming media) to user nodes 12 connected directly to it (sometimes referred to as "first level user nodes"). Each first level user node 12 has a second level user node 13 connected to it and each second level user node 13 has a third level user node 14 connected to it. The computer system at each first level user node 12 passes a copy of the content data received from server node 11 to the computer system at the second level user node 13 attached to such first level user node 12. The computer system at each second level user node 13 in turn passes the content data onto the computer system at the fourth level user node 14 attached to it.

As more fully discussed below, under this embodiment the computer systems at the server and user nodes may have distribution software installed in them which enables the nodes to be arranged as shown and for the computer systems to receive and re-transmit data.

The cascadingly connected arrangement of nodes (i.e., first level nodes are connected to the server, second level nodes are connected to first level nodes, third level nodes are connected to second level nodes and so on) shown in FIG. 3 takes advantage of the bandwidth available in certain nodes to essentially simultaneously receive and transmit data.

In a linear propagation arrangement, the effective distribution capacity of a server is in essence multiplied by the number of levels of nodes linked together. In the example of FIG. 3 (which example is intended to be illustrative and not restrictive), the distribution capacity of the server node is increased from 8 user nodes to 24 in just three levels.

Of note, many user nodes may have at least sufficient bandwidth (e.g., upstream bandwidth as well as downstream bandwidth) to receive data from one node and to re-transmit streams of data essentially simultaneously to two or more other nodes. This capacity could be used in another embodiment to set up a computer network with a cascadingly connected exponential propagation arrangement 16 (as shown in FIG. 4). As the name implies, an exponential propagation arrangement effectively increases the distribution capacity of a server exponentially. For example (which example is intended to be illustrative and not restrictive), with just three levels of user nodes, each having the capacity to retransmit two data streams, the distribution capacity of the server in FIG. 4 is increased from 8 user nodes to 56.

In another embodiment a distribution network may also be set up as a cascadingly connected hybrid linear/exponential arrangement 18, such as shown in FIG. 5.

Of note, the effective distribution capacity grows more quickly in a hybrid linear/exponential arrangement with each new level than does the distribution capacity in a linear propagation arrangement, and less quickly than does the distribution capacity in a pure exponential arrangement. However, any of these arrangements allows a server's distribution capacity to be greatly increased (e.g., with little or no additional investment in equipment for the server). Further, any other desired hybrid arrangement may be used.

Referring again to FIGS. 1-5, all of the connections between nodes are illustrated with arrows on each end. This is intended to signify that data flows in both directions between connected nodes. For example (which example is intended to be illustrative and not restrictive), a user node connected to a server may transmit data to the server indicating the identity of the user node, what the user node wants and/or other data, while the server node may transmits data confirming its identity and containing information and other content to the user node. In the remaining drawings such arrows may not be shown for the sake of simplicity. Further, it is noted that the bulk of data which is transmitted may be content (e.g., web pages, music files, streaming media), and such content will be understood to flow downtree from node to node in the drawings (i.e., in the direction from the root server to a first level node, to a second level node, to a third level node, etc.).

As can be understood from the above, an exponential propagation arrangement may create the most distribution capacity. However, while many (and perhaps even most) user nodes may have sufficient bandwidth to re-transmit acceptable quality multiple copies of the data, a number of user nodes may not have sufficient bandwidth to re-transmit more than one copy of the data with acceptable quality, and some user nodes may not have sufficient bandwidth to re-transmit even a single acceptable copy. Under these conditions, a distribution system employing the present invention may be configured, for example, as a hybrid propagation network. In such a system, a personal computer acting as a server node may reach many (e.g., hundreds, thousands or more) user nodes, even if the server node itself has capacity to transmit content data directly to only one other node.

In the following discussion it will be assumed that the system employing the present invention will take advantage of the capability of many user nodes to simultaneously re-transmit up to two copies of data (e.g., content data). However, it should be understood that the invention could take advantage of user nodes capable of simultaneous re-transmission of even higher numbers of copies.

In one embodiment the length of the distribution chains (i.e., the number of levels of user nodes linked through each other to the server) may be kept as small as possible to reduce the probability that the nodes at the ends of the chains will suffer a discontinuity of service. Thus, under this embodiment, in order to maximize the number of user nodes which may be connected to the server while trying to keep the length of the distribution chains as small as possible, the user nodes having the greatest bandwidth may be placed as far up uptree as possible (i.e., be placed as close as possible to the server, where "close" refers to network node level and not necessarily to geographical proximity).

In this regard, if an unreliable user node is placed near or at the end of a chain, few or no other user nodes would be affected by the unreliable user node's leaving the network. In contrast, if an unreliable user node were placed at or near the beginning of a chain (i.e., be far uptree), many other nodes would be affected by the unreliable node's departure. Because various embodiments of the invention may be used for appointment viewing of streaming media, in which an essentially continuous connection to an audiovisual content source may essentially be a necessity, it may be important (e.g., for this steaming media use) that the most reliable user nodes be placed high up in the chain (i.e., high uptree).

A user node may be deemed unreliable for any of a number of reasons. One example (which example is intended to be illustrative and not restrictive), is that the user node is connected to the Internet by lines having intermittent failures. Another example (which

example is intended to be illustrative and not restrictive), is that the user is merely sampling the content available on the network and intentionally disconnects the user node from the distribution network after discerning that he or she has no interest in the content.

Thus, under an embodiment of the present invention the user nodes may be positioned in the most advantageous positions, taking into account the dynamic nature of the distribution network, in which many user nodes may enter and leave the distribution network throughout the server's transmission of a streaming media show. In addition, the invention may help to preserve the viewing experience of users at user nodes positioned even at the end of a distribution chain (the server and/or user nodes may be enabled to perform the operations required to set up and maintain the distribution network by having data distribution software installed therein).

Referring now to a "User Node Arrival" example (which example is intended to be illustrative and not restrictive), it can be seen from FIGS. 3-5 that the distribution chains can be viewed as a plurality of family trees, each family tree being rooted to the server 11 through one of the first level nodes 12 (each node in the distribution network may have distribution software loaded in it which enables the node to perform the functions described below; before any new node may join the distribution network, such new node may also have such software loaded in it).

Of note, in the bulk of the examples discussed below, the network topologies have a branch factor of two (i.e., no user node is assigned more than two child nodes to be connected directly to it). A network topology with a branch factor of two may be referred to as a binary tree topology. It should be understood, of course, that the teachings set forth herein may be extended to network topologies having other branch factors, for example (which example is intended to be illustrative and not restrictive), branch factors of three, four or more.

In any case, FIG. 6 is a schematic drawing of a distribution network topology useful for describing the current "User Node Arrival" example. This FIG. 6 shows a distribution chain or family tree rooted to the server 11 through user node A, a first level user node 12 (the dashed lines represent connections from the server to other first level nodes or from node A to another user node). User node A could be thought of as a child node of the server and as a parent node for other user nodes connected directly to it. User node B, a second level user node 13, could be thought of as A's child. User nodes C and D, third level user nodes 14, may be thought of as B's children and A's grandchildren (and each other's siblings). User nodes E and F, fourth level user nodes 15, may be thought of as C's children (and each other's

siblings). User node G, also a fourth level user node 15, may be thought of as D's child. And user nodes E, F and G may be thought of as B's grandchildren and A's great grandchildren.

In the present example, whenever a new user node (or connection requesting user node) 19, such as node X in FIG. 6, seeks connection to the distribution network, it will first make a temporary connection to the server node (or a connection server, not shown) in order to begin the process for connecting to the distribution system. The server (or connection server) will discern from the user node a bandwidth rating (discussed below) appropriate to that node and, depending upon the available capacity of the server and any existing distribution chains, the server will either assign the new user node to a spot directly connected to the server or will provide the new user node with a connection path through a tree to the server.

FIG. 10 is a flow diagram associated with this example showing a Server's Connection Routine which is performed when a prospective child node seeks to join the distribution network. In step 101 the server performs the Server's Connection Instruction Routine (discussed below), in which the server determines what connection instructions to give to the new user node (or connection requesting user node). The server then goes to step 102 where it determines whether, as a result of the Server's Connection Instruction Routine, the prospective child node is being instructed to dock with the server. If the prospective child node is being instructed to dock with the server, then the server goes to step 103 in which the server would allow the new user node to dock with it, and the server would begin transmitting data (e.g., streaming media) directly to the new user node.

Of note, as referred to above, two different servers could be used - one to perform the server's connection routine and the other to transmit data (e.g., streaming media) - since both servers would be performing server functions, they will hereinafter sometimes be considered a single server for purposes of the description herein.

Of further note, while the prospective child node may be a new user node or a connection requesting user node, to simplify the following discussion such prospective child node may simply be referred to as a "a new user node".

In any case, if the new user node is not being instructed to dock directly with the server, then the server goes to step 104 in which it provides the new user node with an address connection list and disconnects the new user node from the server.

Essentially contemporaneously with the performance by the server of the Server's Connection Routine, the new user node is performing the Prospective Child Node's Request to Server for a Connection Routine. FIG. 11 is a flow diagram associated with this example

illustrating the Prospective Child Node's Request to Server for a Connection Routine. Upon making the temporary connection to the server, the new user node goes to step 111 in which it provides bandwidth rating and performance rating information to the server. It then proceeds to step 112 in which it receives connection instructions from the server. Then the new user node proceeds to step 113 to determine whether it has been instructed to dock directly with the server. If the answer is "yes," then the new user node proceeds to step 114 in which it erases any information which may have been in its ancestor database and, if the distribution software has a Return to Server Subroutine in it, resets the connection attempt counter to zero. The new user node then proceeds to step 115 in which it docks with the server and begins receiving data (e.g., streaming media). If the new user node is not being instructed to dock directly with the server, then the new user node goes to step 116 in which it receives the new connection address list from the server and loads such list into the user node's ancestor database and begins the Prospective Child Node's Connection Routine (discussed below). If the distribution software has a Return to Server Subroutine in it, the connection attempt counter is reset to one in step 116.

In the examples discussed in connection with FIGS. 6-9 and 12A-12C (which examples are intended to be illustrative and not restrictive), the server has determined that the new user node X will not be allowed to connect directly to the server. Also, for the purposes of these examples, all of the user nodes are presumed to be equally capable of simultaneously re-transmitting two copies of the content data and that the tree rooted through node A is the most appropriate tree through which node X should be connected to the server. In one embodiment the server may rely on chain length in determining to which particular user node, already in the distribution network, that node X should connect.

Referring again to the example of FIG. 6, the topology of the distribution network based on the most recent information available to the server at the moment that node X seeks to join the distribution network is shown. Path D-B-A-S (where "S" is the server) represents the shortest available path from an end of a chain back to the server (e.g., from a node level point of view and not necessarily from a geographical proximity point of view), and the server 11 gives that path information, or connection address list, to node X during step 104 of FIG. 10 (and node X receives such list during step 116 of FIG. 11). That is, node X will be given a connection address list with the URLs and/or IP addresses of each of nodes D, B, A and S. The distribution software in node X causes the path information to be stored in the ancestor portion (or ancestor database) 132 of node X's topology database 131 shown in FIG. 13. The ancestor database may include an ancestor list, a list of node X's ancestors' addresses

from node X's parent back to the server node. (FIG. 13 shows an example block diagram (which example is intended to be illustrative and not restrictive) showing the memory blocks into which the software used in connection with the present invention may partition a user node's memory 130.) Node X then attempts to contact node D first, the user node most distant from server 11 in the path. Note that when the server provides the D-B-A-S connection address to node X, the server is giving what it "believes" to be the complete path information going all the way back to the server. That is, subsequent to the most recent generation of the topological data, node D may have departed from the network, as may have one or more of its ancestors, resulting in a reconfiguration (discussed below) of at least a portion of the tree of which D was a part.

Referring now to FIG. 14 is a flow diagram associated with this example showing the Prospective Child Node's Connection Routine, the routine which a new user node, here node X, will go through in attempting to connect to a distribution chain (or tree) after receiving a connection address list (which node X has stored in the ancestor portion of its topology database) from the server or from a prospective parent node or during a reconfiguration event. In step 141, node X attempts to contact the first node on the connection address list. The first node, and only node, on the connection address list could be the server itself. Here node D is the first node on the list. Node X then proceeds to step 142 and determines whether the first node on the connection address list is still on-line and still part of the distribution network (in one example, if no response is received within a predetermined period of time, from the first node on the connection address list, the answer to the query in step 142 will be deemed to be no). If node D is on-line and still part of the distribution network, node X proceeds to step 143 in which node X inquires whether node D has room for node X. This inquiry may need to be made because the distribution network may have gone through a reconfiguration event resulting in node D's not having sufficient capacity to provide a copy of the content data to node X. If node D has room for node X, then node X proceeds to step 144 in which it connects (or docks) with node D and begins receiving content data from it. This is depicted in FIG. 7. Note that node X is now one of several level four nodes 15.

On the other hand, in step 142, if node D is not on-line (e.g., no response is received from node D within a predetermined period of time) or if node D is on-line but is no longer part of the distribution system (e.g., subsequent to the server's obtaining its topology data the user of the system at node D either caused his or her computer system to go off-line or to leave the distribution system, or there was a line failure causing the computer system to go off line), as depicted in FIG. 8, then node X goes to step 145 in which it deletes the first

address from the connection address list in node X's ancestor database (and, in one example, and for a purpose which will become clear when discussing reconfiguration events below, sets its reconfiguration flag buffer 136 to the lowest propagation rating). At this time node B, in the present example, becomes the first node on the connection address list. Then node X goes back to step 141 and repeats the routine described above. Note that because of node D's leaving the distribution network, a reconfiguration event was triggered which resulted in node G changing from a fourth level node 15 to a third level node 14.

In step 143, if the prospective parent node has no room for the new node (e.g., the capacity of the prospective parent node is fully occupied), the new node goes to step 146, in which it receives a new connection address list from the prospective parent. The prospective parent may then perform a Fully Occupied Parent's Connection Instruction Routine, discussed below in connection with FIG. 18, wherein it creates the new connection address list based on topology data obtained from its progeny. That new list may include the path back to the server through the prospective parent just in case, as discussed above, there are user node departures along the path.

Of note, by having a prospective parent node prepare the new connection address list as described in this example, the burden on the server is reduced and is distributed among the user nodes.

Still referring to the example depicted in FIG. 8, when node X gets to step 143, node B will respond that it has no room and node X will proceed to step 146. When node X performs step 146, the new connection address list it receives from node B will be G-B-A-S. Then node X proceeds to step 141 and repeats the routine from that point on. When the routine is performed on the topology shown in FIG. 8, step 143 will result in node G responding that it has room for node X. Node X will then perform step 144 and be connected to the distribution network through node G as shown in FIG. 9. Here, node X becomes a fourth level node 15.

The distribution software may include a Return to Server Subroutine, comprised of steps 151, 152 and 153 as shown in FIG. 15, as part of the Prospective Child Node's Connection Routine. This subroutine reduces the risk that a prospective child node would enter into an endless cycle of fruitless attempts to dock with nodes in a particular tree. If the answer to the query in step 143 is "no," then node X goes to step 151 in which it increments by one the connection attempt counter 135 in node X's memory. Then node X goes to step 152 in which it determines whether the connection attempt limit has been reached. In one example (which example is intended to be illustrative and not restrictive), the limit may be

preset at any number greater than one and may depend upon what the designer of a particular distribution network determines would be a reasonable amount of time for a node to attempt to make a connection on a particular tree, or a branch of a tree, before that node should be given an opportunity to obtain a completely new connection address list directly from the server. If the connection attempt limit has not been reached, then node X proceeds with step 146 as discussed above. If the connection attempt limit has been reached, then node X goes to step 153, in which it goes back to the server and begins the connection routine again as discussed above in connection with FIG. 6. If docking with a parent node is successful, then after step 144 node X performs step 154 in which the connection attempt counter is set to zero.

Referring now to FIG. 16, a flow diagram associated with this example illustrating the Prospective Parent Node's Connection Routine is shown. Using the example illustrated in FIGS. 6, 8 and 9, when node X queries node B in step 142 during the Prospective Child Node's Connection Routine, node B may begin performing the Prospective Parent Node's Connection Routine. In step 161, in response to node X's query, node B determines whether it is part of the distribution system node X seeks to join. If node B were not part of the distribution network, it would respond in the negative to node X's query and node B would be finished with the Prospective Parent Node's Connection Routine. In the example of FIG. 8, the answer is "yes" and node B proceeds to step 162.

In step 162 node B determines whether it has room for a new node. If the answer were "yes," node B would proceed to step 163 where it would allow node X to dock with it, and node B would begin transmitting to node X data (e.g., streaming media) originating from the server. In the example illustrated in FIG. 8, the answer is "no," and node B, acting as an instructing node, goes to step 164 where it performs the Fully Occupied Parent's Connection Instruction Routine (discussed below) and provides the prospective new child node (here node X) with a new connection address list. As noted above, the new connection address list may include the path back to the server through the node B (the prospective parent in this example) in the event that there are user node departures along the path, which departures may include node B.

After performing step 164 the temporary connection between node B and node X is terminated, and node X is sent on its way. In the example of FIGS. 8 and 9, the new connection address list is G-B-A-S. When node X approaches node G, node G performs the Prospective Parent Node's Connection Routine discussed above. In the example illustrated in FIGS. 8 and 9, node G allows node X to dock with it.

Referring now to a "Distribution Network Construction" example (which example is intended to be illustrative and not restrictive), it is noted that under this example the length of the distribution chains (i.e., the number of levels of user nodes linked through each other to the root server) is aimed to be kept as small as possible.

Assuming that all new user nodes have the same re-transmission capability (or disregarding the different re-transmission capabilities which different new user nodes may have), the user nodes would be distributed in this example through the first level until all the direct connection slots to the server were filled. Then as new user nodes sought connection to the distribution network, they would be assigned to connections with the first level nodes 12 until all the slots available on the first level nodes were filled. This procedure would be repeated with respect to each level as more and more new user nodes attempted to connect to the distribution network. In other words, the server, acting as an instructing node, would perform a Server's Connection Instruction Routine in which one step is determining whether there is room on the server for a new user node and, if so, the server would instruct the new user node to connect directly to the server. If there were no room on the server, then the server would perform the step of consulting its network topology database and devising a connection address list having the fewest number of connection links to a prospective parent user node. After performing the Server's Connection Instruction Routine, the server would either allow the new user node to dock directly with the server or send the new user node on its way to the first prospective parent user node on the connection address list.

In this example (which example is intended to be illustrative and not restrictive), a partially occupied potential parent node in a particular level (i.e., a prospective parent node already having a child but still having an available slot for an additional child node) may be preferred over unoccupied (i.e., childless) potential parent nodes on the same level. This may help to keep the number of interior nodes (i.e., the number of nodes re-transmitting data) to a minimum.

Alternatively, in another example (which example is intended to be illustrative and not restrictive), nodes that have zero children may be preferred over nodes that already have one child. While it is true that this may increase the number of repeat nodes, what the inventors have found is that by filling the frontier in an "interlaced" fashion, connecting nodes build up their buffers more quickly (allowing a reduction in the incidence of stream interruptions).

Referring now to FIGS. 12A-12C, these FIGS. illustrate, in this example, what happens when a partially occupied parent node is preferred over a parent childless node as a

destination address for a new user node (assuming all other factors are equal). FIG. 12A is a schematic diagram associated with this example showing a topology wherein nodes C and D, both third level nodes 14, have remaining capacity for one or more child nodes. Server 11 has the choice of sending new user node X to either node C, as shown in FIG. 12B, or node D, as shown in FIG. 12C, without increasing the length of the longest chain in the distribution network. However, user nodes are free to leave the distribution network at any time. With the topology shown in FIG. 12C, if either of nodes C or D leaves the network, there would be an effect on a child node. With the topology shown in FIG. 12B, there is a significant chance that if one of nodes C and D leaves the network, there would be no impact on any child nodes. That is, if it is node D that leaves the network, there is no child which would be made an orphan.

Of note, in discussing the examples illustrated in FIGS. 6-9 and 12A-12C, it has been presumed that all of the user nodes are equally capable of simultaneously re-transmitting two copies of the content data. However, the user nodes actually joining a distribution network will have various capabilities for re-transmitting data. Some will have no reliable capability because of hardware limitations. Other user nodes will have high nominal capability because of their hardware and type of Internet connection, but may have low reliability because of poor line conditions or the vagaries of the desires of the humans actually using the user nodes. For example, a user node having a T1 or faster connection to the Internet has a significantly large bandwidth, but is not reliable if the user (or viewer) is merely sampling the content available on the distribution network.

As noted above, in one example the user nodes having the greatest reliable capability should be placed as high up in a distribution chain as possible (i.e., as far uptree as possible) because they would have the ability to support the greatest number of child nodes, grandchild nodes and so on.

Thus, to differentiate the reliable capabilities of user nodes, a number of factors may be considered. Examples of such factors (which examples are intended to be illustrative and not restrictive), include following:

- One is time, that is, the number of seconds (or other units of time) since the node made its most recent connection to the network. Everything else being equal, a user node which has been continuously connected to the distribution network for a long period of time may be considered under this example to be likely more reliable

(either because of line conditions or user interest) than a user node which has been continuously connected to the network for a short period of time.

- Another factor is bandwidth rating, which may be determined, for example, by actual testing of the user node when it first attempts to connect to the server or a parent node (e.g., at initial connection time) or determined by the nominal bandwidth as determined by the type of connection made by the user node to the Internet. In one example (which example is intended to be illustrative and not restrictive), we will describe ratings based on nominal bandwidth as follows:

    - A user node with a 56 Kbits/sec dialup modem connection to the Internet is essentially useless for re-transmission of content data because of its small bandwidth. In this example, such a node is assigned a bandwidth rating of zero (0.0).

    - A user node with a cable modem or DSL (e.g., ADSL) connection to the Internet may be given, in this example, a bandwidth rating of one (1.0), because it is a common type of node and has a nominal upstream transmission bandwidth of 128 Kbits/sec, which is large enough to potentially re-transmit two acceptable quality copies of the content data it receives (assuming a 50Kbit/sec content data stream). Such capability fits well into a binary tree topology.

    - A full rate ISDN modem connection nominally has an upstream bandwidth of 56 Kbits/sec and a downstream bandwidth of 56 Kbits/sec, which would potentially support acceptable quality re-transmission of a single copy of the content data stream (assuming a 50Kbit/sec content data stream). For this reason, a user node with a full rate ISDN modem connection to the Internet may be given, in this example, a bandwidth rating of one-half (0.5), or half the rating of a user node connected to the Internet by a DSL (e.g., ADSL) or cable modem connection.

    - User nodes with T1 or greater links to the Internet should be able to support more (e.g. at least twice as many) streams as DSL (e.g., ADSL) or cable modems, and therefore may be given, in this example, a bandwidth rating of two (2.0). In the event that in a distribution network parent nodes

may be assigned more than two child nodes directly connected thereto, bandwidth ratings greater than 2.0 may be assigned under this example to Internet connections having greater bandwidth than T1 connections.

- In another example (which example is intended to be illustrative and not restrictive), other bandwidth networks (e.g., 50 Kbit/sec and 100 Kbit/sec) may be supported.
- In another example, the bandwidth needed for a node to be "repeat capable" may depend on the particular network to which it is attached (upon initial connection the connecting node may first test its upstream bandwidth and then report that bandwidth to the network server; the server may determine whether the node is "repeat capable" or not.
- In another example (which example is intended to be illustrative and not restrictive), a node may be deemed "repeat capable" if the node is not firewalled (e.g., port 1138 is open) and the node has sufficient bandwidth to retransmit two copies of the incoming stream.
- A third factor is performance. A user node's performance rating may, in one example, be zero (0.0) if it is disconnected as a result of a Grandparent's Complaint Response Routine (discussed below in connection with FIG. 31). Otherwise, the user node's performance rating, in this example, may one (1.0).

Further, in this example (which example is intended to be illustrative and not restrictive), a user node's utility rating may determined by multiplying connection time by performance rating by bandwidth rating. That is, in this example:

- Utility Rating = Time x Performance Rating x Bandwidth Rating.

Referring once again to FIG. 13, it is seen that in this example information regarding a user node's time connected to the network, bandwidth rating, performance rating, utility rating and potential re-transmission rating (discussed below) may be stored in the user node's elapsed time buffer 137, bandwidth rating buffer 138, performance rating buffer 139, utility rating buffer 121 and potential re-transmission rating buffer 122, respectively.

In another example (which example is intended to be illustrative and not restrictive), nodes entering the network may be judged to be either "repeat capable" or "non-repeat capable" (wherein non-repeat capable nodes may be called "bumpable" nodes). Repeat

capability may be based on: (1) Upstream bandwidth (e.g., tested at initial connection); and (2) the firewall status, opened or closed, of a node. In one specific example, if a node is either firewalled or has upstream bandwidth less than (approx.) 2.5 times the video streaming rate, that node will be deemed bumpable. All nodes joining the network, whether bumpable or non-bumpable, may be placed as close to the server as possible. However, for the purpose of placement (as described for example in the Universal Connection Address Routine of Figure 20), a repeat capable node can bump a bumpable node when being placed in the network.

Referring now to FIG. 17 a flow diagram associated with this example illustrating the Server's Connection Instruction Routine is shown. This routine need not necessarily rely on the new user node's utility rating. This routine may rely on the potential re-transmission rating of a user node, which is arrived at by multiplying the user node's performance rating by its bandwidth rating. That is, in this example:

- Potential Re-transmission Rating = Performance Rating x Bandwidth Rating.

Thus, in this example, the server would want to put those user nodes with the highest potential re-transmission rating as close to the server in a distribution chain as possible (i.e., as high uptree as possible) because they have the greatest likelihood of being able to re-transmit one or more copies of content data. On the other hand, a potential re-transmission rating of zero in this example indicates that a user node has no ability to (or little expected reliability in) re-transmitting even one copy of content data (the server in this example would want to put a user node with a zero rating as far as reasonably possible from the server in a distribution chain (i.e., as low downtree as possible)). For the purpose of ease of discussion, in the flow diagram example of FIG. 17 illustrating the Server's Connection Instruction Routine, the server is concerned about whether the potential re-transmission rating is zero (i.e., either one or both of the performance rating and bandwidth rating is zero) or greater than zero (i.e., both the performance rating and the bandwidth rating are greater than zero).

In step 171 the server node interrogates the new user node (or connection requesting node) for its bandwidth rating and performance rating. If the new user node is really new to the distribution network, or if it has returned to the server because all of the user node's ancestor nodes have disappeared from the network, the new user node's performance memory will contain, in this example, a performance rating of 1.0 (e.g., the default rating). However, if the new user node has been dispatched to the server for a new connection to the network

because the new user node had failed to provide content data to one of its child nodes, then, in one example, its performance memory will contain a performance rating of zero.

In step 172, the server determines, in this example, whether the potential re-transmission rate of the connection requesting node is greater than zero (i.e., whether both the bandwidth rating and the performance rating are greater than zero, or, if only the bandwidth rating is considered, whether the bandwidth rating is greater than zero (i.e., the connection requesting node is a high-bandwidth node)). If the answer is "yes," then the server goes to step 173 in which the server determines whether it has room for the new user node. If the answer to the query in step 173 is "yes," then the server goes to step 174 in which it instructs the new user node to connect directly to the server. Then the server goes to step 102 in the Server's Connection Routine (see FIG. 10).

If the answer to the query in step 173 is "no" (i.e., the server does not have the capacity to serve the new user node directly), then the server goes to step 175. In step 175, the server, acting as an instructing node, consults its network topology database and devises a connection address list having the fewest number of connection links to a prospective parent node. That is, the server checks its information regarding the nodes in the level closest to the server (i.e., the highest uptree) to determine whether there are any potential parent nodes with space available for the new user node. If there are no potential parent nodes with space available, then the database is checked regarding nodes in the level one link further from the server, and so on until a level is found having at least one potential parent node with space available for the new user node. That is, the server determines which parent node with unused capacity for a child node is closest to the server (i.e., in the highest level, with the first level being the highest), and devises the connection address list from such prospective parent node to the server. The server then goes to step 102 (shown in FIG. 10).

In another embodiment of the invention, the server could skip step 172 and go directly to step 173 (or it could go to step 172 and, if the answer to the query in step 172 is "no" (i.e., either one or both of the bandwidth rating and the performance rating are zero, or, if only the bandwidth rating is considered, whether the bandwidth rating is zero (i.e., the connection requesting node is a low-bandwidth node)), the server could go to step 175). However, this could prevent the server from loading up the highest levels of the distribution chains with nodes capable of re-transmitting at least one acceptable copy of the content data (in contrast to if the server does perform step 172 and does goes to step 176 if the answer to the query in step 172 is "no.").

In step 176 the server consults its network topology database and devises a connection address list having the greatest number of connection links to a prospective parent node. That is, the server checks its information regarding the nodes in the level furthest from the server (i.e., the lowest downtree) to determine whether there are any potential parent nodes with space available for the new user node. If there are no potential parent nodes with space available, then the database is checked regarding nodes in the level one link closer to the server, and so on until a level is found having at least one potential parent node with space available for the new user node. In this manner, user nodes having limited or no reliable re-transmission capability may be started off as far from the server as possible and will have a reduced effect on the overall capacity of the distribution network.

As indicated above, and as discussed more fully below, one or more reconfiguration events may have transpired since the server's topology database was last updated. As a result, the first prospective parent node which is actually present on the distribution network for the new user node to contact may not have room for the new user node. By way of example (which example is intended to be illustrative and not restrictive), when node X tries to join the distribution network having the topology shown in FIG. 12A, the server provides node X with the following connection address list: C-B-A-S. If node C had disappeared from the network between the last update of the server's topology database and node X's attempting to contact node C, then node E, by virtue of a reconfiguration event, would be connected, in this example, to node B as shown in FIG. 12D. Then node X, in performing the Prospective Child Node's Connection Routine discussed in connection with FIGS. 14 and 15, would contact node B. Node B, in the Prospective Parent Node's Connection Routine, discussed in connection with FIG. 16, would have to answer the query of step 162 in the negative and go to step 164, in which it performs the Fully Occupied Parent's Connection Instruction Routine.

Referring now to FIG. 18, a flow diagram associated with this example illustrating that routine is shown. It is similar to the Server's Connection Instruction Routine. Since the fully occupied parent node has already determined that it has no room for the new user node (or connection requesting user node), the Fully Occupied Parent's Connection Instruction Routine does not need to include a step in which a determination is made regarding whether there is room for the new user node (or connection requesting node). In the Fully Occupied Parent's Connection Instruction Routine the fully occupied parent node, acting as an instructing node, first performs step 181 in which it interrogates the new user node for its bandwidth rating and performance rating. In step 182, the fully occupied parent node determines whether the potential re-transmission rate of the new user node is greater than

zero. (If only the bandwidth rating is considered, then it determines whether the bandwidth rating is greater than zero (i.e., the connection requesting node is a high-bandwidth node).) If the answer is "yes," then the fully occupied parent node goes to step 183 in which the fully occupied parent node consults its topology database, which contains the latest information available to that node regarding the links from the fully occupied parent node back to the server and regarding the fully occupied parent node's own progeny (i.e., its children, grandchildren etc.,) and devises a new connection address list having the fewest number of connection links to a new prospective parent node. That is, the fully occupied parent node checks its information regarding the nodes in the level closest to the fully occupied parent node (but not closer to the server) to determine whether there are any potential parent nodes with space available for the new user node. If there are no potential parent nodes with space available, then the database is checked regarding nodes in the level one link further from the fully occupied parent node (and further from the server), and so on until a level is found having at least one potential parent node with space available for the new user node. That is, the fully occupied parent node determines which new prospective parent node with unused capacity for a child node is closest to the fully occupied parent node, and devises the connection address list from such new prospective parent node through the fully occupied parent node and on to the server. The fully occupied parent node then goes to step 184 in which it provides the new user node with the new connection address list and disconnects the new user node from the fully occupied parent.

If the answer to the query in step 182 is no (i.e., either (i) one of the bandwidth rating and performance rating is zero or (ii) if only the bandwidth rating is considered, the bandwidth rating is zero (i.e., the connection requesting node is a low-bandwidth node)), the fully occupied parent node goes to step 185. In step 185 the fully occupied parent node consults its network topology database and devises a connection address list having the greatest number of connection links to a new prospective parent node. That is, the fully occupied parent node checks its information regarding the nodes in the level furthest from it (and farther from the server than it is) to determine whether there are any potential parent nodes with space available for the new user node. If there are no potential parent nodes with space available, then the database is checked regarding nodes in the level one link closer to the fully occupied parent node, and so on until a level is found having at least one potential parent node with space available for the new user node. As discussed above, this helps assure that new user nodes having limited or no reliable re-transmission capability are started off as far from the server as possible. After the fully occupied parent node devises the connection

address list from such new prospective parent node through the fully occupied parent node and on to the server, the fully occupied parent node then goes to step 184 where it performs as discussed above.

In another embodiment of the invention, the distribution software could be designed such that a fully occupied parent performs an abbreviated Fully Occupied Parent's Connection Instruction Routine, in which steps 181, 182 and 185 are not performed. That is, it could be presumed that the server has done the major portion of the work needed to determine where the new user node should be placed and that the fully occupied parent user node need only redirect the new user node to the closest available new prospective parent. In such event, only steps 183 and 184 would be performed.

In the example discussed above in which node C had disappeared from the network when new user node X had been given, by the server, connection address C-B-A-S, and in which node B is a fully occupied parent node as shown in FIG. 12D, node B would appear to have the choice of devising either connection address list D-B-A-S or E-B-A-S regardless of whether the full or abbreviated Fully Occupied Parent's Connection Instruction Routine were performed.

In this regard, to determine which connection address list to choose when there are two or more prospective parent nodes in a particular level having space for a new user node, the distribution software could have an additional subroutine as part of steps 175, 176, 183 and 185. An example of this subroutine, called the Multi-Node Selection Subroutine is illustrated in FIG. 19.

In step 191 the server or fully occupied parent node deciding where to send a new user node determines whether any of the potential new parent nodes is partially occupied. As discussed earlier, in one example a partially occupied potential parent node may be preferred over an unoccupied potential parent node. In this case, if any of the potential parent nodes is partially occupied, then the server or fully occupied parent node goes to step 192. In step 192 the partially occupied prospective parent node with the highest utility rating is selected as the new prospective parent node. If there were only a single partially occupied potential parent node, then that node is selected.

If in step 191 it is determined that there are no partially occupied potential parent nodes, then the server or fully occupied parent node goes to step 193. In step 193 the unoccupied prospective parent node with the highest utility rating is selected as the new prospective parent node.

Webgroup CZ a.s. Ex. 1002, Page 1189 of 1406

In another example (which example is intended to be illustrative and not restrictive),the software engineer could have step 193 follow an affirmative response to the query in step 191 and step 192 follow a negative response; in such event, unoccupied prospective parent nodes would be selected ahead of partially occupied prospective parent nodes (all other things being equal, it may be advantageous to select nodes that have zero children over nodes that already have one child; while it is true that this may increase the number of repeat nodes, what the inventors have found is that by filling the frontier in an "interlaced" fashion, connecting nodes build up their buffers more quickly (allowing a reduction in the incidence of stream interruptions).

After whichever of steps 192 and 193 is completed, the server or fully occupied parent node returns to the step from which it entered the Multi-Node Selection Subroutine (i.e., step 175, 176, 183 or 185), and completes that step.

So, in the example shown in FIG. 12D, where node C left the network thereby leaving node B with the chore of devising a new connection address list for node X, node B would perform the Fully Occupied Parent's Connection Instruction Routine. Regardless of the bandwidth and performance ratings of node X, node B would be choosing between nodes D and E in the third level. In step 191 node B would determine that neither D nor E is partially occupied, and therefore node B would go to step 193. Assuming that nodes E and D have equal bandwidth and performance ratings and that node D was connected to the network longer than node E, node D would be selected because it would have the higher utility rating since it was connected to the network longer than node E. Node B would then go to step 194 and then return to the step from which it entered the Multi-Node Selection Subroutine. When node B returns to step 183 or 185, it completes that step and moves on to step 184. In that step, node B provides new user node X with new connection address list D-B-A-S and node X connects to the distribution network as shown in FIG. 12E.

Referring now to an "Alternative Distribution Network Construction" example (which example is intended to be illustrative and not restrictive), it is noted that under this example the length of the distribution chains (i.e., the number of levels of user nodes linked through each other to the server) is aimed to be kept as small as possible.

Also under this example, user nodes having the highest bandwidth capabilities are aimed to be kept closer to the server (e.g., in order to allow the greatest expansion of the distribution system). However, it is possible that zero bandwidth rated nodes may nevertheless appear relatively far uptree (thereby stunting the growth of that chain). The following method may be used in constructing the distribution network both by servers and

by prospective parents which are actually completely occupied, either of which may be thought of as an instructing node (that is, software enabling the routines discussed below could be installed on servers and user nodes alike).

More particularly, in the distribution system of this example, each child node reports directly to (or is tested by) its parent node with respect to information relating to the child node's bandwidth rating, performance rating, potential re-transmission rating and utility rating. In turn, each parent node reports all the information it has obtained regarding its child nodes on to its own parent node (a parent node also reports to each of its child nodes the address list from that parent back to the server, which list forms what may be referred to as the ancestor portion of the topology database – in addition, a parent node reports to each of its child nodes the addresses of their siblings). The reports occur during what may be referred to as a utility rating event. Utility rating events may occur, for example, on a predetermined schedule (e.g., utility rating events may occur as frequently as every few seconds). As a result of all the reporting, each node stores in its topology database the topology of the tree (including all its branches) extending below that node, and the server stores in its topology database the topology of all the trees extending below it. This may be referred to as the descendant portion (or descendant database) 133 of the topology database (see FIG. 13). The descendant database of a particular node may include a descendant list, a list of the addresses of all the nodes cascadingly connected below that particular node. Included in the topology database information may be the utility ratings of the nodes below the node in which that particular topology database resides.

After each reporting event in this example, each parent node (including the server), acting as an instructing node, devises two lists of prospective (or recommended) parent nodes. In this example, the first list, or Primary Recommended Parent List ("PRPL"), stored in the Primary Recommended Parent List buffer 123 (see FIG. 13), lists all the nodes in the descendant portion of that node's topology database which have bandwidth available to support another child node (in one example (which example is intended to be illustrative and not restrictive), in a binary tree system, all nodes in the descendant portion of the topology database having (i) a bandwidth rating of at least one and (ii) less than two child nodes would be listed). They would be listed with those node's which are closest to the node in which that particular topology database resides at the top of the list, and those nodes which are in the same level would be ranked such that the node with the highest utility rating would be listed first, the node with the second highest utility rating would be listed second and so on. By way of example (which example is intended to be illustrative and not restrictive), the PRPL of a

second level node would list a third level node with available bandwidth ahead of a fourth level node with available bandwidth even if the fourth level node's utility rating were higher than that of the third level node.

The second list in this example, or Secondary Recommended Parent List ("SRPL"), stored in the Secondary Recommended Parent List buffer 124 (see FIG. 13), lists all the nodes in the descendant portion of that node's topology database which have the ability to re-transmit content data to child nodes but are fully occupied, and at least one of its child nodes is incapable of re-transmitting content data to another child node (in one example (which example is intended to be illustrative and not restrictive), in a binary tree system, all nodes in the descendant portion of the topology database having (i) a bandwidth rating of at least one and (ii) at least one child node having a bandwidth rating less than one (i.e., being incapable of re-transmitting content data to two child nodes) would be listed). Like the nodes in the PRPL, the nodes in the SRPL would be listed with those node's which are closest to the node in which that particular topology database resides at the top of the list, and those nodes which are in the same level would be ranked such that the node with the highest utility rating would be listed first, the node with the second highest utility rating would be listed second and so on.

Of note, in this example the SRPL lists those parent nodes having the growth of their branches (i.e., their further progeny) blocked or partially blocked by a low-bandwidth child node. This may lead to an unbalanced growth of the distribution system, and a limitation on the total capacity of the system.

Of further note, to the extent that a node (including a server) has room for another child node or is the parent of a low bandwidth node, it may be listed on its own PRPL or SRPL.

Referring now to FIGS. 20A and 20B, an example flow diagram illustrating what may be referred to as the Universal Connection Address Routine is shown. As indicated above, a server or a fully occupied prospective parent node receiving a connection request may be referred to as an "instructing node." When a new node (here node N) approaches an instructing node, the instructing node performs step 201, it receives a connection request. It then goes to step 202 in which it interrogates or tests node N to determine whether it is a low-bandwidth node ("low-bandwidth" may mean, for example, either or both: (1) a node that is incapable of broadcasting two copies of its incoming stream on to its children; and (2) a node that is incapable of rebroadcasting its stream because it is firewalled). In the binary tree system of one example, a low-bandwidth node is a node with a bandwidth rating less than

one. If node N is a low bandwidth node, the instructing node proceeds to step 203 in which the instructing node determines whether there are any available prospective parent nodes which are not fully occupied. Sometimes the distribution network may be fully occupied. If it is, the instructing node's PRPL will be empty. If it is empty, the response to the query in step 203 would be yes. Then the instructing node goes to step 209 in which the new node is sent back to the server to start the connection process from the beginning. If the response to the query in step 203 is no, then the instructing node goes to step 204 in which it selects a prospective (or recommended) parent node for node N. The instructing node then moves on to step 205 in which it consults its topology database and devises a connection address list from the recommended parent node back to the server, and provides such connection address list to node N. (If the instructing node is a user node, then the connection address list leads back to the server through the instructing node.) At this point, node N performs the Prospective Child Node's Connection Routine discussed above in connection with FIG. 14.

As part of step 205, the instructing node inserts node N into its topology database as a child of the recommended parent node. It does this because other new nodes may seek connection instructions prior to the next utility rating event (i.e., before reports providing updated information regarding the topology of the distribution network are received by the instructing node), and such new nodes should not be sent to a prospective parent which the instructing node could know is fully occupied. In this regard, the instructing node then goes to step 206 in which it checks its topology database to determine whether the recommended parent, with node N presumptively docked to it as a child node, is fully occupied (in the example here of a binary tree network, whether it has two child nodes). If the answer is no, then the instructing node has finished this routine. If the answer is yes, then the instructing node goes to step 207 in which it removes the recommended parent from the PRPL and inserts it into the SRPL, and the instructing node has finished the routine.

If the answer to the query in step 202 is no (e.g., node N is not a low-bandwidth node; in the binary tree network example it is a high-bandwidth node capable of re-transmitting content data to two child nodes), the instructing node moves on to step 208. There it determines whether both the PRPL and SRPL are empty (which may occur under certain circumstances, such as, for example, when the number of levels in a distribution system is capped and at least all the nodes on all but the last level are fully occupied with high-bandwidth nodes). If so, the instructing node goes to step 209 in which the new node is sent back to the server to start the connection process from the beginning. If the response to the query in step 208 is no, then the instructing node goes to step 210 in which it selects a

prospective (or recommended) parent node for node N from the PRPL and an alternate recommended parent node from the SRPL (if either the PRPL or SRPL is empty, the instructing node will make a "nil" selection from that list – the instructing node knows from step 208 that at least one of the lists will not be empty). The instructing node then goes to step 211 in which it determines whether the alternate recommended parent node is closer to the server (i.e., higher uptree) than the recommended parent node derived from the PRPL. If the alternate recommended parent node is on the same level as, or on a lower level than the recommended parent node derived from the PRPL (or if the selection from the SRPL is nil), then the answer to the query in step 211 is no.

In such event, the instructing node goes to step 212 in which it consults its topology database and devises a connection address list from the recommended parent node back to the server, and provides such connection address list to node N (if the instructing node is a user node, then the connection address list leads back to the server through the instructing node).

As in step 205 discussed above, at this point, node N performs the Prospective Child Node's Connection Routine discussed above in connection with FIG. 14, and in step 212, the instructing node inserts node N into its topology database as a child of the recommended parent node.

The instructing node moves to step 213 in which it adds node N to an appropriate position on the PRPL. It does this because, as a result of step 202, it knows that the node N is capable of re-transmitting content data to its own child nodes.

The instructing node then goes to step 214 in which it checks its topology database to determine whether the recommended parent, with node N presumptively docked to it as a child node, is fully occupied (in the example here of a binary tree network, whether it has two child nodes). If the answer is no, then the instructing node has finished this routine. If the answer is yes, then the instructing node goes to step 215 in which it removes the recommended parent from the PRPL because it is now deemed to not be an available prospective parent node.

Then the instructing node goes to step 216 in which it consults its topology database to determine whether any of the recommended parent node's children is a low-bandwidth node (in this example, knowing that node N is not a low-bandwidth node and knowing that the recommended parent node has two child nodes, the question is whether the child node other than node N is a low-bandwidth node.) If the answer is no (i.e., all the recommended parent node's children are high-bandwidth nodes), then the instructing node has finished the routine.

If the answer is yes, then the growth of the recommended parent node's line of progeny is partially blocked by a low-bandwidth child node. The instructing node moves on to step 217 in which it adds the recommended parent to the SRPL.

If the answer to the query in step 211 is yes (i.e., the alternate recommended parent (selected from the SRPL) is: (i) on a higher level than the recommended parent (selected from the PRPL) or (ii) the selection from the PRPL is nil), then the instructing node moves to step 218. In that step the instructing node consults its topology database to determine: (i) which of the alternate recommended parent node's child nodes is a low-bandwidth node or (ii) if they both are low-bandwidth nodes, which of the child nodes has been connected to the system a shorter period of time. In one example (which example is intended to be illustrative and not restrictive), the instructing node may send a disconnect signal to that child node with instructions to return to the server to start the connection process from the beginning (as a new user node (or connection requesting user node)). In another example (which example is intended to be illustrative and not restrictive), the bumped node may climb its path to its grandparent which gives it a new connection path – rather than returning to the root server (doing so typically means that the incoming node that bumped the non-repeat-capable node ends up being that node's new parent).

The instructing node moves on to step 219 in which it consults its topology database and devises a connection address list from the alternate recommended parent node back to the server, and provides such connection address list to node N (if the instructing node is a user node, then the connection address list leads back to the server through the instructing node).

As in steps 205 and 212 discussed above, at this point, node N performs the Prospective Child Node's Connection Routine discussed above in connection with FIG. 14, and in step 219, the instructing node inserts node N into its topology database as a child of the alternate recommended parent node.

The instructing node moves to step 220 in which it adds node N to an appropriate position on the PRPL. It does this because, as a result of step 202, it knows that the node N is capable of re-transmitting content data to its own child nodes.

The instructing node then goes to step 221 in which it checks its topology database to determine whether all the child nodes of the alternate recommended parent are high-bandwidth nodes. If the answer is no, then the instructing node has finished this routine. If the answer is yes, then the instructing node goes to step 222 in which it removes the alternate recommended parent from the SRPL because it is now deemed to not be an available

alternative prospective parent node since the growth of its progeny line is not even partially blocked by one of its own children. At this point the instructing node has finished the routine.

With the routines discussed in connection with the above examples, the distribution network will be built with each new node assigned to the shortest tree (or chain), and those with the fewest number of links between it and the server. However, low-bandwidth nodes, which would tend to block the balanced growth of the distribution network, would be displaced by high-bandwidth nodes and moved to the edges of the network where they would have reduced effect on the growth of the network.

Referring now to FIG. 21, this FIG. may be used as an example to illustrate how the Universal Connection Address Routine works. It shows primary server 11 with node A as first level node 12, its child nodes B and C as second level nodes 13, their child nodes D, E, F and G as third level nodes 14, node D and G's child nodes H, I, J and K as fourth level nodes 15, and node I's child nodes L and M as fifth level nodes 17. Assume for this example that all available docking links directly to the server 11 are occupied by high-bandwidth nodes, and that all trees are at full capacity other than that rooted to the server 11 through first level node A. The utility rating for each node is set forth in FIG. 21 under its letter designation. Low-bandwidth nodes (in this example, those nodes having a bandwidth rating less than one) are shown with a bandwidth rating of "Ω," which indicates in this example that such nodes will not have any child nodes assigned to them. Nodes A, B, C, D, E, G, I, J and K are high-bandwidth nodes (or repeater nodes (i.e., they are capable of re-transmitting the content data they receive from their respective parent nodes to their respective child nodes, if any)).

A new user node (or other connection requesting user node), here referred to as "node N", may be directed to node A as a result of various reconfiguration events. When node A receives a connection request from node N, node A will, in this example, either consult both of its PRPL and SRPL buffers, if node N is a high-bandwidth node, or consult just its PRPL buffer (if node N is a low-bandwidth node).

Nodes F, H, L, and M will not appear on any list in this example since they are low-bandwidth nodes. Nodes B, C, D, G, I and A itself will not appear on the PRPL in this example since these nodes are fully occupied. However, nodes C, D, and I will appear on the SRPL in this example because they each have at least one low bandwidth child node.

Using the rules discussed above (i.e., ranking prospective parent nodes by level and within levels by utility rating) the PRPL would be as follows in this example:

- PRPL

- E (a third level node with available capacity)
  - J (the fourth level node with available capacity having the highest utility rating)
- K (a fourth level node with available capacity)

The SRPL in this example would be as follows:

- SRPL
  - C (the fully occupied second level node with a low-bandwidth child node)
  - D (the fully occupied third level node with a low-bandwidth child node)
  - I (the fully occupied fourth level node with a low-bandwidth child node)

If node N is a low-bandwidth node, node A will give, in this example, node N the following as its new connection address list:

- E-B-A-S.

Since node E would not have two child nodes, it would remain on the PRPL.

If node N is a high-bandwidth node, node A will compare (step 211 of FIG. 20B) the first node on the PRPL (the recommended parent node) with the first node on the SRPL (the alternate recommended parent node). Here, node C, the first node on the SRPL is a higher level node than node E, the first node on the PRPL. So, node A will send a disconnect signal (step 218 of FIG. 20B) to node F, node C's low-bandwidth child node. Then it will provide node N with the following new connection address list and add node N to the PRPL (step 219 of FIG. 20B):

- C-A-S.

Since node C would now have two high-bandwidth child nodes (nodes N and G), node C would be removed from the SRPL (step 222 of FIG. 20B).

Further, in this example wherein node N is a high-bandwidth node, when node F returns to the server 11 (or, in another example, goes to Node A) for a new connection, the

server (or Node A) will also use the Universal Connection Address Routine (Node F may go to Node A rather than the server because (in one example) when a node is "kicked" it may climb its internal connection path rather than jumping directly to the root server). Since node F is a low-bandwidth node, the server (or Node A) will give node F the following as its new connection address list:

- E-B-A-S.

FIG. 22 illustrates the new topology. As can be seen, absent intervening events, low-bandwidth node F will end up moving down from the third level to the fourth level and the bandwidth capacity of the third level will increase from six child nodes to eight (its maximum in this binary tree example). The potential bandwidth capacity of the fourth level would also increase, from ten child nodes to twelve.

Referring now to a "Distribution Network Reconfiguration" example (which example is intended to be illustrative and not restrictive), it is noted that under this example the user nodes are free to exit the distribution network at will. And, of course, user nodes may exit the distribution network due to equipment failures between the user node and the communication network (the Internet in the examples discussed herein). This was first discussed in connection with FIGS. 10A-E.

Under this example the present invention may handle the reconfiguration required by a user node departure by having certain user nodes in the same tree as the departing node perform a Propagation Routine. The results of the propagation routine of this example are illustrated in FIGS. 23 and 24. There a tree rooted to the server through first level user node P is illustrated. Node P has two child nodes, second level nodes Q and X. Through node X, P has two grandchild nodes, third level nodes A and B. Based on the relative utility ratings of nodes Q and X, P has sent signals to its children instructing them to set the color of the flag represented by the information in their respective reconfiguration flag buffers to "green" and "red," respectively. The use of colors as designators is merely discretionary. In reality they represent relative ratings of siblings for purposes of determining their roles in a reconfiguration event, and may be referred to as "propagation ratings." In addition, instead of colors, numbers (e.g., 1 and 2) could be used, as well as any of many other nomenclature schemes to describe the grades of propagation ratings. The "red" "green" ratings discussed herein shall be deemed representative of all such schemes. The number of grades of propagation ratings assigned by a parent node may be equal to the number of children each

parent node has. For example, for a branch factor "n" system, the maximum number of grades of propagation ratings may be "n." Since the distribution network in the examples discussed herein is a binary tree distribution network, a parent node will be required to assign at most up to two grades of propagation ratings.

In the example shown in FIG. 23, node P, during the most recent utility rating measurement event, discerned that node Q has a higher utility rating than node X, and therefore P has assigned node Q a green rating, represented by the solid-lined circle surrounding the letter Q in FIG. 23. P has assigned node X a red rating, represented by the dashed-lined circle surrounding the letter X in FIG. 23. In a similar manner, node X has assigned green and red ratings to third level nodes A and B, respectively. In this example (which example is intended to be illustrative and not restrictive), at the same time that a parent node assigns a propagation rating to a child node, it may also provide to such child node the address of the child node's sibling, if there is any. A child node may store information about its sibling (or siblings) in the sibling portion (or sibling database) 134 of its topology database (see FIG. 13). The sibling database includes a sibling list, a list of the addresses of a node's siblings (the data relating to the siblings' addresses may also contain information regarding the propagation ratings of the siblings (e.g., in the event that the distribution system has a branch factor greater than two)). In the example shown in FIG. 23, nodes Q and X know that they are each other's siblings and nodes A and B know that they are each other's siblings.

In another example (which example is intended to be illustrative and not restrictive), nodes do not store information about their siblings. In other words, in this example, a node generally does not know who its sibling is. Instead, cross connections between a red node and its green sibling are implemented via a "priority join" message sent to a red child that includes the IP address of the green sibling as the first entry in the connection path list.

In the event that node X were to leave the distribution network, nodes A and B would of course stop receiving content data from node X. Nodes A and B would consult their topology databases for the address of their grandparent, and each would interrogate node P for instructions. Since node X is out of the distribution network, node P would send out a reconfiguration event signal (sometimes referred to as a "propagation signal") to the nodes which had been node X's children (i.e., the nodes which were node P's grandchildren through node X) and node P would send an upgrade propagation rating signal to its remaining child, here node Q.

In response to the upgrade propagation rating signal, node P's remaining child, node Q, would set its reconfiguration flag buffer 136 (see FIG. 13) to the next highest available propagation rating grade. Since in the example illustrated in FIG. 23, node Q's reconfiguration flag buffer already is set for the highest propagation rating grade (here green), node Q could either do nothing or reset its propagation rating in response to the upgrade propagation rating signal. The result would be the same, node Q's propagation rating would remain green. If node Q's propagation rating were red, then it would set its propagation rating to green in response to the upgrade propagation rating signal. Node Q would do nothing else in response to the upgrade propagation rating signal (note that as a matter of design choice, the software engineer could have the parent of the departed node (here node P is the parent of departed node X) send no upgrade propagation rating signal to its remaining child node (here node Q) if its remaining child node already is at the highest propagation rating).

In this example, the recipients of the propagation signal (i.e., the children of the missing node) would respond thereto as follows. First they would check their own respective propagation ratings. If the propagation signal's recipient has the highest propagation rating grade (here green), it would reset its propagation rating to the lowest rating grade (here red); re-transmit the propagation signal to its own child nodes (if there are any); disconnect the child node which did not have the highest propagation rating prior to its receipt of the propagation signal if the propagation signal's recipient with the green rating has more than one child node; allow its sibling to dock with it as a child node for the purpose of transmitting content data to that child node; and dock (or remained docked), for purposes of receiving content data, with the node sending the propagation signal to it (in systems having a branch factor of more than two, the propagation signal recipient whose propagation rating had been the highest would disconnect its child nodes which did not have the highest propagation rating, prior to the receipt of the propagation signal just sent, and it would allow its (i.e., the formerly green node's) siblings to dock with it as child nodes).

If the propagation signal's recipient has other than the highest propagation rating (i.e., just prior to the receipt of the propagation signal), it would upgrade its propagation rating to the next highest rating grade; dock with its sibling which had the highest rating grade; and begin receiving content data from it. If the propagation signal's recipient has other than the highest propagation rating, it does not re-transmit the propagation signal to its own child nodes.

In the example illustrated in FIG. 23, nodes A and B receive the propagation signal from node P. Since node A has the highest propagation rating grade, here green, it: (i) sets its

reconfiguration flag buffer 136 (see FIG. 13) so that it has the lowest propagation rating grade, here red; and (ii) docks with node P (becoming a second level node 13) to begin receiving content data from node P. Node B changes its propagation rating from red to the next higher propagation rating (and since this example is a binary tree (or branch factor two) system, the next higher rating is the highest, green) and docks with node A to receive content data. The resulting topology is shown in FIG. 24. Note that node B remains a third level node 14.

FIGS. 25 and 26 illustrate what happens in this example when the departing node is green. In FIG. 25, node X is the departing node and it is green. When node P sends the upgrade propagation rating signal to node Q, it changes its propagation rating from red to green. In other respects the reconfiguration event proceeds essentially as described in the paragraph immediately above, and results in the topology shown in FIG. 26 (which is the same as the topology in FIG. 24).

FIG. 27 is a flow diagram associated with an example showing the Child Node's Propagation Routine, the routine which is followed by a child node upon receiving a propagation signal. Of note, this example is provided for illustration only, and is not restrictive, and other examples are of course possible (e.g., the color of a node may assigned by its parent such that nodes assign and know the color of their children but not of themselves).

In any case, still referring to FIG. 27, the child node first performs step 271 wherein it determines whether it has received such a signal. If it has not, then it does nothing. If it has received a propagation signal, it proceeds to step 272 wherein it checks its propagation rating grade in reconfiguration flag buffer 136 (see FIG. 13) . If its propagation rating is at the highest grade (i.e., it is a "green" node in this example), then it proceeds to step 273 where it sets its reconfiguration flag buffer to the lowest propagation rating grade. It then proceeds to step 274 in which it re-transmits the propagation signal to its own child nodes, and which results in the undocking of all its child nodes except for the one with the highest propagation rating. The child node (i.e., the child node referred to in the second sentence of this paragraph) then performs step 275 in which it determines whether it is already docked with the node which sent the propagation signal. If it is not (i.e., it received the propagation signal from its grandparent), then it proceeds to step 276. In that step it: (i) devises a new connection address list, which is the ancestor portion of its topology database with the current nominal parent node removed, resulting in the grandparent node becoming the first node on the connection address list; and (ii) then performs the Prospective Child Node's Connection

Routine (i.e., it goes to step 141 discussed above in connection with FIGS. 14 and 15). The Prospective Child Node's Connection Routine is performed because some likelihood exists that even the grandparent node may have departed from the distribution system between the moment it sent out the propagation signal and the moment that its highest rated grandchild from its missing child attempted to dock with it.

If the answer to the query in step 275 is in the affirmative (i.e., the child node is receiving a propagation signal which has been re-transmitted by its parent), then the child node does nothing more (or as illustrated in FIG. 27, it performs step 277 which is to remain docked to its parent node).

If the answer to the query in step 272 is in the negative (i.e., it does not have the highest propagation rating (it is a "red" node in this example)), then it proceeds to step 278 in which it: (i) sets its reconfiguration flag buffer so that its propagation rating is the next higher grade (in this binary tree system the rating is upgraded from red to green); (ii) undocks from the parent with which it was docked before receiving the propagation signal (if it was docked with a parent before receiving such signal); and (iii) either (a) waits a predetermined period of time during which the node's sibling which was green prior to their receipt of the propagation signal should have re-transmitted the propagation signal to its own child nodes (thereby causing any red child nodes to undock from it) or (b) confirms that the node's sibling which was green prior to their receipt of the propagation signal actual did re-transmit the propagation signal to its child nodes (if it has any). Then the child node performs step 279 in which it: (i) devises a new connection address list, which is the ancestor portion of its topology database with its sibling node having the highest propagation rating placed in front of the previous parent as the first node on the connection address list; and (ii) then performs the Prospective Child Node's Connection Routine (i.e., it goes to step 141 discussed above in connection with FIGS. 14 and 15). The Prospective Child Node's Connection Routine is performed because some likelihood exists that the sibling may have departed from the distribution system between the moment that the propagation signal had been sent to the child node and the moment that the child node attempted to dock with its sibling.

In another example (which example is intended to be illustrative and not restrictive), part (iii) of step 278 may be handled using the "priority join" mechanism. More particularly, in this example, a priority join from a node X cannot be refused by a target node T – it must accept (dock) the incoming node. If the target node T already had two children G & R, the target node T instructs its red child R to connect (via "priority join") to the green node G. The node T then disconnects from its red child R immediately prior to accepting the incoming

node X. The bumped node R then sends a priority join to its own green sibling A as the target. These actions cause the reconfiguration events to cascade until the edge of the tree is reached (of note, the algorithm described in this paragraph may have essentially the same effect as illustrated in Figures 28 and 29 – under certain circumstances the algorithm described in this paragraph may be somewhat more reliable).

FIG. 28 illustrates an example distribution system comprising node P as a first level node 12; nodes Q and X as second level nodes 13; nodes A and B as third level nodes 14; nodes C, D, E an F as fourth level nodes 15; nodes G and H as fifth level nodes 17; nodes I and J as sixth level nodes 20; nodes K and L as seventh level nodes 21 and nodes M and N as eighth level nodes 22. Nodes Q, B, C E, H, I, L and M have red propagation ratings, as symbolized by the dashed circles, and the remaining nodes have green propagation ratings as symbolized by the solid circles. As a result of node X's departing from the system, node P sends out an upgrade propagation rating signal to node Q and a propagation signal to the children of node P's departed child node X (i.e., nodes A and B).

In another example (which example is intended to be illustrative and not restrictive), during a graceful depart of node x, node x may send out messages to its parent and children immediately prior to its departure – rather than the parent of node x initiating these messages as described above.

In any case, continuing the example of FIG. 28, node Q changes its propagation rating to green. Further, in this example nodes A and B begin the Child Node's Propagation Routine. With respect to node A, it answers the query of step 271 in the affirmative. Since its rating is green, it also answers the query of step 272 in the affirmative. In step 273 node A changes the setting of its reconfiguration flag buffer to show a red propagation rating. In step 274 it re-transmits the propagation signal to its child nodes C and D. It answers the query of step 275 in the negative because it is not docked for purposes of receiving content data with node P. Node A then goes to step 276 wherein it consults the ancestor portion of its topology database and creates a new connection address list starting with its grandparent. The new connection address list is P-S. Then node A performs the Prospective Child Node's Connection Routine, starting with step 141. (See FIG. 14.) Assuming that no other intervening events have occurred, node A will successfully dock with node P.

Node B answers the query of step 271 in the affirmative and, because its propagation rating was red when it received the propagation signal, it answers the query of step 272 in the negative. From there it goes to step 278 in which it changes its propagation rating to green. Then in step 279 node B consults the ancestor portion of its topology database and creates a

new connection address list with its sibling, node A, placed in front of node X as the first address on the new connection address list. The new connection address list is A-X-P-S. Then node B performs the Prospective Child Node's Connection Routine, starting with step 141. Assuming that no other intervening events have occurred, node B will successfully dock with node A (if node A has disappeared, node B would attempt to dock with node X, but since it is not there, it would move on to node P.)

Node A, which had the higher propagation rating of the two child nodes of departed node X, moves up one level to become a second level node 13. Since it is a "new" entry to the second level, its initial utility rating and its propagation rating will be lower than that of node Q. As time goes by, at subsequent utility rating measurement events node A's utility rating (and hence its propagation rating) may become higher than that of node Q.

Node B, which had the lower propagation rating of the two child nodes of departed node X, does not re-transmit the propagation signal to its child nodes (nodes E and F), and they will follow B wherever it goes in the distribution system. In the example discussed here, node B becomes the child of node A while remaining third level node 14. At least initially, it will be node A's child with the higher utility rating and propagation rating.

As a result of node A's performing step 274, its child nodes C and D (which were fourth level nodes 15 in FIG. 28 when node X was still in the system) receive a propagation signal. Since node C has a red propagation rating, it, like node B, will remain in its level, change its propagation rating to green and dock with its sibling, with the result being that node D becomes its parent.

Since node D had a green propagation rating when it received the propagation signal, it answers the queries of steps 271 and 272 in the affirmative and changes its propagation rating to red in step 274. It answers the query of step 275 in the affirmative, and remains docked with node A. As a result, node D moves up a level and becomes an third level node 14 (with, at least until the next utility rating event, a lower utility rating and propagation rating than its new sibling, node B).

This process proceeds down the tree, with each child of a node which moves up a level doing one of the following under this example: (i) if it is a node having a green propagation rating, it remains docked with its parent, thereby itself moving up a level, changes its propagation rating to red and re-transmits the propagation signal to its child nodes; or (ii) if it is a node having a red propagation rating, it docks with the node which was its sibling, thereby staying in the same level, and changes its propagation rating to green.

The resulting topology after the reconfiguration event caused by node X's departure is illustrated in FIG. 29.

Of note, it is believed that reconfiguration using the Child Node's Propagation Routine of this example when a node departs the system does not necessarily result, in the long run, in significantly more inter-node reconnection events than any other reconfiguration method (and may result in fewer reconnection events). Moreover, it is believed that reconfiguration using the Child Node's Propagation Routine of this example helps assure that the more reliable nodes are promoted up the distribution network even if many reconfiguration events occur close in time to each other in a particular tree.

Referring now to a specific example of pseudo-code (which example is intended to be illustrative and not restrictive), it is noted that a propagation routine may be set forth as follows (wherein node X is the node departing from the distribution system):

```
Departs(X)
Begin
  If (X.Parent.GreenChild == X)  /* the departing node is green*/
  {
    X.Parent.GreenChild := X.Parent.RedChild
    X.Parent.RedChild := X.GreenChild
  }
  Else /* the departing node is already red */
  {
    X.Parent.RedChild :=X.GreenChild
  }
  Propagate(X.GreenChild, X.RedChild)
End
```

Referring now to another specific example of pseudo-code (which example is intended to be illustrative and not restrictive), it is noted that a propagation routine may be set forth as follows (wherein node promotion during the network reconfiguration event is precipitated by node X's departure):

```
Propagate (X, RedSibling)
Begin
  OriginalGreenChild := X.GreenChild
```

```
OriginalRedChild := X.RedChild
X.RedChild := X.GreenChild
X.GreenChild := RedSibling
If (OriginalGreenChild <> null)
{
  Propagate(OriginalGreenChild, OriginalRedChild)
}
End
```

Referring now to a "Malfunctioning Nodes" example (which example describes a voting system between grandchildren and grandparents about a potentially malfunctioning parent and is intended to be illustrative and not restrictive), it is noted that what happens when a node leaves the distribution network was discussed in the above example (e.g., when a node leaves the network, its parent will, at the next utility rating event, report that it has room for a new node, except when the parent has been contacted about the missing node by its grandchild node or nodes, in which event, a reconfiguration event will proceed as described above). Sometimes, however, a node intends to remain in the network, but there is a failure of communication.

In this regard, each node's topology database may include information regarding that node's ancestors and descendants. In the event that a child node stops receiving signals from its parent node, the child may, in one example, send a "complaint" message to its grandparent. The grandparent may check whether the parent is still there. If it is not, then the grandparent may send a propagation signal to the child nodes of the missing parent.

Further, if the grandparent detects that the parent node is actually still there, then the grandparent node may send a disconnect signal to the parent node (e.g., sending it back to the server to begin the connection process again). This may occur, for example, when one of the two following conditions is exists: (i) the child node is the only child node of the parent, or (ii) the child and its sibling(s) are complaining to the grandparent.

In this example, the grandparent would also send a propagation signal to the child nodes of the disconnected parent, and a reconfiguration event would occur.

However, if the child node has siblings and they are not sending complaint signals to the grandparent, then the grandparent may assume that the problem is with the complaining child node. Thus, grandparent may send a disconnect signal to the complaining child node (e.g., sending it back to the server to begin the connection process again). If the complaining

child node had its own child nodes, they would contact the departed child node's parent to complain, starting a reconfiguration event (in another example (which example is intended to be illustrative and not restrictive), the grandparent would send out signals to the malfunctioning parent (instructing it to depart) and to the children (instructing the green child to climb its path to its grandparent and instructing the red child to cross connect to the green child).

The foregoing example (which example is intended to be illustrative and not restrictive) can be described in connection with FIG. 30 (which depicts a tree in a binary system having a primary server 11, in which node A, a first level node 12, has two child nodes B and B' (which are second level nodes 13); node B has two child nodes C and C' (which are third level nodes 14); node C has two child nodes D and D' (which are fourth level nodes 15); and node D has two child nodes E and E' (which are fifth level nodes 17)) and FIG. 31 (which is a flow diagram showing an example Grandparent's Complaint Response Routine).

Who does node C complain to in this example when node C no longer gets satisfactory service from node B? Node C complains to its grandparent, node A. If node C does not hear back from node A within a predefined amount of time (e.g., if node A has left the network), node C will then exit the network and immediately reconnect as a new node by going to the primary server S for assignment.

What does node A do in response to a complaint from node C in this example? When node A receives a complaint from grandchild node C about node C's parent node B (i.e., node A's child node B), node A will choose to either remove its child node B or its grandchild node C. A will make this determination based on whether node C alone, or both node C and its sibling node C' are experiencing problems with node B, together with the knowledge of whether node A is continuing to receive satisfactory service reports from node B. If node A is continuing to get satisfactory service reports from node B and there is no indication that node C' (the sibling of node C) is experiencing problems with node B, then node A will assign the "fault" to node C and issue a disconnect order for its removal. At this point the green child of node C (i.e., node D or D') will move up a level connecting to parent B, and the red child of node C (the other of node D or D') will connect as a child of its former sibling. The reconfiguration event will then propagate as discussed above.

If, on the other hand, node A is not getting satisfactory service reports in this example from node B and/or a complaint from node C's sibling arrives within a `window` of node C's complaint, then node A will assign the "fault" to node B and issue a disconnect order for its

removal. At this point the green child of node B (i.e., node C or C') will move up a level connecting to grandparent node A, and the red child of node B (the other of node C or C'), will connect as a child of its former sibling. The reconfiguration event will then propagate as discussed above.

An exception to the above is the case where node C is the only child of node B. Under these circumstances node B may be disconnected in this example by node A based solely on the recommendation of node C. In another example, the system will not disconnect a node with one child based solely on the complaint of that child (in this case there may be insufficient data to accurately assign blame - disconnecting the node being complained against and promoting the complainer may have the potential to promote a node that is experiencing problems).

Referring now to FIG. 31 (showing a flowchart associated with this example), node A receives a complaint from node C about node B in step 311. Node A then goes to step 312 in which it checks its topology database to determine whether node C is the only child of node B. If the answer is no (as shown in FIG. 30), then node A goes to step 313 in which node A determines whether there is a communication problem between it and node B. If the answer is no, then node A proceeds to step 314 in which it determines whether it has received a similar complaint about node B from node C' within a predetermined period of time of node A's having received the complaint from node C. If the answer to that query is no, then node A goes to step 315 in which it sends a disconnect signal to node C. At that point node A has completed the Grandparent's Complaint Response Routine (in one example a propagation signal does not necessarily have to sent by node A to node C's child nodes - if any exist, they will complain to node B which, upon discerning that node C is no longer in the distribution network, will send a propagation signal to such complaining nodes).

If the response to any of the queries in steps 312, 313 and 314 is yes in this example, then node A proceeds to step 316 in which it disconnects node B. Node A then proceeds to step 317 in which it sends a propagation signal to its grandchild nodes (here nodes C and C') and a reconfiguration event will occur as described above.

The method of this example described above takes a "2 out of 3" approach on the question of node removal. In this regard, it is believed that many interior nodes in a binary tree distribution network constructed pursuant the present invention will have direct connections to three other nodes: their parent, their green child, and their red child. The connections between a node and its three "neighbor" nodes can be thought of as three separate communications channels. In this example a node is removed from the network

when there are indications of failure or inadequate performance on two of these three channels. When there are indications that two of the channels are working normally, the complaining node is presumed to be "unhealthy" and is removed.

In the case where an interior node has only a single child, the "complaint" of that child to its grandparent is sufficient, in this example, to remove the parent node - even when the node to be removed is communicating perfectly well with it's own parent. In other words, given the communication chain A-B-C where node A is the parent of node B and node B is the parent of node C, and given that node C has no siblings, then a complaint of node C to node A will cause node A to remove node B in this example regardless of the fact that node A and node B are not having communication problems (this course of action may help ensure that a potentially unreliable node does not move up the hierarchy of nodes, even at the cost of occasionally sending a "healthy" node back to the edge of the distribution chain based on uncorroborated complaints of its child). Of course, as mentioned above, there are examples where the system will not disconnect a node with one child based solely on the complaint of that child.

In another example of voting (which example is intended to be illustrative and not restrictive), instead of (or in conjunction with) nodes voting on the behavior of other nodes, nodes may continually grade their own performance and if they detect that there is insufficient bandwidth on two or more of their links (links to their parent and their children) the node will perform a graceful depart from the network (initiating a reconfiguration as described elsewhere) and then the node will either climb its path to an ancestor node (or go directly to the server) to request a connection path to the edge of the tree. This system allows nodes to "step aside" when they detect connection / bandwidth related issues.

Referring now to a "Stepped Delay of Playing Content Data" example (which example is intended to be illustrative and not restrictive) it is noted that in order to have all the user nodes experience the playing of the content data at approximately the same time, regardless of the level in which the node resides, the content data buffer 125 shown in FIG. 13 of a user node may be larger the higher uptree it is in a distribution chain (i.e., the closer it is to the root server). The larger the buffer, the greater the amount of time between a particular event (or from the node's receiving the content data), and the node's actually playing the content data in its content data buffer. To the extent that the content data buffer of a node is sized to vary the time that the playing of the content data is started, the content data buffer is a delay. Alternatively, the delay may be a timer or a delay buffer 126 as shown in

FIG. 13, or a combination of elements. The delay's purpose may be to help assure that all users experience the play of the content data approximately simultaneously.

For a distribution network having n levels of user nodes cascadingly connected to a server node, where n is a number greater than one (and therefore the distribution network comprises the server node and first through nth level user nodes), the period of time (i.e., the delay time) between:

(i) the moment content data is received by a node or, from a predetermined moment such as, for example, a reporting event or utility rating event (the occurrence of which may be based on time periods as measured by a clock outside of the distribution system and would occur approximately simultaneously for all nodes); and

(ii) the playing of the content data by the node;

is greater for a node the higher uptree the node is on the distribution chain. That is, the delays in first level nodes create greater delay times than do the delays in second level nodes, the delays in second level nodes create greater delay times than the delays in third level nodes and so on. Described mathematically, in an n level system, where x is a number from and including 2 to and including n, the delay time created by a delay in an (x-1) level node is greater than the delay time created by a delay in an x level node.

By way of example (which example is intended to be illustrative and not restrictive), first level nodes could have a built in effective delay time in playing content data of one-hundred-twenty seconds, second level nodes could have a built in effective delay time of one-hundred-five seconds, third level nodes could have a built in effective delay time of ninety seconds, fourth level nodes could have a built in effective delay time of seventy-five seconds, fifth level nodes could have a built in effective delay time of sixty seconds, sixth level nodes could have a built in effective delay time of forty-five seconds, seventh level nodes could have a built in effective delay time of thirty seconds, and eighth level nodes could have a built in effective delay time of fifteen seconds.

The delays may take advantage of the fact that transmission of the packets forming the content data from one node to another may take less time than the actual playing of such packets. This may allow for essentially simultaneous playing of the content data throughout all the levels of the distribution network. The delays may also allow nodes to handle reconnection and reconfiguration events without any significant loss of content data.

In another example (which example is intended to be illustrative and not restrictive), the system may not endeavor to have buffers closer to the server contain more data than buffers of nodes that are further away. Instead, every node may have a buffer that can hold,

for example, approximately two minutes worth of A/V content. The system may endeavor to fill every node's buffer as rapidly as possible, regardless of the node's distance from the server, in order to give each node the maximum amount of time possible to deal with network reconfiguration and uptree node failure events.

Of note, nodes may receive a "current play time index" when they connect to the server. This value may be used to keep all nodes at approximately the same point in the stream – to have all nodes playing approximately the same moment of video at the same time – by telling them, essentially, begin playing A/V content at this time index. The play time index may be, for example, approximately two minutes behind "real time" – allowing for nodes to buffer locally up to two minutes of content (the present invention may permit drift between nodes within the buffer (e.g., two minute buffer) or the present invention may reduce or eliminate this drift to keep all nodes playing closer to "lock step").

Turning now to a general description of an example process for Node X to enter a network including server Node S, Node X must contact Node S to initiate the process. For illustrative purposes, in the following example (which example is intended to be illustrative and not restrictive) each node in the network may have no more than two connections, and the root server (i.e., the highest node in the tree) shall be referred to as Node S.

The process of this example begins with Node X making a request of Node S to join the network.

If Node S has an open connection (e.g., including one or more connected bumpable non-repeat-capable nodes which may be replaced due to an incoming connection request from a repeat-capable node), Node S can accept Node X's request to join the network, and Node X becomes a child of Node S.

If, on the other hand, Node S does not have an open connection, Node S may reject Node X's request, and may provide to Node X a node-by-node path from Node S to Node P, which Node S understands to be in the network, and under which, as determined by Node S, Node X may be able to join the network.

The process of this example continues with Node X making a request of Node P to join the network.

If Node P does not respond – regardless of why Node P does not respond – Node X may request connection from the next higher node in the path. For the purpose of this illustration, thereafter the next higher node is now considered Node P. Node X may make such a request of successive Node Ps, until Node X receives a response.

If a particular Node P has an open connection, that Node P can accept Node X's request to join the network, and Node X becomes a child of that particular Node P.

If, on the other hand, a particular Node P does not have an open connection, that particular Node P may reject Node X's request, and may provide to Node X a node-by-node path from that particular Node P to Node P', which the instructing Node P understands to be in the network, and under which, as determined by the instructing Node P, Node X may be able to join the network.

If Node X receives a further rejection, Node X may then treat the Node P' as a Node P and continue the process.

In general, under this example the process is continued until Node X finds a connection.

Referring now more specifically to a "Registration Process" example involving two arbitrary Nodes X and N (neither of which is necessarily a server), FIG. 32 shows Node X sending a request to Node N for acceptance into the distribution network tree (of which Node N is part).

In this example, Node N (which may be thought of as an instructing node) may generally return one of three codes (or messages): Accept, Path, or Reject. FIGS. 33A-33C show example messaging between Node X and Node N under this example. More particularly:

- FIG. 33A shows Node X sending a Register message to Node N and Node N responding to the Register message with an Accept message
- FIG. 33B shows Node X sending a Register message to Node N and Node N responding to the Register message with a Path message (e.g., identifying a path from Node N to a new instructing node)
- FIG. 33C shows Node X sending a Register message to Node N and Node N responding to the Register message with a Reject message (i.e., rejecting Node X's request for a connection to Node N).

In another example, the registration process may be extended to include some system maintenance or configuration activities. Such maintenance or configuration activities may include "flood testing" (discussed in detail below), identification of a bad protocol, and/or Firewall Status (discussed in detail below).

In this regard, FIG. 34A shows the messaging (in connection with registration with a flood test) between Node X, a node requesting to join the network, Node S, a server node

within the network, and Node R (e.g., a random (or predetermined) node that may, but not need be, within the network).

Further, FIG. 34B shows the messaging (in connection with registration with a bad protocol version) between Node X and Node S, a server node within the network. Of note, such a bad protocol message may be sent by the server to a connection requesting node to inform that node that it is running an obsolete version of the client software and must upgrade to the current version before being allowed to join the network.

Further still, FIG. 34C shows the messaging (in connection with registration with standard response) between Node X and Node S, a server node within the network (wherein such standard response includes, for example, Accept / Reject / Path).

Referring now in more detail to the "flood test" example shown in FIG. 34A, this example process begins, as above, with Node X making a request to Node S to join the network. Node S then sends Node X a Meta message (such a Meta message may be sent by the server to a connection requesting node to inform that node of certain characteristics of the network such as, for example: the streaming bandwidth rate used by the network, the server's public key for authenticating that secure packets originated from this server, and any other information the architects of the network might deem necessary or desirable for nodes to know when connecting to the network). Node S may also require that Node X undergo performance or flood testing before being accepted or placed within the network. In such an event, Node S responds to Node X's request to join the network with an instruction that Node X undergo a flood test (e.g., of Node X's upstream channel). Such an instruction may be accompanied by an address of Node R, the illustrative flood test target. Note that any node within or without the network may conduct the flood test. One purpose of the flood test may be to permit Node S to be aware of Node X's upstream capability before determining where (or if) to assign Node X in the network.

Where Node S requires that Node X undergo performance or flood testing before being accepted or placed within the network, Node S provides a message so informing Node X, shown as "DoFlood" in FIG 34A. The DoFlood message may provide to Node X the address of the flood test target, but the flood test target could be Node S itself, or a predetermined flood test target.

In response to the DoFlood message, Node X sends an InitFlood message to the flood test target. In one embodiment, Node X would await an acknowledgement (not shown) of its InitFlood message, but in another embodiment, awaiting an acknowledgement is not

necessary. Node X would then begin transmitting FloodData messages, as shown in FIG 34A.

Since, in this example, FloodData messages are transmitted for a purpose of determining Node X's upstream bandwidth, in one embodiment, Node X would transmit an amount of FloodData to the flood test target as shown in FIG 34A. In various embodiments, the maximum amount of FloodData may be limited to a fixed number of FloodData messages, to a fixed amount of data transmitted within FloodData messages, or to transmission of FloodData or FloodData messages over a fixed period of time.

To protect the flood test target from being inundated with FloodData (e.g., where Node X has a very high upstream bandwidth capability), Node X may cap (e.g., be so directed by Node S) the FloodData transmission to, e.g., 100 Kbits/sec, 200 Kbits/sec, or some other data rate that would be a desired data transmission rate for a node on the particular network of interest.

Thus, by receiving the FloodData messages, the flood test target can determine, for example, an upstream capability rating of Node X (provided that the flood test target has the same or more bandwidth in the downstream channel compared to the upstream capability of Node X.

In another example, both the target and the sender will know the bandwidth of the sender at the conclusion of the flood test. More particularly, the present invention may use TCP/IP (rather than UDP), and all packets sent may receive an acknowledgement. In this example, Node X, the node sending out the flood packets, sends out the next flood packet only after receipt of the first packet has been acknowledged by the target of the flood test. Thus, the number of flood data packets Node X is able to send per unit time (along with the size of those packets) may allow Node X to calculate its upstream bandwidth.

In another example, the target of the "flood test" may be any node including the server but excluding any firewalled or low-bandwidth nodes.

After the "flood test", Node X may then connect with Node S (or be instructed to go to another node if Node S can not/will not accept Node X). Of note, if Node X fails the "flood test", Node X may be sent far downtree or may be refused entry into the network entirely. Further, if node N is accepted under these circumstances it will be deemed a "bumpable" non-repeat-capable node.

Referring now in more detail to the "Firewall Status" example shown in FIG. 34C, this example process begins, as above, with Node X making a request to Node S to join the network. Node S then send Node X a Meta message. A firewall status message is a message

sent over a new connection from (in the case of Figure 34C) Node S to Node X. If Node X receives this message, over a communications channel initiated by Node S, Node X will know that it is not firewalled. Failure to receive a firewall status message when a node is expecting such a message allows that node to conclude that it is in fact firewalled. Thus, if Node X is expecting to receive a firewall status message over new connection initiated by some other node and that message does not arrive, Node X can conclude (with a high degree of likelihood of being correct) that it is firewalled. Also, since (in one example) the present invention uses the TCP/IP messaging protocol the sender, Node S, will also know whether the firewall status message was successfully received by Node X and thus Node S will also know whether Node X is or is not firewalled (one or more other nodes may also receive data regarding the firewall status).

After receiving the firewall status report (not shown) Node S will then respond with a standard response (accept, path, reject) as discussed above.

To now give a specific example of the use of both the "flood test" and the "firewall status" mechanisms during registration of a new node, FIG. 35A shows a state of the network before Node X joins the network and FIG. 35B shows a state of the network after Node X joins the network. Further, FIG. 36 shows the messaging among Node X, Node S, Node B and Node R. More particularly:

- Node X sends a Register message to Node S and Node S responds with a Meta message (providing Node X with basic information about the network) and a DoFlood message (which requests Node X to determine its bandwidth and report back to Node S when Node X has that information). Node S knows to send a "DoFlood" to Node X because the initial Register message sent by Node X to Node S contains an indication that Node X does not yet know its current upstream bandwidth capacity. The DoFlood message will contain the address of a target node (Node R), selected by Node S, that Node X should flood against.
- Node X sends an InitFlood message to Node R and then "floods" Node R with data for some period of time (e.g., 15 seconds). At the conclusion of this test Node X will be able to compute its upstream bandwidth based on the number and size of data packets it was able to successfully transmit to Node R.

- Node X sends another Register message to Node S and Node S responds with a Meta message. Contained within this second Register message is the result of Node X's "flood test" which gives an indication of Node X's upstream bandwidth capacity.
- Node S now tests whether external nodes can initiate communication with Node X by sending Node X a Firewall Status message over a new connection. If this message is successfully received by Node X (and acknowledgement received by Node S), both Nodes X and S will know that Node X is not firewalled (on a network communication port).
- Node S sends a Path message to Node X. This message will include a list of nodes that X should attempt connection with, beginning with the preferred target node (e.g., Node B). As described elsewhere in the application, the choice of target node, and hence the contents of the path, may be influenced by both the current configuration of the network and whether or not Node X is repeat-capable (based on the results of the "flood test" and "firewall test").
- Node X sends a Register message to Node B and Node B responds with an Accept message.

Referring now to a "Firewall Request / Firewall Status" example involving two arbitrary Nodes A and B (neither of which is necessarily a server), FIG. 37 shows a portion of a network including Node A and Node B. In this example (as shown in FIG. 38), a Firewall Request message is sent by Node B to request that the recipient of the message, Node A, test Node B's Firewall Status. The receiving Node A may send (e.g., over a new connection), the Firewall Status message to Node B. If Node B timely receives and interprets the Firewall Status message it can be certain that it is a non-firewalled node. If Node B does not timely receive a Firewall Status message from Node A then Node B may assume that it is firewalled.

In another example (which example is intended to be illustrative and not restrictive), if Node A fails to connect to Node B or to send the Firewall Status message no further action is needed on the part of Node A.

Node B may also augment its assumption about its Firewall Status by using a three strikes (i.e., three attempts) method before considering itself to be firewalled (of course, three strikes is provided as an example only, and any desired number of "strikes" or attempts may be used).

In another example (which example is intended to be illustrative and not restrictive), the multiple attempts may be carried out within a predetermined time "window" (after which receiving no Firewall Status message Node B may consider itself firewalled).

In another example (which example is intended to be illustrative and not restrictive), Firewall Requests may be sent out by all nodes (e.g., at regular time intervals) in order to maintain a current and accurate picture of their Firewall Status.

In another example (which example is intended to be illustrative and not restrictive), Firewall Requests may be sent out by certain node(s) (e.g., at regular time intervals) in order to maintain a current and accurate picture of their Firewall Status.

In another example (which example is intended to be illustrative and not restrictive), the Firewall Status message may be sent by the server on initial registration (e.g., without the need for a Firewall Request message and both the sender (the server) and the receiving node (the node that is registering) may use the successful delivery of the Firewall Status message as an indicator of the connecting node's Firewall Status.

Referring now to a "Propagate Path / Down" example (which example is intended to be illustrative and not restrictive), FIG. 39A shows a portion of a network including Node A and Node B. Further, FIG. 39B shows an example of nodes in a tree sending Propagate Path / Down messages downtree to their children (e.g., at regular time intervals).

In one example (which example is intended to be illustrative and not restrictive), the Propagate Path / Down message may include topology information containing a path back to the root server and the time interval for sending such message may be calculated on a node-by-node and/or level-by-level basis relative to the amount of data to be sent in the Propagate Path / Down message (wherein the amount of data in the Propagate Path / Down message is related to a particular node's (or level's) downtree position relative to the root server). Note, that although this time interval may not be very important for Propagate Path / Down, since the amount of data for each successive downtree node (or level) may increase relatively slowly (e.g., linearly), the time period may be of critical importance for Propagate NTM / Up (which is discussed below), since the amount of data for each successive uptree node (or level) may increase relatively quickly (e.g., exponentially). Of note, the acronym "NTM" refers to the Network Topology Model.

In any case, FIG. 40 shows the messaging between Node A and Node B in connection with a Propagate Path / Down message (i.e., Node A sends a Propagate Path message downtree to Node B).

Webgroup CZ a.s. Ex. 1002, Page 1217 of 1406

Referring now to a "Propagate NTM / Up" example (which example is intended to be illustrative and not restrictive), FIG. 41A shows a portion of a network including Node A and Node B. Further, FIG. 41B shows an example of nodes in a tree sending Propagate NTM / Up messages uptree to their parents (e.g., at regular time intervals).

In one example (which example is intended to be illustrative and not restrictive), the Propagate NTM / Up message may include information containing the topology of the subtree(s) below a particular node and the time interval for sending such message may be calculated on a node-by-node and/or level-by-level basis relative to the amount of data being sent in the Propagate NTM / Up message (wherein the amount of data in the Propagate NTM / Up message is related to a particular node's (or level's) uptree position relative to tree height (e.g., the height of a particular node above its lowest leaf level)). Note that in this example (which example is intended to be illustrative and not restrictive), the NTM data that the node sends up is rooted at itself and contains both its children.

In any case, FIG. 42 shows the messaging between Node A and Node B in connection with a Propagate NTM / Up message (i.e., Node B sends a Propagate NTM message uptree to Node A).

In another embodiment, the following process may be employed when a node enters the network. More particularly, when the server adds a node X to the system (gives it a connection path to node Y) the server will add node X to its network topology model as a child of node Y. In other words, the server will assume that the connection will take place normally with no errors. The reason why doing so may be critical to the functioning of the system in this embodiment is that if the server failed to account for the fact that node X is now (probably) a child of node Y, using the "keep the tree balanced" approach embodied in the Universal Connection Address Routine, all new nodes connecting to the system would be assigned as children of node Y up until the point where a propagate up arrives indicating that node X was successfully added to the tree. If the tree is large and node Y is many levels removed from the server it could be some time (e.g., a minute or more, in very large trees several minutes) before confirmation arrives that node X truly connected to node Y as its child.

Now, in addition to simply placing node X into the server's NTM (Network Topology Model) and being done with the matter, in this embodiment the system must account for the fact that it may take a number of propagate NTM/up cycles for the true status of node X to be reported back to the server. Thus, for some number of propagate cycles (or some amount of time) the server may compare the newly propagated (updated) NTM it is receiving from its

children to the list of "recently added nodes". If a recently added node is not in the propagated NTM it will be re-added to the NTM as a child of node Y. At some point node X will no longer be considered "recently added" and the server will cease adding node X back into its NTM. In other words, the server will assume that, for whatever reason, node X never successfully connected to the network.

In another embodiment, the following process may be employed when a node gracefully exits the system. More particularly, when a node (node X) leaves the network by performing a graceful exit (e.g., the user selects "exit" or clicks the "x" or issues some other command to close the application) the node will send signals to its parent and child nodes (if any) immediately prior to actually shutting down. Upon receipt of such a "depart" message, the parent of the departing node (node P) will modify its internal NTM (Network Topology Model) to a configuration that corresponds to the predicted shape of the network after the departing node exits. In this embodiment, node P will assume that its NTM is accurate and that the entire cascade of reconfiguration events initiated by the departure of node X will happen normally. As such, node P will now expect the former green child of node X (node XG -- if such a child exists) to connect – essentially taking node X's place in the network.

At this point, node P's NTM represents a prediction of the (anticipated) state of the network rather than the actual reported configuration. In order to indicate that node P does not (yet) have a physical connection to node XG, node P will mark node XG as "soft" in its NTM – meaning node XG is expected to take up this position in the network but has not yet physically done so. Node P will report this "predicted" NTM (along with node XG's status as a soft node) up during its propagate NTM/Up cycles, until node P physically accepts a child connection in node XG's "reserved" spot and receives an actual report of the shape of the downtree NTM from that child, via propagate NTM/ups.

Of note, the above actions may be taken in order to have the propagated NTM's reflect, as accurately as possible, the topology of the network.

Of further note, because of the distributed nature of a network according to the present invention, a complete and accurate picture of the current shape of the network at any instance in time can never be guaranteed. In fact, though the root server has the "widest" view of the network, without the heuristics described herein, that view would be the "most dated" of any node in the network. Thus, heuristics such as those just described may be vital to producing NTM's that are as close to complete and accurate as possible (e.g., so that the Universal Connection Address Routine can position incoming nodes so as to keep the distribution tree as nearly balanced as possible).

Referring now to a "Banned List" example (which example is intended to be illustrative and not restrictive), it is noted that such a "banned list" (or "banished list") may be used for keeping certain nodes off of the network, removing certain nodes from the network, and/or keeping certain nodes as far downtree as possible (e.g., in the case of a binary tree network keeping certain nodes as "red" nodes).

More particularly, FIG. 43 shows a portion of a network including Node A, Node B, Node C and Node D and FIG. 44 shows the messaging between Node A, Node B, Node C and Node D in connection with Banned List messages (i.e., in this FIG. 44, Node A sends a Banned List message to Node B and Node B sends a Banned List message to Nodes C and D).

In one example (which example is intended to be illustrative and not restrictive), nodes receiving this message should re-transmit the message downtree to all children in an unaltered fashion.

In another example (which example is intended to be illustrative and not restrictive), the Banned List messages may include IP lists and/or URL's.

In another example (which example is intended to be illustrative and not restrictive), the Banned List messages may originate at the server.

In another example (which example is intended to be illustrative and not restrictive), Banned List messages may be sent and/or originated by any desired node(s).

In another example (which example is intended to be illustrative and not restrictive), Banned List messages and may be sent using a Secure Packet format.

In another example (which example is intended to be illustrative and not restrictive), node(s) may store the content of the message (e.g., the banned list itself) for future use.

In another example (which example is intended to be illustrative and not restrictive), the server (or any other desired node(s)) may send out and/or originate the Banned List messages at regular time intervals.

Referring now to a "Bumpable Node" embodiment, it is noted that this "bumpable node" mechanism may be used to "bump" (or send downtree) a particular node (e.g., when a new node is added). More particularly, in one example (which example is intended to be illustrative and not restrictive), a server may instruct Node X to connect with Node P and Node P may know to "bump" its child, Node C, by: (a) instructing Node C to disconnect from Node P; (b) allowing Node X to connect to Node P; and (c) instructing Node C to re-connect as a child of Node X. Of note, such a "bumping" operation may be carried out, for example (which example is intended to be illustrative and not restrictive), because the

bumped node is firewalled and/or because the bumped node has failed an upstream and/or downstream bandwidth test (which test may be carried out by the server or by any other node(s)).

Of note, as used in this application, the terms "bumpable nodes" or "bumpable non-repeat-capable nodes" or "non-repeat-capable nodes" are nodes which either: (a) have insufficient bandwidth to act as repeaters in the network or (b) are firewalled.

Of further note, in one example the more inclusive "is bumpable" test may replace the "is low bandwidth" test in the Universal Connection Address Routine of Figure 20.

Referring now to a "Load Manager" embodiment, it is noted that this "load manager" mechanism may be used to rate limit (i.e., slow or stop) the addition of new nodes to the network. Such rate limiting may be useful because the larger the network grows, the more nodes can join per unit of time.

In one example (which example is intended to be illustrative and not restrictive), the rate limited addition of new nodes may be carried out by a server (or connection server) and may be based upon the length of time that it takes for the buffers associated with one or more nodes (or levels) of the existing network to fill (or reach a certain value). In a more specific example, the rate limited addition of new nodes may be based upon the length of time that it takes for the buffers associated with potential parents of the new nodes to fill (or reach a certain value).

In another example (which example is intended to be illustrative and not restrictive), the rate limited addition of new nodes may be carried out by any desired node(s) (e.g., one or more user nodes and/or a combination of one or more user nodes and a server (or connection server) node).

Referring now to a "Node Interlacing" embodiment, it is noted that this "node interlacing" mechanism may be used to add new nodes to the network by interlacing the new nodes on a level-by-level basis as shown in FIG. 45.

More particularly, as seen in this FIG. 45, new nodes may be added in the order indicated (as can be seen below, this example (which example is intended to be illustrative and not restrictive) relates to a binary tree network). That is, Node 1 may first be added as a child of the server followed by Node 2 as a child of the server – this will fully populate the first level; Node 3 may next be added as a child of Node 1, followed by Node 4 as a child of Node 2, followed by Node 5 as a child of Node 1, followed by Node 6 as a child of Node 2 – this will fully populate the second level; Node 7 may next be added as a child of Node 3, followed by Node 8 as a child of Node 5, followed by Node 9 as a child of Node 4, followed

by Node 10 as a child of Node 6, followed by Node 11 as a child of Node 3, followed by Node 12 as a child of Node 5, followed by Node 13 as a child of Node 4, followed by Node 14 as a child of Node 6 – this will fully populate the third level, etc.

Of note, such node interlacing may be used to efficiently fill (or bring to a certain value) the buffers associated with one or more nodes (or levels) of the existing network while new nodes are added.

Of further note, such node interlacing may help prevent adding a second child to a parent until the first child's buffer is full (or brought to a certain value).

Of still further note, such node interlacing may help to: (a) prevent taxing the parent's downtree channel; and/or (b) prevent two children being left with partially filled buffers in the event that their parent departs.

Of still further note, such node interlacing may be used, for example, in conjunction with or as an alternative to the load balancing mechanism discussed above.

In another embodiment the present invention may be used when a plurality of computer systems are connected (e.g., to the Internet) by one or more of an ISDN line, a DSL (e.g., ADSL) line, a cable modem, a T1 line and/or an even higher capacity link.

In another embodiment a distribution network for the distribution of data from a server node to a plurality of user nodes connected to the server node, wherein each of the user nodes has associated therewith a buffer is provided, which distribution network comprises: a mechanism for rate limiting the addition of new user nodes to the distribution network, wherein the rate limited addition of new user nodes to the distribution network is based at least in part upon the length of time that it takes for at least one buffer associated with at least one user node to reach a predetermined percentage of capacity, wherein the predetermined percentage of capacity is greater than zero.

In another embodiment a distribution network for the distribution of data from a server node to a plurality of user nodes connected to the server node, wherein each of the user nodes is in one of a plurality of levels located downtree from the server node is provided, which distribution network comprises: a mechanism for adding new user nodes to the distribution network in an interlaced manner, wherein the interlacing provides that each sibling user node in a given level of the distribution network is associated with just one child before any siblings in the given level are associated with two children.

The following embodiments will now describe a number of additional example algorithms which may be utilized in whole or in part to implement the present invention:

In one embodiment a process for docking a connection requesting user node with a distribution network is provided, said process including the following steps:

(a) having an instructing node receive a connection request from said connection requesting user node;

(b) forming an instructing node topology database indicating, at a point in time:

(i) which, if any, user nodes are docked with said instructing node as child nodes; which, if any, user nodes are docked with each of said child nodes as grandchild nodes of said instructing node; which, if any, user nodes are docked with each of said grandchild nodes as great-grandchild nodes of said server node; and so on; and

(ii) said docked user nodes respective bandwidth capacities;

(c) selecting from a group of nodes including the instructing node and said docked user nodes a recommended parent node for said connection requesting user node, wherein said recommended parent node has apparent available capacity to transmit content data to said connection requesting user node and is at least as close (i.e., in terms of network topology) to said instructing node as any other docked user node having apparent available capacity to transmit content data to said connection requesting user node (of note, placement may also or alternatively depend, as described elsewhere in the present application, in whole or in part on whether the connection requesting node is repeat-capable or not (i.e., whether it can support children)); and

(d) providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said recommended parent node back to said instructing node.

In one example, the process may further comprise the following steps:

(e) having said connection requesting user node go to (or attempt to go to) the node at the top of said connection address list;

(f) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(g) if the node at top of said connection address list is not part of the distribution network, deleting such node from said connection address list and repeating steps (e) and (f) with respect to the next node at the top of said connection address list;

(h) if the node at the top of said connection address list is part of said distribution network, having said connection requesting user node dock with said node at the top of said connection address list.

In another example, step (d) may further comprise the following step:

(i) if said instructing node is not a server node, including in said connection address list a list of nodes cascadingly connected with each other from the instructing node back to said server node.

In another example, the process may further comprise the following steps:

(e) having said connection requesting user node go to (or attempt to go to) the node at the top of said connection address list;

(f) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(g) if the node at the top of said connection address list is not part of the distribution network, deleting such node from said connection address list and repeating steps (e) and (f) with respect to the next node at the top of said connection address list;

(h) if the node at the top of said connection address list is part of said distribution network, determining whether said node at the top of said connection address list has available capacity to transmit content data to said connection requesting user node; and

(i) if the node at the top of said connection address list is part of said distribution network and has available capacity to transmit content data to said connection requesting user node, having said connection requesting user node dock with the node at the top of said connection address list.

In another example, the process may further comprise the following steps:

(j) if the node at the top of connection address list is part of said distribution network and said node at the top of said connection address list does not have available capacity to transmit content data to said connection requesting user node, repeating steps (a)-(d), with said node at the top of connection address list being said instructing node and a new connection address list being the product of steps (a)-(d).

In another example, the process may further comprise the steps of counting the times that step (j) is performed and, when step (j) is performed a predetermined number of times, having said connection requesting user node repeat steps (a)-(d) with said primary server being the instructing node.

In another embodiment a process for docking a connection requesting user node with a distribution network is provided, said process including the following steps:

(a) having an instructing node receive a connection request from said connection requesting user node;

(b) forming an instructing node topology database indicating, at a point in time:

(i) which, if any, user nodes are docked with said instructing node as child nodes; which, if any, user nodes are docked with each of said child nodes as grandchild nodes of said instructing node; which, if any, user nodes are docked with each of said grandchild nodes as great-grandchild nodes of said server node; and so on; and

(ii) said docked user nodes' respective bandwidth capacities;

(c) assigning utility ratings to each of the docked user nodes, said utility ratings being a function of at least the bandwidth capacity of the docked user node and the elapsed time that the docked user node has been docked with the distribution network;

(d) selecting from a group of nodes including the instructing node and said docked user nodes a recommended parent node for said connection requesting user node, wherein said recommended parent node has apparent available capacity to transmit content data to said connection requesting user node and is at least as close (i.e., in terms of network topology) to said instructing node as any other docked user node having apparent available capacity to transmit content data to said connection requesting user node, and when the closest (i.e., in terms of network topology) docked user node with apparent available capacity to transmit content data to said connection requesting user node is equidistant (i.e., in terms of network topology) to said instructing node with at least one other docked user node with apparent available capacity to transmit content data to said connection requesting user node, said recommended parent node is the docked user node having the highest utility rating among such equidistant (i.e., in terms of network topology) docked user nodes with apparent available capacity; and

(e) providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said recommended parent node back to said instructing node and, if said instructing node is not a primary server node, back to said primary server node.

In another embodiment a process for docking a connection requesting user node with a distribution network is provided, said process including the following steps:

(a) having an instructing node receive a connection request from said connection requesting user node;

(b) forming an instructing node topology database indicating, at a point in time:

(i) which, if any, user nodes are docked with said instructing node as child nodes; which, if any, user nodes are docked with each of said child nodes as grandchild nodes of said instructing node; which, if any, user nodes are docked with

each of said grandchild nodes as great-grandchild nodes of said instructing node; and so on; and

(ii) said docked user nodes' respective bandwidth capacities, including a designation of whether said respective docked user node's bandwidth capacity is below a predetermined threshold (e.g., said respective docked user node is a low-bandwidth node) or at least said predetermined threshold (e.g., said respective docked user node is a high-bandwidth node);

(c) forming a primary recommended parent node list ("PRPL") comprised of the instructing node (if it has available capacity to transmit content data to said connection requesting user node) plus those docked user nodes having apparent available capacity to transmit content data to said connection requesting user node, with said instructing node being placed first on the PRPL (if it is on the PRPL) and said docked user nodes having apparent available capacity to transmit content date to said connection requesting user node being ranked with those docked nodes which are closer (i.e., in terms of network topology) to the instructing node being ranked higher than those docked nodes which are further away (i.e., in terms of network topology) and with equidistant (i.e., in terms of network topology) docked user nodes being ranked such that those docked nodes which have the higher utility ratings being ranked higher than docked nodes having lower utility ratings;

(d) forming a secondary recommended parent node list ("SRPL") comprised of the instructing node (if it has no available capacity to transmit content data to said connection requesting user node but does have at least one low-bandwidth node docked directly to it) plus said docked user nodes which (i) are high-bandwidth nodes with no available capacity to transmit content data to said connection requesting user node and (ii) have at least one low-bandwidth node docked directly to it, with said instructing node being placed first on the SRPL (if it is on the SRPL) and said docked user nodes on the SRPL being ranked with those docked nodes which are closer (i.e., in terms of network topology) to the instructing node being ranked higher than those docked nodes which are further away (i.e., in terms of network topology) and with equidistant (i.e., in terms of network topology) docked user nodes being ranked such that those docked nodes which have the higher utility ratings being ranked higher than docked nodes having lower utility ratings;

(e) determining whether the connection requesting user node is a low-bandwidth node;

(f) if the connection requesting user node is a low-bandwidth node:

(i) selecting the highest ranked node on the PRPL as a recommended parent node; and

(ii) providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said recommended parent node back to said instructing node and, if said instructing node is not a primary server node, back to said primary server node; and

(g) if the connection requesting user node is a high-bandwidth node:

(i) selecting the highest ranked node on the PRPL as a recommended parent node;

(ii) selecting the highest ranked node on the SRPL as an alternate recommended parent node;

(iii) determining whether the alternate recommended parent node is closer (i.e., in terms of network topology) to the server node than the recommended parent node;

(iv) if the alternate recommended parent node is not closer (i.e., in terms of network topology) to the server node than the recommended parent node, providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said recommended parent node back to said instructing node and, if said instructing node is not the primary server node, back to said primary server node;

(v) if the alternate recommended parent node is closer (i.e., in terms of network topology) to the server node than the recommended parent node, (1) forcing the disconnection of a low-bandwidth node from the alternate recommended parent node and (2) providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said alternate recommended parent node back to said instructing node and, if said instructing node is not the primary server node, back to said primary server node.

In one example, step (f)(ii) may include the following steps:

(1) adding said connection requesting user node to the topology database as a child of the recommended parent node; and

Webgroup CZ a.s. Ex. 1002, Page 1227 of 1406

(2) if said recommended parent node would have no apparent available capacity to transmit content data to an additional node with said connection requesting user node docked with it, deleting the recommended parent node from the PRPL and adding it to the SRPL.

In another example, step (g)(iv) may include the following steps:

(1) adding said connection requesting user node to the topology database as a child of the recommended parent node;

(2) if said recommended parent node would have no apparent available capacity to transmit content data to an additional node with said connection requesting user node docked with it, deleting the recommended parent node from the PRPL; and

(3) if said recommended parent node is deleted from the PRPL but has at least one low-bandwidth node docked directly to it, adding the recommended parent node to the SRPL.

In another example, step (g)(v) may include the following steps:

(3) adding said connection requesting user node to the topology database as a child of the alternate recommended parent node; and

4) if said alternate recommended parent node would have no apparent available capacity to transmit content data to an additional node with said connection requesting user node docked with it, deleting the alternate recommended parent node from the SRPL.

In another example, the process may further comprise the following steps:

(h) having said connection requesting user node go to (or attempt to go to) the node at the top of said connection address list;

(i) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(j) if the node at top of connection address list is not part of the distribution network, deleting such node from connection address list and repeating steps (h) and (i) with respect to the next node at the top of connection address list; and

(k) if the node at top of connection address list is part of said distribution network, having said connection requesting user node dock with said node at the top of connection address list.

In another example, the process may further comprise the following steps:

(h) having said connection requesting user node go to (or attempt to go to) the node at the top of connection address list;

(i) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(j) if the node at top of connection address list is not part of the distribution network, deleting such node from connection address list and repeating steps (h) and (i) with respect to the next node at the top of connection address list;

(k) if the node at the top of connection address list is part of said distribution network, determining whether said node at the top of connection address list has available capacity to transmit content data to said connection requesting user node; and

(l) if the node at the top of said connection address list is part of said distribution network and has available capacity to transmit content data to said connection requesting user node, having said connection requesting user node dock with the node at the top of said connection address list.

In another example, the process may further comprise the following steps:

(m) if the node at the top of said connection address list is part of said distribution network and the node at the top of said connection address list does not have available capacity to transmit content data to said connection requesting user node, repeating steps (a)-(g), with the node at the top of said connection address list being said instructing node and a new connection address list being the product of steps (a)-(g).

In another example, the process may further comprise the steps of counting the times that step (m) is performed and, when step (m) is performed a predetermined number of times, having said connection requesting user node repeat steps (a)-(g) with said primary server being the instructing node.

In another embodiment a process for docking a connection requesting user node with a distribution network is provided, said process including the following steps:

(a) having an instructing node receive a connection request from said connection requesting user node;

(b) determining whether said connection requesting user node's bandwidth capacity is below a predetermined threshold (e.g., said connection requesting user node is a low-bandwidth node) or at least said predetermined threshold (e.g., said connection requesting user node is a high-bandwidth node);

(c) forming an instructing node topology database indicating, at a point in time:

(i) which, if any, user nodes are docked with said instructing node as child nodes; which, if any, user nodes are docked with each of said child nodes as grandchild nodes of said instructing node; which, if any, user nodes are docked with each of said grandchild nodes as great-grandchild nodes of said server node; and so on; and

(ii) said docked user nodes' respective bandwidth capacities;

(d) if said connection requesting user node is a high-bandwidth user node, selecting from a group of nodes including the instructing node and said docked user nodes a recommended parent node for said connection requesting user node, wherein said recommended parent node has apparent available capacity to transmit content data to said connection requesting user node and is at least as close (i.e., in terms of network topology) to said instructing node as any other docked user node having apparent available capacity to transmit content data to said connection requesting user node;

(e) if said connection requesting user node is a low-bandwidth user node, selecting from a group of nodes including the instructing node and said docked user nodes a recommended parent node for said connection requesting user node, wherein said recommended parent node has apparent available capacity to transmit content data to said connection requesting user node and is at least as far (i.e., in terms of network topology) from said instructing node as any other docked user node having apparent available capacity to transmit content data to said connection requesting user node; and

(f) providing a connection address list to said connection requesting user node, said connection address list listing each node in said instructing node's topology database from said recommended parent node back to said instructing node.

In one example, step (f) may further comprise the following step: (i) if said instructing node is not a server node, including in said connection address list a list of nodes cascadingly connected with each other from the instructing node back to said server node.

In another embodiment a process for connecting a connection requesting user node to a computer information distribution network having a primary server node and user nodes docked therewith in a cascaded relationship is provided, said process further comprising the following steps:

(a) providing said connection requesting user node with a connection address list which sets forth a list of user nodes docked in series with each other back to said primary server;

(b) having said connection requesting user node go to (or attempt to go to) the node at top of said connection address list;

(c) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(d) if the node at the top of said connection address list is not part of the distribution network, deleting such node from said connection address list and repeating steps (b) and (c) with respect to the next node at the top of connection address list; and

(e) if the node at the top of said connection address list is part of said distribution network, having said connection requesting user node dock with the node at the top of said connection address list.

In another embodiment a process for connecting a connection requesting user node to a computer information distribution network having a primary server node and user nodes docked therewith in a cascaded relationship is provided, said process further comprising the following steps:

(a) providing said connection requesting user node with a connection address list which sets forth a list of user nodes docked in series with each other back to said primary server;

(b) having said connection requesting user node go to (or attempt to go to) the node at the top of said connection address list;

(c) having said connection requesting user node determine whether the node at the top of said connection address list is part of the distribution network;

(d) if the node at the top of said connection address list is not part of the distribution network, deleting such node from connection address list and repeating steps (b) and (c) with respect to the next node at the top of said connection address list;

(e) if the node at the top of said connection address list is part of said distribution network, determining whether the node at the top of said connection address list has available capacity to transmit content data to said connection requesting user node; and

(f) if the node at the top of said connection address list is part of said distribution network and has available capacity to transmit content data to said connection requesting user node, having said connection requesting user node dock with the node at the top of said connection address list.

In another embodiment relating to a computer information distribution network comprising a primary server node and user nodes docked therewith in a cascaded relationship, wherein each user node may have no more than a predetermined maximum number of child nodes docked with it, a process for reconfiguring the network in the event of a user node's departure therefrom is provided, said process including the following steps:

(a) providing information at a point in time to a node in the distribution network as follows:

(i) the node's propagation rating if it is a user node having a parent node which is a user node, wherein a propagation rating is one of a predetermined number of grades ranging from highest to second highest to third highest and so on, with the number of grades being equal to said predetermined maximum number;

(ii) an ancestor list setting forth the node's ancestor nodes' addresses (if it has any ancestor nodes) back to the primary server node, with the node's parent node being atop the ancestor list;

(iii) a sibling list of the node's sibling nodes' addresses (if it has any sibling nodes) and their respective propagation ratings (of note, in another example (which example is intended to be illustrative and not restrictive), nodes may not have data about their sibling (i.e., nodes do not know who their sibling is); instead, the mechanism used to get a red node to connect to its green sibling may be for the parent of those two nodes (or a proxy for that parent) to send the red child: (1) a connection path with that red child's green sibling at the top of the path; and (2) a command to "priority join" to that green child - when the green child node accepts the incoming "priority join" connection request from its former red sibling, the green node will kick its own red child (if such a child exists) instructing that red child to join as a child of its own green sibling (these actions will cause a chain reaction of reconfigurations which will cascade until the edge of the tree is reached)); and

(iv) a child list of the node's child nodes' addresses (if it has any child nodes) and their respective propagation ratings;

(b) having a first node send a propagation signal to each former child node of a departed node, wherein said first node is an ancestor of said former child node of said departed node;

(c) with respect to each child node receiving the propagation signal which did not have the highest propagation rating prior to its receiving the propagation signal (hereinafter referred to as a "red node"), upon its receiving the propagation signal:

(i) setting the propagation rating of the red node to the next higher grade above the propagation rating of that red node before it received the propagation signal;

(ii) having the red node undock from its parent node (if it was docked with its parent node before it received the propagation signal); and

(iii) having the red node dock with its sibling node which had the highest propagation rating prior to the red node's receiving the propagation signal;

(d) with respect to each child node receiving the propagation signal which had the highest propagation rating prior to its receiving a propagation signal (hereinafter referred to as a "green node"), upon its receiving the propagation signal:

(i) setting the propagation rating of that green node to the lowest grade;

(ii) having the green node retransmit the propagation signal to its child nodes (if it has any); and

(iii) determining whether the green node is docked with the node from which the green node received the propagation signal and if it is, having the green node remain docked with said node from which the green node received the propagation signal, and if it is not, having the green node dock with said node from which the green node received the propagation signal; and

(e) repeating steps (c) and (d) with respect to each user node which receives a retransmitted propagation signal.

In another embodiment relating to a computer information distribution network comprising a primary server node and user nodes docked therewith in a cascaded relationship, wherein each user node may have no more than a predetermined maximum number of child nodes docked with it, a process for reconfiguring the network in the event of a user node's departure therefrom is provided, said process including the following steps:

(a) providing information at a point in time to a node in the distribution network as follows:

(i) the node's propagation rating if it is a user node having a parent node which is a user node, wherein a propagation rating is one of a predetermined number of grades ranging from highest to second highest to third highest and so on, with the number of grades being equal to said predetermined maximum number;

(ii) an ancestor list setting forth the node's ancestor nodes' addresses (if it has any ancestor nodes) back to the primary server node, with the node's parent node being atop the ancestor list;

(iii) a sibling list of the node's sibling nodes' addresses (if it has any sibling nodes) and their respective propagation ratings; and

(iv) a child list of the node's child nodes' addresses (if it has any child nodes) and their respective propagation ratings;

(b) having a first node send a propagation signal to each former child node of a departed node, wherein said first node is an ancestor of said former child node of said departed node;

(c) with respect to each child node receiving the propagation signal which did not have the highest propagation rating prior to its receiving the propagation signal (hereinafter referred to as a "red node"), upon its receiving the propagation signal:

(i) setting the propagation rating of the red node to the next higher grade above the propagation rating of that red node before it received the propagation signal;

(ii) having the red node undock from its parent node (if it was docked with its parent node before it received the propagation signal);

(iii) devising a first connection address list comprising the address of the red node's sibling node which had the had the highest propagation rating prior to the red node's receiving the propagation signal followed by the red node's ancestor list;

(iv) having said red node go to (or attempt to go to) the node at the top of said first connection address list;

(v) having said red node determine whether the node at the top of said first connection address list is part of the distribution network;

(vi) if the node at the top of said first connection address list is not part of the distribution network, deleting such node from said first connection address list and repeating steps (c)(iv) and (c)(v) with respect to the next node at the top of said first connection address list;

(vii) if the node at the top of said first connection address list is part of said distribution network, determining whether the node at the top of said first connection address list has available capacity to transmit content data to said red node; and

(viii) if the node at the top of said first connection address list is part of said distribution network and has available capacity to transmit content data to said red node, having said red node dock with the node at the top of said first connection address list (with regard to these steps (vii) and (viii), in another example (which example is intended to be illustrative and not restrictive), when a red node connects to a green node as part of a network reconfiguration event, it does not matter whether there is "available capacity" or not for the green node to accept its incoming red sibling – the green node has no choice but to accept the node (these actions are facilitated in this example by the red node issuing a "priority join" to the green node; if the green node does not have "available capacity" it has to kick its own red child to make room for the incoming green node));

(d) with respect to each child node receiving the propagation signal which had the highest propagation rating prior to its receiving a propagation signal (hereinafter referred to as a "green node"), upon its receiving the propagation signal:

(i) setting the propagation rating of that green node to the lowest grade;

(ii) having the green node retransmit the propagation signal to its child nodes (if it has any);

(iii) determining whether the green node is docked with the node from which the green node received the propagation signal and if it is, having the green node remain docked with said node from which the green node received the propagation signal, and if it is not, devising a second connection address list starting with said node from which the green node received the propagation signal and followed by that portion of said green node's ancestor list extending back to the primary server from said node from which the green node received the propagation signal;

(iv) having said green node go to (or attempt to go to) the node at the top of said second connection address list;

(v) having said green node determine whether the node at the top of said second connection address list is part of the distribution network;

(vi) if the node at the top of said second connection address list is not part of the distribution network, deleting such node from said second connection address list and repeating steps (d)(iv) and (d)(v) with respect to the next node at the top of said second connection address list;

(vii) if the node at the top of said second connection address list is part of said distribution network, determining whether said node at the top of said second connection address list has available capacity to transmit content data to said green node; and

(viii) if the node at the top of said second connection address list is part of said distribution network and has available capacity to transmit content data to said green node, having said green node dock with the node at the top of said second connection address list; and

(e) repeating steps (c) and (d) with respect to each user node which receives a retransmitted propagation signal.

In one example, step (c)(iii) may include the following additional step: (1) waiting a predetermined period of time so as to allow the red node's sibling with the highest

propagation rating prior to the red node's receipt of the propagation signal (hereinafter the "green node") to retransmit the propagation signal to the green node's child nodes (if any).

In another embodiment relating to a computer information distribution network comprising an instructing node having a fist user node docked with said instructing node to receive content data therefrom and a second user node docked with said first user node to receive content data therefrom, a process for handling a purported communication interruption between said first user node and said second user node is provided, said process including the following steps:

(a) having said instructing node receive a first complaint about said first user node from said second user node;

(b) if the second user node is the only user node docked with said first user node at a point in time, if said instructing node receives another complaint about the first user node from another user node within a predetermined period of time from when said instructing node received said first complaint or if said instructing node experiences a communication problem between it and said first user node during said predetermined period of time: (i) disconnecting said first user node from said instructing node; and

(c) if said instructing node has not experienced a communication problem between it and said first user node during said predetermined period of time and if a plurality of user nodes are docked with said first user node at said point in time and said instructing node has not received another complaint about said first user node from a user node other than said second user node within said predetermined period of time: (i) disconnecting said second user node from said first user node.

In one example, step (b) may include the following step: (ii) sending a signal to the user nodes docked with said first user node indicating the departure of said first user node from said network.

In another example, each user node may have no more than a predetermined maximum number of child nodes docked with it, and wherein step (b) may include the following steps

(ii) providing information at said point in time to each of said second user node, the other user nodes which had been docked with said first user node (if any) and at least one of any user nodes cascadingly connected in the distribution network under said first user node prior to said first user node's being disconnected from said instructing node (if any) as follows:

(1) the node's propagation rating, wherein a propagation rating is one of a predetermined number of grades ranging from highest to second highest to third highest and so on, with the number of grades being equal to said predetermined maximum number;

(2) an ancestor list setting forth the node's ancestor nodes' addresses (if it has any ancestor nodes) back to the instructing node, with the node's parent node being atop the ancestor list;

(3) a sibling list of the node's sibling nodes' addresses (if it has any sibling nodes) and their respective propagation ratings; and

(4) a child list of the node's child nodes' addresses (if it has any child nodes) and their respective propagation ratings;

(iii) having said instructing node send a propagation signal to each of said second user node and the other user nodes which had been docked with said first user node (if any);

(iv) with respect to each user node receiving the propagation signal which did not have the highest propagation rating prior to its receiving the propagation signal (hereinafter referred to as a "red node"), upon its receiving the propagation signal:

(1) setting the propagation rating of the red node to the next higher grade above the propagation rating of that red node before it received the propagation signal;

(2) having the red node undock from its parent node (if it was docked with its parent node before it received the propagation signal); and

(3) having the red node dock with its sibling node which had the highest propagation rating prior to the red node's receiving the propagation signal;

(v) with respect to each user node receiving the propagation signal which had the highest propagation rating prior to its receiving a propagation signal (hereinafter referred to as a "green node"), upon its receiving the propagation signal:

(1) setting the propagation rating of that green node to the lowest grade;

(2) having the green node retransmit the propagation signal to its child nodes (if it has any); and

(3) determining whether the green node is docked with the node from which the green node received the propagation signal and if it is, having the green node remain docked with said node from which the green node received the propagation signal, and if it is not, having the green node dock with said node from which the green node received the propagation signal; and

(vi) repeating steps (iv) and (v) with respect to each user node which receives a retransmitted propagation signal.

In another embodiment a distribution network for the distribution of content data from a server node to user nodes, wherein said user nodes are connected to said server and each other in cascaded relationship is provided, wherein:

(a) at least one of said user nodes is a repeater node connected directly to said server node, wherein said repeater node retransmits content data received by it to a user node docked to it for purpose of receiving content data from said repeater node (hereinafter referred to as a "child node"); and

(b) wherein each repeater node has the ability to provide to a user node which is attempting to dock with said repeater node connection address instructions.

In one example, each repeater node may include a descendant database indicating:

(i) which child nodes, if any, at a point in time, are docked with it so as to receive content data from said repeater node, and

(ii) which user nodes, if any, at said point in time, are purportedly docked with each of said child nodes.

In another example, the connection address instructions may refer said user node which is attempting to dock with said repeater node to a node in said descendant database.

In another example, each user node may include an ancestor database indicating to which node said user node is docked so that said user node may receive content data therefrom (hereinafter referred to as a "parent node"), and to which node, if any, at said point in time, said parent node is docked so that it may receive content data therefrom.

In another example, if said parent node of said user node departs from said distribution network, said user node may contact another node on its ancestor database.

In another example, each child node of a repeater node may include a sibling database indicating which user nodes, if any, are also child nodes of said repeater node.

In another embodiment a distribution network for the distribution of content data from a server node to user nodes is provided, wherein n levels of user nodes are cascadingly connected to said server node, wherein n is a number greater than one, wherein each user node includes a delay which causes the playing of content data by such node to be delayed a period of time (hereinafter "delay time") from a point in time, and wherein delays in higher level nodes create greater delay times than do delays in lower level nodes.

In another embodiment a distribution network for the distribution of content data from a server node to user nodes is provided, wherein n levels of user nodes are cascadingly

connected to said server node, wherein n is a number greater than one, wherein each user node includes a delay which causes the playing of content data by such node to be delayed a period of time (hereinafter "delay time") from a point in time, wherein x is a number from and including 2 to and including n, and wherein delays in (x-1) level nodes create greater delay times than do delays in x level nodes.

In one example, said point in time is an event experienced approximately simultaneously by substantially all user nodes.

In another example, said point in time is when said node receives content data.

While a number of embodiments and examples of the present invention have been described, it is understood that these embodiments and examples are illustrative only, and not restrictive, and that many modifications may become apparent to those of ordinary skill in the art. For example, any desired branch factor may be used (*see*, e.g., FIG. 46A showing a branch factor of 1 (i.e., each parent node may have only one child node); FIG. 46B showing a branch factor of 2 (i.e., each parent node may have one or two children nodes); and FIG. 46C showing a branch factor of 3 (i.e., each parent node may have one, two or three children nodes)). Of course, other branch factors (e.g., 4, 5, 6, etc) may be used and, as discussed above, the distribution network may be a hybrid network utilizing subtrees having different branch factors). Further still, a modified Utility Rating may be determined as follows: Utility Rating = Time (of connection) x Bandwidth Rating. Further still, a node ID may be based upon: (a) an IP address (external/internal/DHCP); (b) a URL; and/or (c) a Port. Further still, the root server may propagate "its" time upon assignment of a connection and the user node may get a "delta" (i.e., difference) from its clock to use (in the event of a reset the user node may re-acquire the time from the server (or from another time-providing source)). Further still, the various time intervals discussed herein may be predetermined time intervals (e.g., .5 sec., 1 sec, 1 min.) and/or the time intervals may be based upon some varying criteria (e.g., flow of data in the network, number of nodes in the network, number of levels in the network, position of a given node in the network). Further still, partial propagation of data (e.g., ancestor data and/or descendent data) from one or more nodes may be permitted. Further still (as discussed above), one or more of the steps described herein may be omitted (and the various steps which are performed may not necessarily need to be carried out in the order described herein (which description was intended to represent a number of examples, and not be restrictive)). Further still, the root server and each of the user nodes may utilize essentially identical software for carrying out the network configuration, reconfiguration and data transfer operations described herein or the root server may have dedicated server software

while the user nodes have different, dedicated user node software. Further still, the entire distribution network (e.g., the root server and all of the user nodes) may have the same branch factor (e.g., a branch factor of 2) or the user nodes may have a first branch factor (e.g., a branch factor of 2) and the root server may have a second branch factor (e.g., the root server may be capable of acting as a parent to more user nodes than 2). Further still, heuristics may be employed to drive network configuration, reconfiguration and/or data flow (e.g., based upon historic network configuration, reconfiguration and/or data flow).

Webgroup CZ a.s. Ex. 1002, Page 1240 of 1406

CLAIMS

1. A method for propagating a network topology model of a binary tree topology network through the network, the network including a plurality of nodes, including a root node and at least one leaf node, operatively networked together to provide a communications path for data, each of the plurality of nodes except the root node being docked downtree of a parent node, the parent node being one of the plurality of nodes, and each of the plurality of nodes adapted to be docked uptree of a first child node and a second child node, each of the at least one leaf nodes having none of the plurality of nodes docked downtree of and therewith, the method comprising the steps of:

each of the at least one leaf nodes providing a propagate network topology model message containing the address of the providing leaf node to the parent node docked uptree of and with the providing leaf node;

for each of the plurality of nodes receiving the propagate network topology model message from each child node docked downtree of and therewith:

forming a network topology model representing one or more paths from the receiving node to each one of the plurality of nodes downtree of the receiving node;

storing in a memory accessible to the receiving node, the network topology model so formed;

providing to the parent node docked uptree of and with the receiving node a propagate network topology model message containing the network topology model so formed,

thereby propagating a network topology model through the network.

2. The method of claim 1, wherein the communications path for data comprises a downtree communications path.

3. The method of claim 1, wherein the communications path for data comprises a downtree communications path for data and an uptree communications path for data.

4. The method of claim 1, wherein the step of each of the at least one leaf nodes providing a propagate network topology model message is carried out a plurality of times.

5. The method of claim 1, wherein the step of each of the at least one leaf nodes providing a propagate network topology model message is carried out periodically.

6. The method of claim 1, wherein a first node being one of the plurality of nodes, but not a leaf node, receives a register message from a second node that is not part of the network, and wherein the first node is docked uptree of a first child node and a second child node, each of the first child node and the second child node being one of the plurality of nodes, the method further comprising the steps of:

searching the network topology model stored in the memory of the first node for a path to an open node, the open node being one of the plurality of nodes that the network topology model shows as not being docked uptree of and with two child nodes;

sending a path message to the second node containing at least an address of the open node.

7. The method of claim 6, wherein the path message comprises a path from the open node to the first node.

8. The method of claim 6, wherein the searching step comprising finding the open node such that a connection to the open node keeps the binary topology network balanced.

9. The method of claim 6, wherein step of searching further comprises the steps of:

searching consecutively further down hierarchical levels of the binary tree represented in the network topology model stored in the memory of the first node:

first to locate a path representing a node not being docked uptree of and with any child nodes, and if no such path is located,

then to locate a path representing a node not being docked uptree of and with two child nodes, and

repeating the searching step until one such path is located; and

designating the located path as a path to the open node.

10. A method for propagating a network topology model of a binary tree topology network through the network, the network including a plurality of nodes, including a root node and at least one leaf node, operatively networked together to provide a communications path for data, each of the plurality of nodes except the root node being docked downtree of a parent node, the parent node being one of the plurality of nodes, and each of the plurality of nodes adapted to be docked uptree of a first child node and a second child node, each of the at least one leaf nodes having none of the plurality of nodes docked downtree of and therewith, the method comprising the steps of:

providing a propagate path message from the root node to each of the plurality of nodes that are docked downtree of and with the root node, the propagate path message indicating an address of the root node;

for each of the plurality of nodes receiving the propagate path message from the root node or from another one of the plurality of nodes:

storing in a memory accessible to the receiving node, the path to the root node stored in the propagate path message;

if the receiving node has at least one of the plurality of nodes docked downtree of and therewith, adding to the propagate path message an address of the receiving node; and

providing the propagate path message to each of the plurality of nodes docked downtree of and with the receiving node, the propagate path message a path to the root node;

thereby propagating a root path of a binary tree topology network through the network.

11. The method of claim 10, wherein the communications path for data comprises a downtree communications path for data.

12. The method of claim 10, wherein the communications path for data comprises a downtree communications path for data and an uptree communications path for data.

13. The method of claim 10, wherein the step of providing a propagate path message is carried out a plurality of times.

14. The method of claim 10, wherein the step of providing a propagate path message is carried out periodically.

15. A method for propagating a network topology model of a binary tree topology network through the network, the network including a plurality of nodes, including a root node and at least one leaf node, operatively networked together to provide a communications path for data, each of the plurality of nodes except the root node being docked downtree of a parent node, the parent node being one of the plurality of nodes, and each of the plurality of nodes adapted to be docked uptree of a first child node and a second child node, each of the at least one leaf nodes having none of the plurality of nodes docked downtree of and therewith, the method comprising the steps of:

each of the at least one leaf nodes, providing a propagate network topology model message containing the address of the providing leaf node to the parent node docked uptree of and with the providing leaf node;

for each of the plurality of nodes receiving the propagate network topology model message from each child node docked downtree of and therewith:

forming a network topology model comprising a path from the receiving node to each one of the plurality of nodes downtree of the receiving node;

storing in a memory accessible to the receiving node, the network topology model so formed;

providing to the parent node docked uptree of and with the receiving node a propagate network topology model message containing the network topology model so formed,

providing a propagate path message from the root node to each of the plurality of nodes that are docked downtree of and with the root node, the propagate path message indicating an address of the root node;

for each of the plurality of nodes receiving propagate path message from the root node or from another one of the plurality of nodes:

storing in a memory accessible to the receiving node, the path to the root node stored in the propagate path message;

if the receiving node has at least one of the plurality of nodes docked downtree of and therewith, adding to the propagate path message an address of the receiving node; and

providing the propagate path message to each of the plurality of nodes docked downtree of and with the root node.

16. The method of claim 15, wherein the communications path for data comprises a downtree communications path for data.

17. The method of claim 15, wherein the communications path for data comprises a downtree communications path for data and an uptree communications path for data.

18. The method of claim 15, wherein the step of providing a propagate network topology model message is carried out a plurality of times.

19. The method of claim 15, wherein the step of providing a propagate network topology model message is carried out periodically.

20. The method of claim 15, wherein the step of providing a propagate path message is carried out a plurality of times.

21. The method of claim 15, wherein the step of providing a propagate path message is carried out periodically.

22. The method of claim 15, wherein a first node being one of the plurality of nodes, but not a leaf node, receives a register message from a second node that is not part of the network, and wherein the first node is docked uptree of a first child node and a second child node, each of the first child node and the second child node being one of the plurality of nodes, the method further comprising the steps of:

searching the network topology model stored in the memory of the first node for a path to an open node, the open node being one of the plurality of nodes that the network topology model shows as not being docked uptree of and with two child nodes;

sending a path message to the second node containing at least an address of the open node.

23. The method of claim 22, wherein the path message comprises a path from the open node to the first node.

24. The method of claim 22, wherein the path message comprises a path from the open node to the root node.

25. The method of claim 22, wherein the searching step comprising finding the open node such that a connection to the open node keeps the binary topology network balanced.

26. The method of claim 22, wherein step of searching further comprises the steps of:

searching consecutively further down hierarchical levels of the binary tree represented in the network topology model stored in the memory of the first node:

first to locate a path representing a node not being docked uptree of and with any child nodes, and if no such path is located,

then to locate a path representing a node not being docked uptree of and with two child nodes, and

repeating the searching step until one such path is located; and

designating the located path as a path to the open node.

27. A method for propagating a network topology model of a binary tree topology network through the network, the network including a plurality of nodes, including a root node and at least one leaf node, operatively networked together to provide a communications path for data, each of the plurality of nodes except the root node being docked downtree of a parent node, the parent node being one of the plurality of nodes, and each of the plurality of nodes adapted to be docked uptree of a first child node and a second child node, each of the at least one leaf nodes having none of the plurality of nodes docked downtree of and therewith, the method comprising the steps of:

providing a banned list message from the root node to each of the plurality of nodes that are docked downtree of and with the root node, the banned list message comprising an identifier for each of a plurality of banned nodes;

for each of the plurality of nodes receiving the banned list message from the root node or from another one of the plurality of nodes:

storing in a memory accessible to the receiving node, the identifiers for each of the plurality of banned nodes; and

providing the banned list message to each of the plurality of nodes docked downtree of and with the receiving node;

thereby propagating the list of banned nodes through the network.

28. The method of claim 27, wherein the communications path for data comprises a downtree communications path for data.

29. The method of claim 27, wherein the communications path for data comprises a downtree communications path for data and an uptree communications path for data.

30. The method of claim27, further comprising the step of rejecting a register message from a new node that is not part of the network if the node is identified on the banned list.

31. A method for propagating a network topology model of a binary tree topology network through the network, the network including a plurality of nodes, including a root node and at least one leaf node, operatively networked together to provide a communications path for data, each of the plurality of nodes except the root node being docked downtree of a parent node, the parent node being one of the plurality of nodes, and each of the plurality of nodes adapted to be docked uptree of a first child node and a second child node, each of the at least one leaf nodes having none of the plurality of nodes docked downtree of and therewith, the method comprising the steps of:

the first node sending a request firewall status message over a first channel to one of the plurality of nodes that is docked with the first node;

the one of the plurality of nodes receiving the request firewall status message sending at least one response message to the first node over a separate channel; and

the first node determining its firewall status based upon whether it receives the response message.

32. The method of claim 31, wherein the communications path for data comprises a downtree communications path for data.

33. The method of claim 31, wherein the communications path for data comprises a downtree communications path for data and an uptree communications path for data.

34. The method of claim 31, wherein the step of sending at least one response message comprises the steps of:

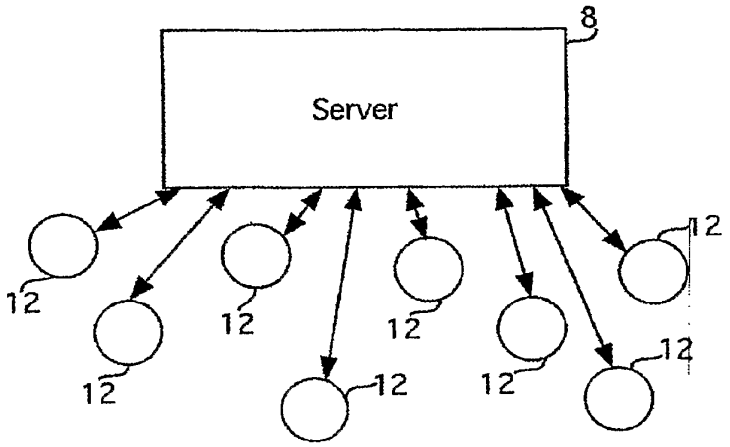
sending a first response message to the first node over a separate channel;

waiting a predefined period for an acknowledgement of the first response message, and if no acknowledgement is received, sending a second response message to the first node over the separate channel;

waiting a predefined period for an acknowledgement of the second response message, and if no acknowledgement is received, sending a third response message to the first node over the separate channel; and

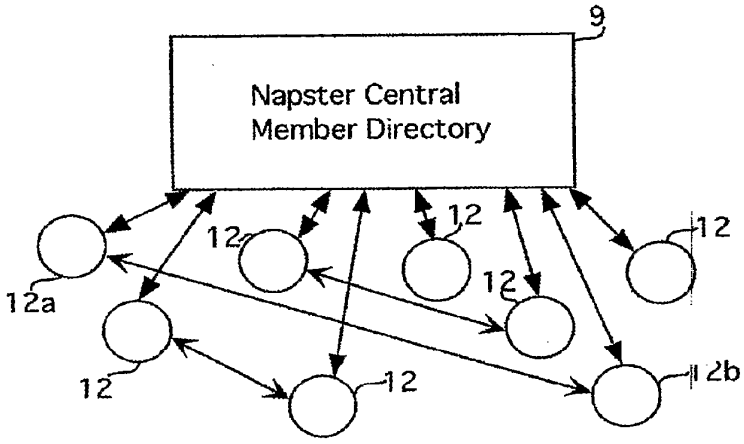
waiting a predefined period for an acknowledgement of the third response message, and if no acknowledgement is received, sending a firewall status on message to the first node over the first channel.

Webgroup CZ a.s. Ex. 1002, Page 1249 of 1406



PRIOR ART

Fig. 1



PRIOR ART

Fig. 2

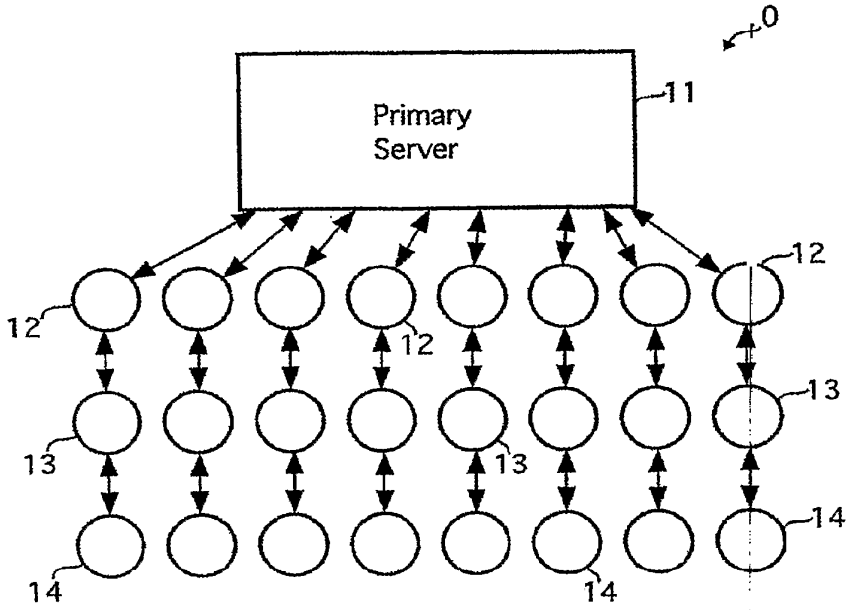


Fig. 3

"Start" corresponds to application 31

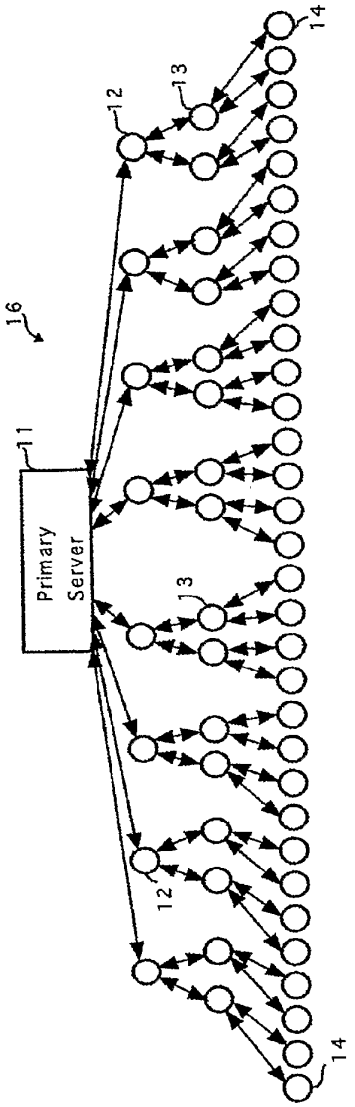


Fig. 4

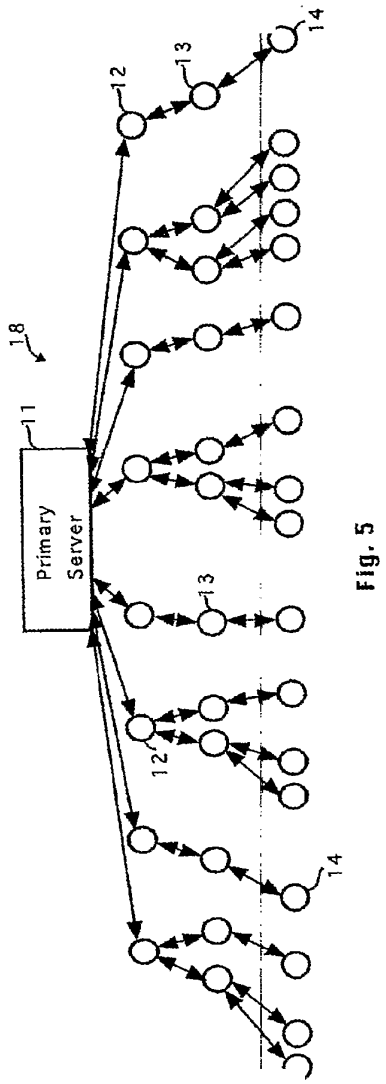


Fig. 5

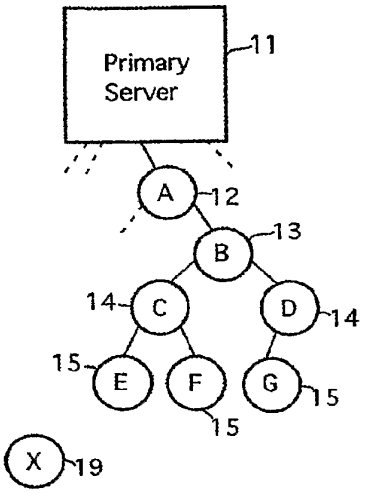


Fig. 6

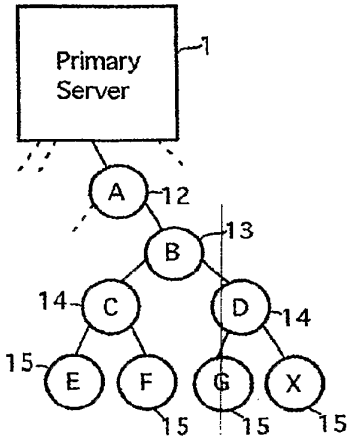


Fig. 7

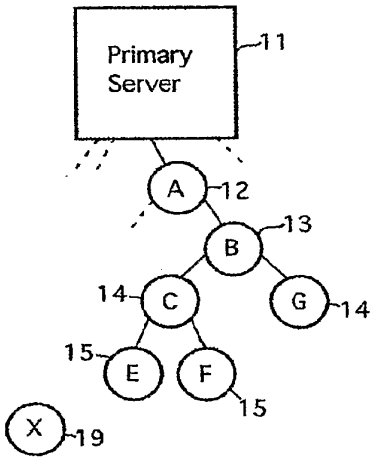


Fig. 8

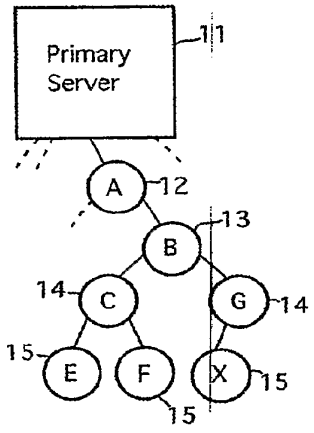


Fig. 9

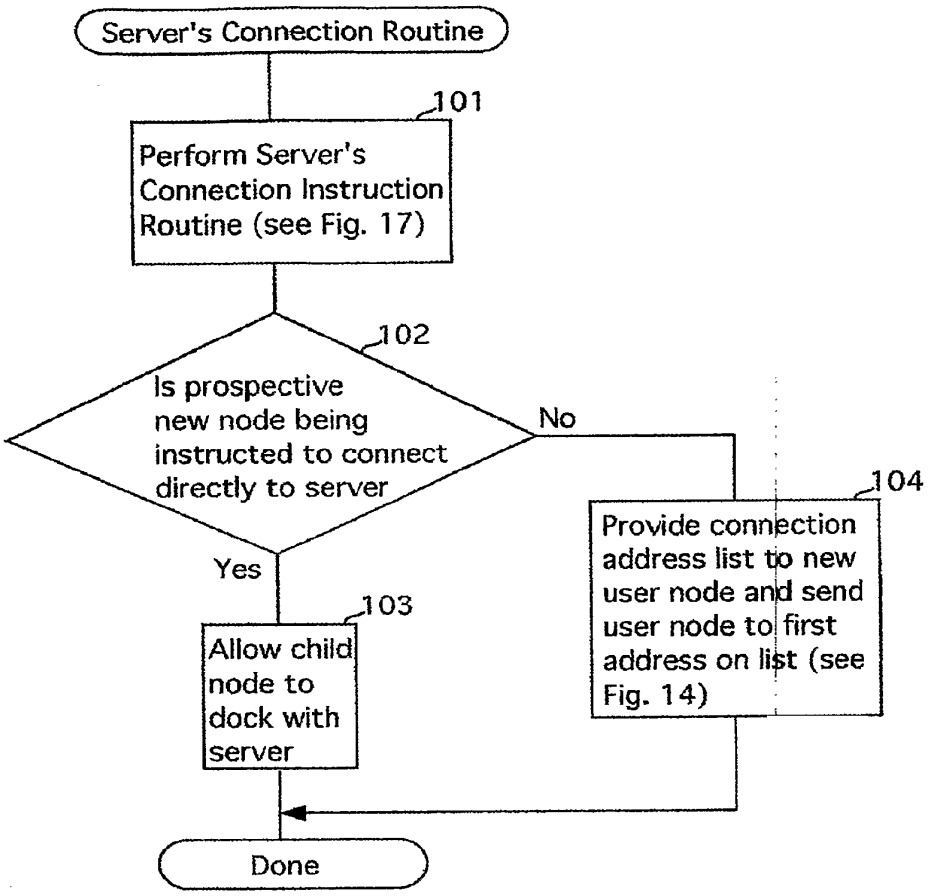

Server's Connection Routine
101
Perform Server's Connection Instruction Routine (see Fig. 17)
102
Is prospective new node being instructed to connect directly to server
No
Yes
103
Allow child node to dock with server
104
Provide connection address list to new user node and send user node to first address on list (see Fig. 14)
Done

Fig. 10

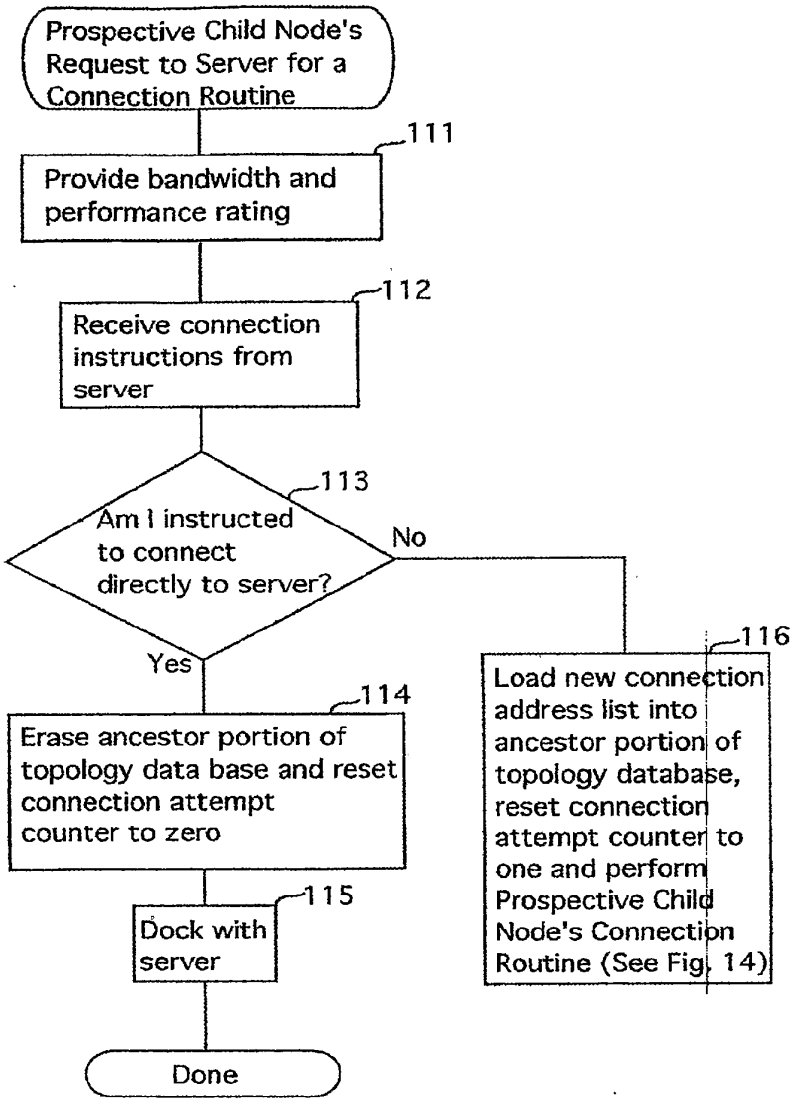

Prospective Child Node's Request to Server for a Connection Routine
111
Provide bandwidth and performance rating
112
Receive connection instructions from server
113
Am I instructed to connect directly to server?
No
Yes
114
Erase ancestor portion of topology data base and reset connection attempt counter to zero
115
Dock with server
Done
116
Load new connection address list into ancestor portion of topology database, reset connection attempt counter to one and perform Prospective Child Node's Connection Routine (See Fig. 14)

Fig. 11

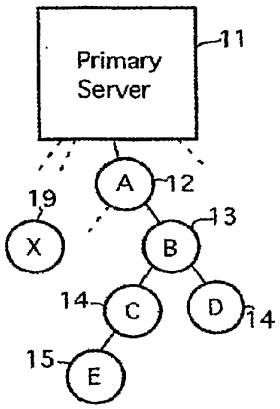


Fig. 12A

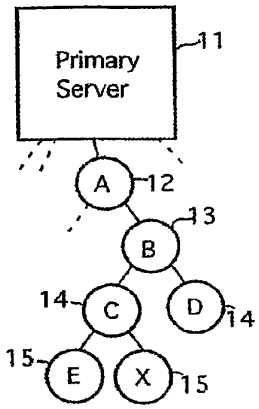


Fig. 12B

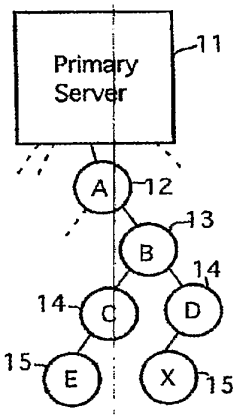


Fig. 12C

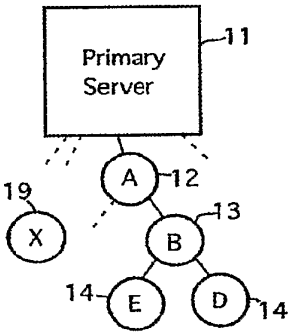


Fig. 12D

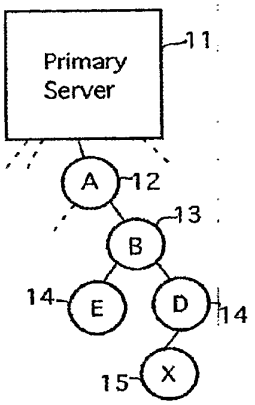


Fig. 12E

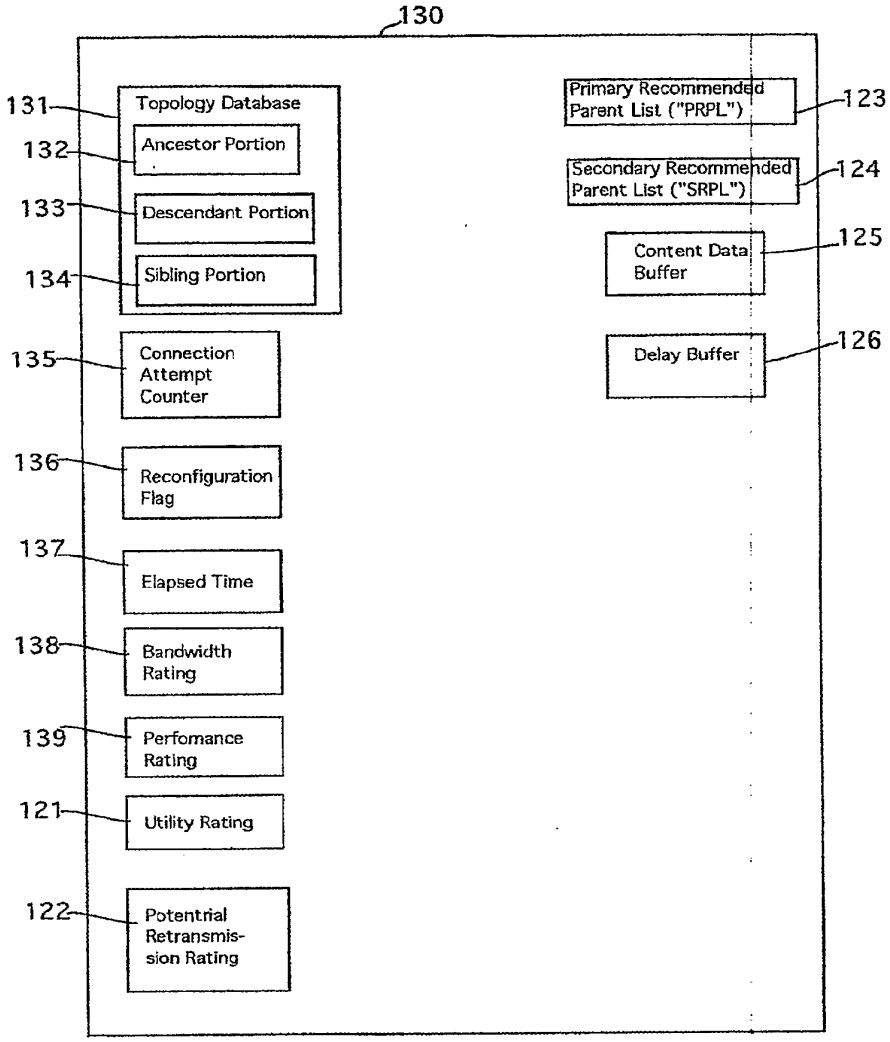

130
131
Topology Database
132
Ancestor Portion
133
Descendant Portion
134
Sibling Portion
135
Connection Attempt Counter
136
Reconfiguration Flag
137
Elapsed Time
138
Bandwidth Rating
139
Perfomance Rating
121
Utility Rating
122
Potentrial Retransmis-sion Rating
Primary Recommended Parent List ("PRPL")
123
Secondary Recommended Parent List ("SRPL")
124
Content Data Buffer
125
Delay Buffer
126

Fig. 13

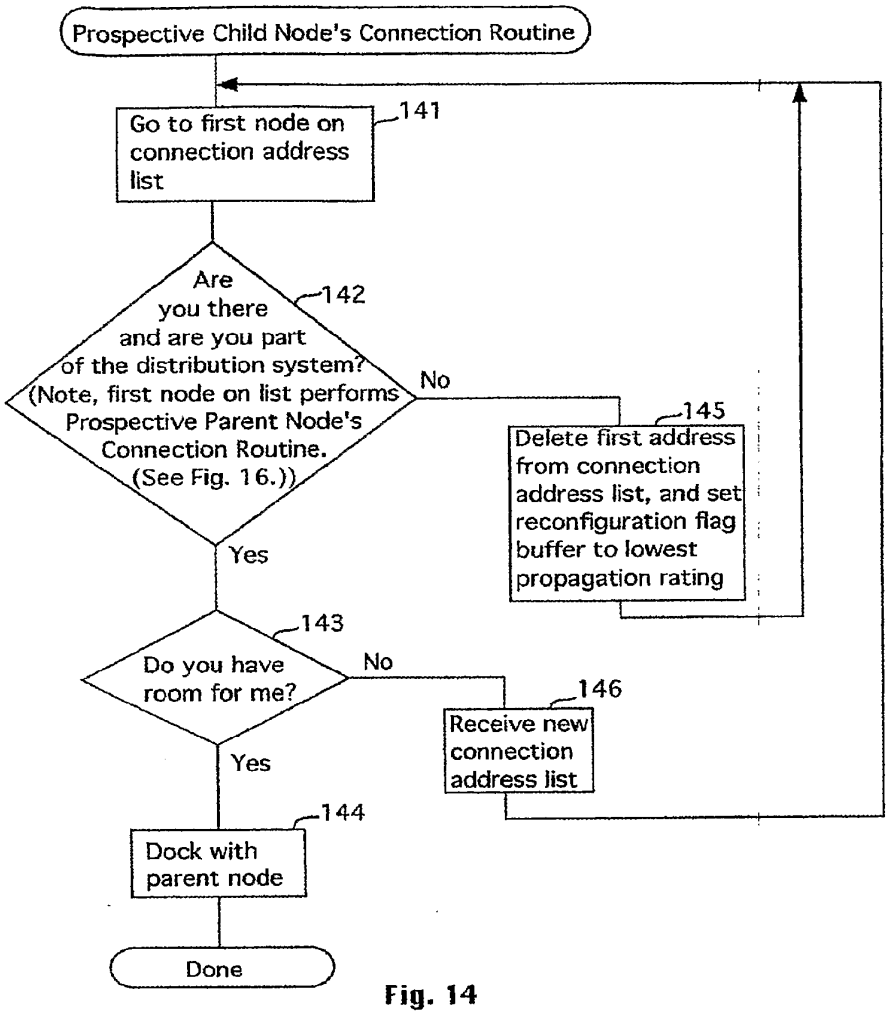

Prospective Child Node's Connection Routine
Go to first node on connection address list
141
Are you there and are you part of the distribution system? (Note, first node on list performs Prospective Parent Node's Connection Routine. (See Fig. 16.))
142
No
Delete first address from connection address list, and set reconfiguration flag buffer to lowest propagation rating
145
Yes
Do you have room for me?
143
No
Receive new connection address list
146
Yes
Dock with parent node
144
Done

Fig. 14

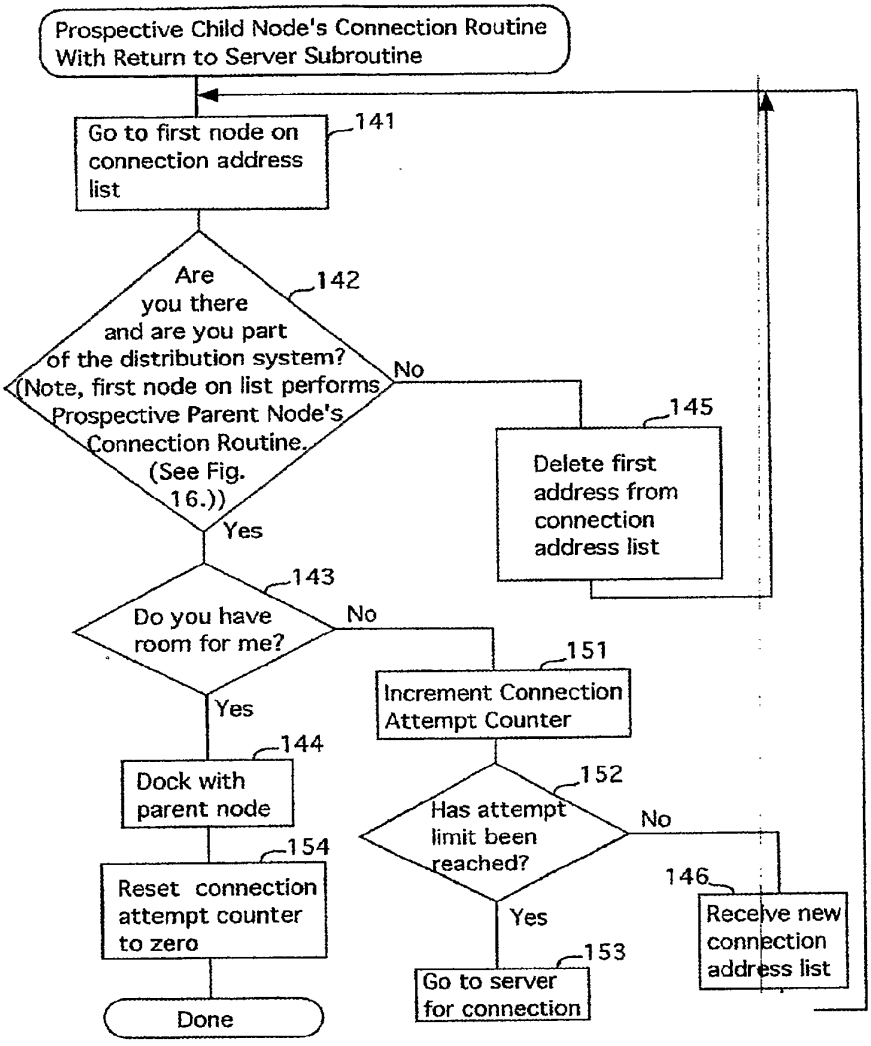

Prospective Child Node's Connection Routine With Return to Server Subroutine
Go to first node on connection address list
141
Are you there and are you part of the distribution system? (Note, first node on list performs Prospective Parent Node's Connection Routine. (See Fig. 16.))
142
No
Yes
Delete first address from connection address list
145
Do you have room for me?
143
No
Yes
Increment Connection Attempt Counter
151
Dock with parent node
144
Has attempt limit been reached?
152
No
Yes
Reset connection attempt counter to zero
154
Receive new connection address list
146
Go to server for connection
153
Done

Fig. 15

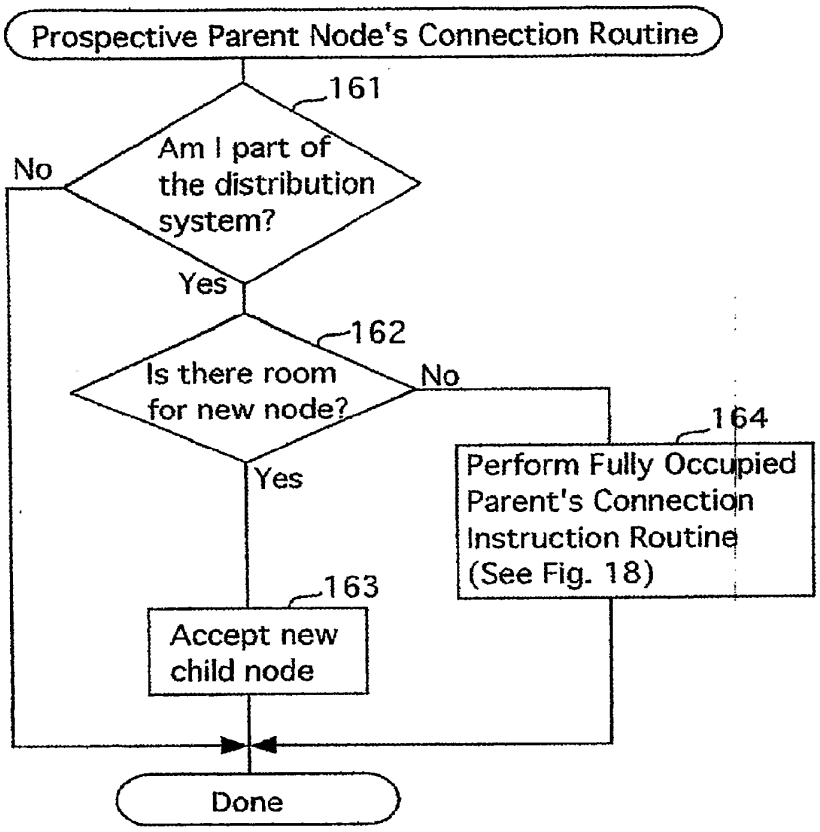

Prospective Parent Node's Connection Routine
161
Am I part of the distribution system?
No
Yes
162
Is there room for new node?
No
Yes
164
Perform Fully Occupied Parent's Connection Instruction Routine (See Fig. 18)
163
Accept new child node
Done

Fig. 16

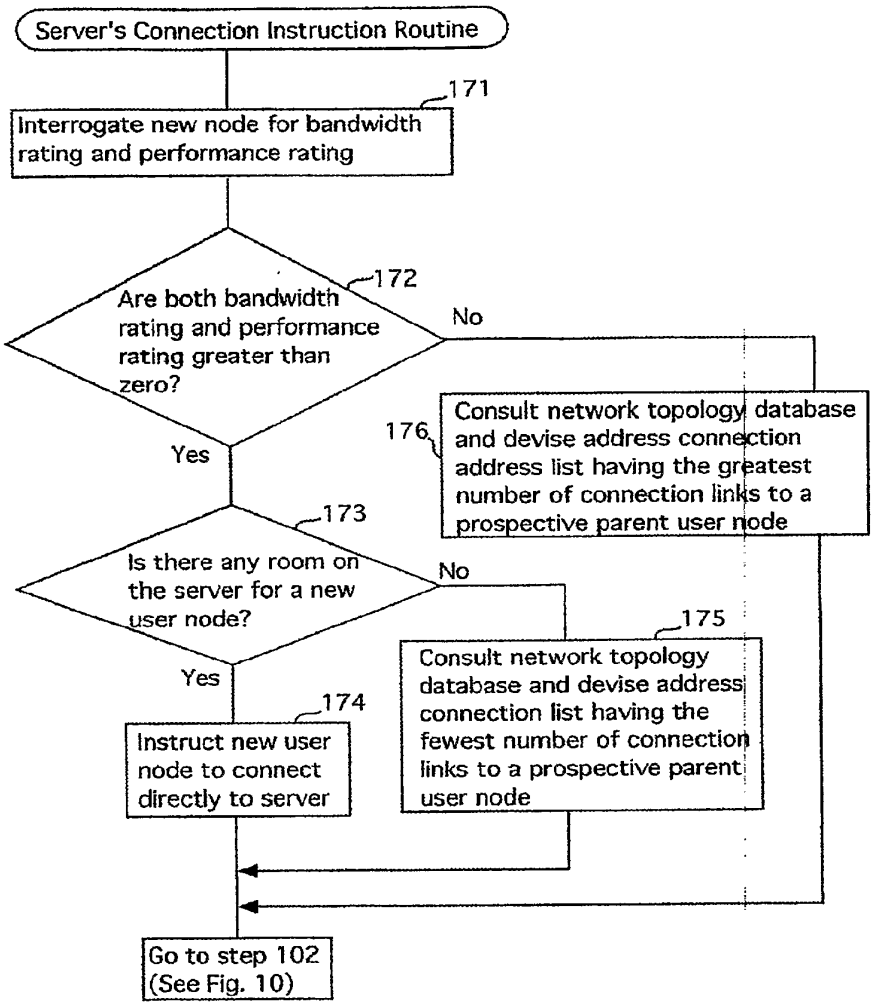

Server's Connection Instruction Routine
171
Interrogate new node for bandwidth rating and performance rating
172
Are both bandwidth rating and performance rating greater than zero?
No
Yes
176
Consult network topology database and devise address connection address list having the greatest number of connection links to a prospective parent user node
173
Is there any room on the server for a new user node?
No
Yes
175
Consult network topology database and devise address connection list having the fewest number of connection links to a prospective parent user node
174
Instruct new user node to connect directly to server
Go to step 102 (See Fig. 10)

Fig. 17

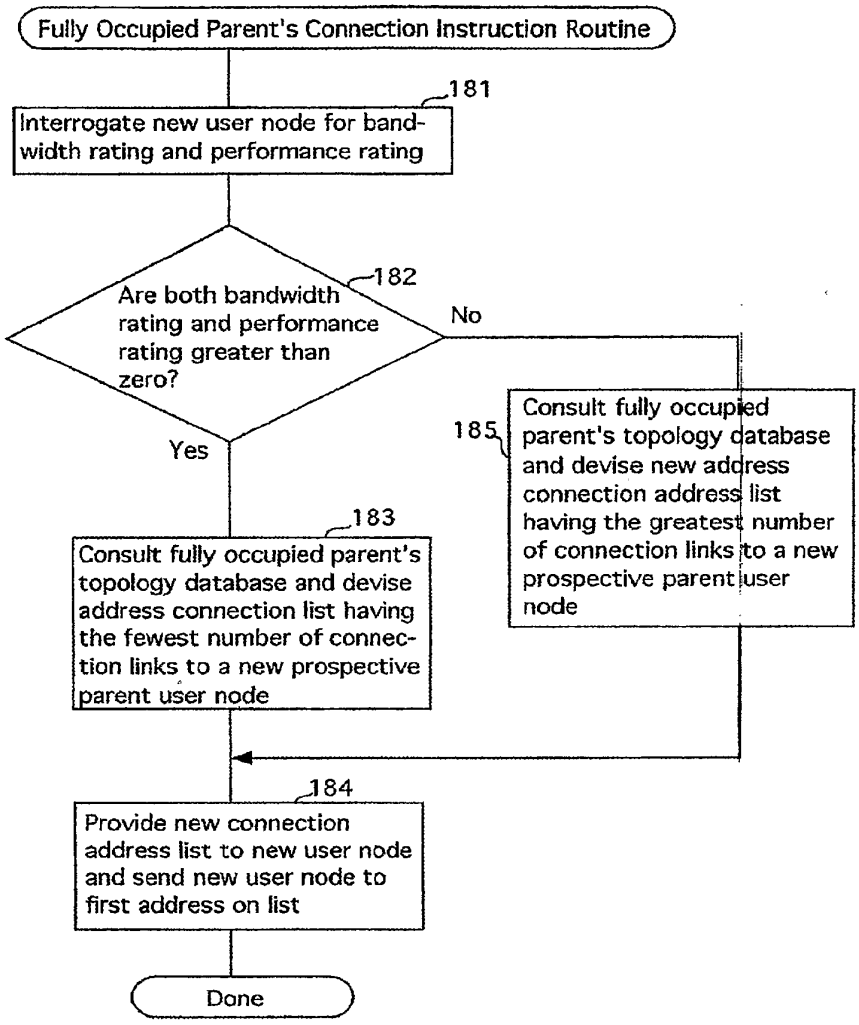

Fully Occupied Parent's Connection Instruction Routine
181
Interrogate new user node for bandwidth rating and performance rating
182
Are both bandwidth rating and performance rating greater than zero?
No
Yes
185
Consult fully occupied parent's topology database and devise new address connection address list having the greatest number of connection links to a new prospective parent user node
183
Consult fully occupied parent's topology database and devise address connection list having the fewest number of connection links to a new prospective parent user node
184
Provide new connection address list to new user node and send new user node to first address on list
Done

Fig. 18

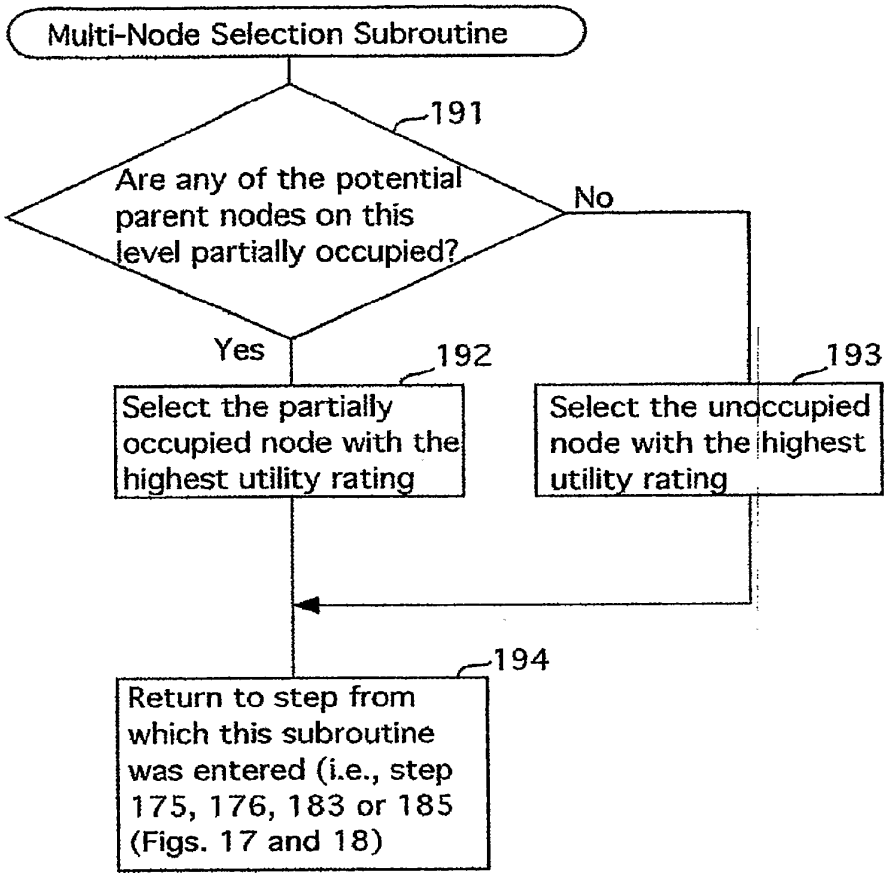

Multi-Node Selection Subroutine
191
Are any of the potential parent nodes on this level partially occupied?
No
Yes
192
Select the partially occupied node with the highest utility rating
193
Select the unoccupied node with the highest utility rating
194
Return to step from which this subroutine was entered (i.e., step 175, 176, 183 or 185 (Figs. 17 and 18)

Fig. 19

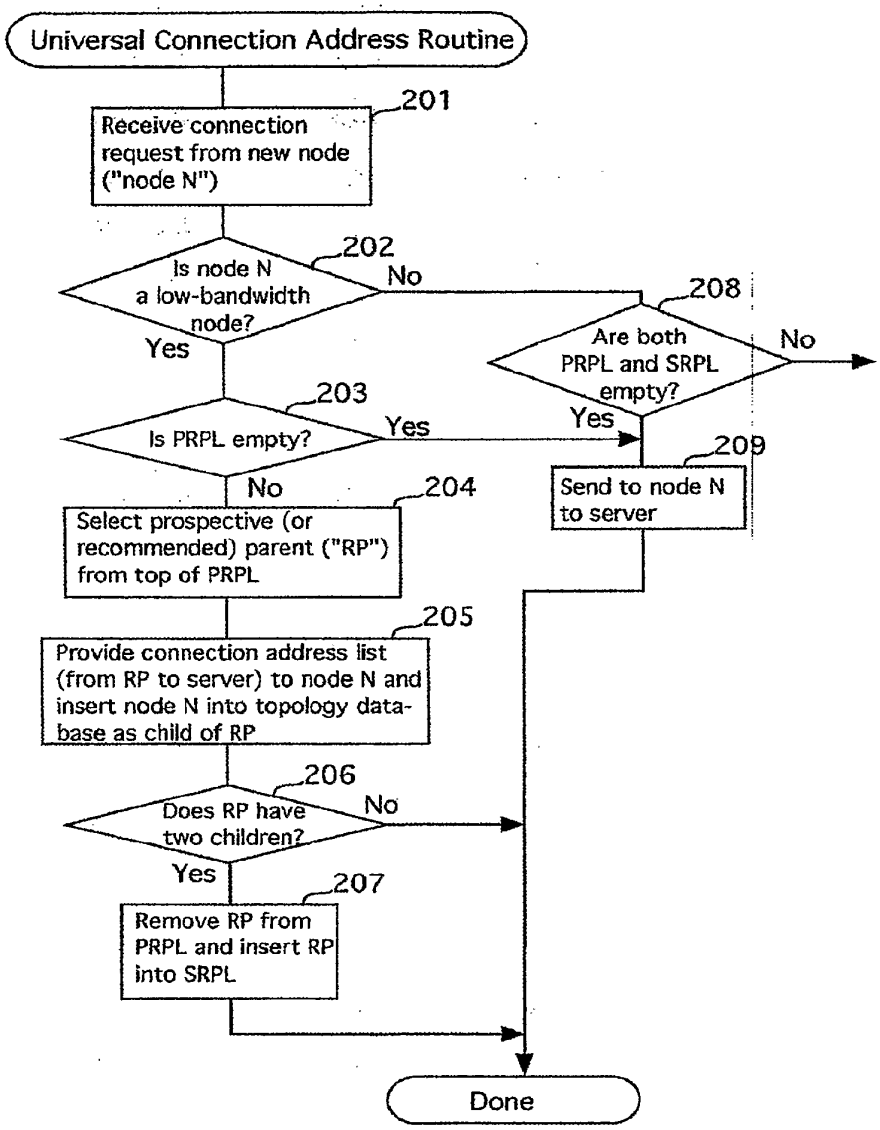

Universal Connection Address Routine
201
Receive connection request from new node ("node N")
202
Is node N a low-bandwidth node?
No
Yes
208
Are both PRPL and SRPL empty?
No
Yes
203
Is PRPL empty?
Yes
No
209
Send to node N to server
204
Select prospective (or recommended) parent ("RP") from top of PRPL
205
Provide connection address list (from RP to server) to node N and insert node N into topology data-base as child of RP
206
Does RP have two children?
No
Yes
207
Remove RP from PRPL and insert RP into SRPL
Done

Fig. 20A

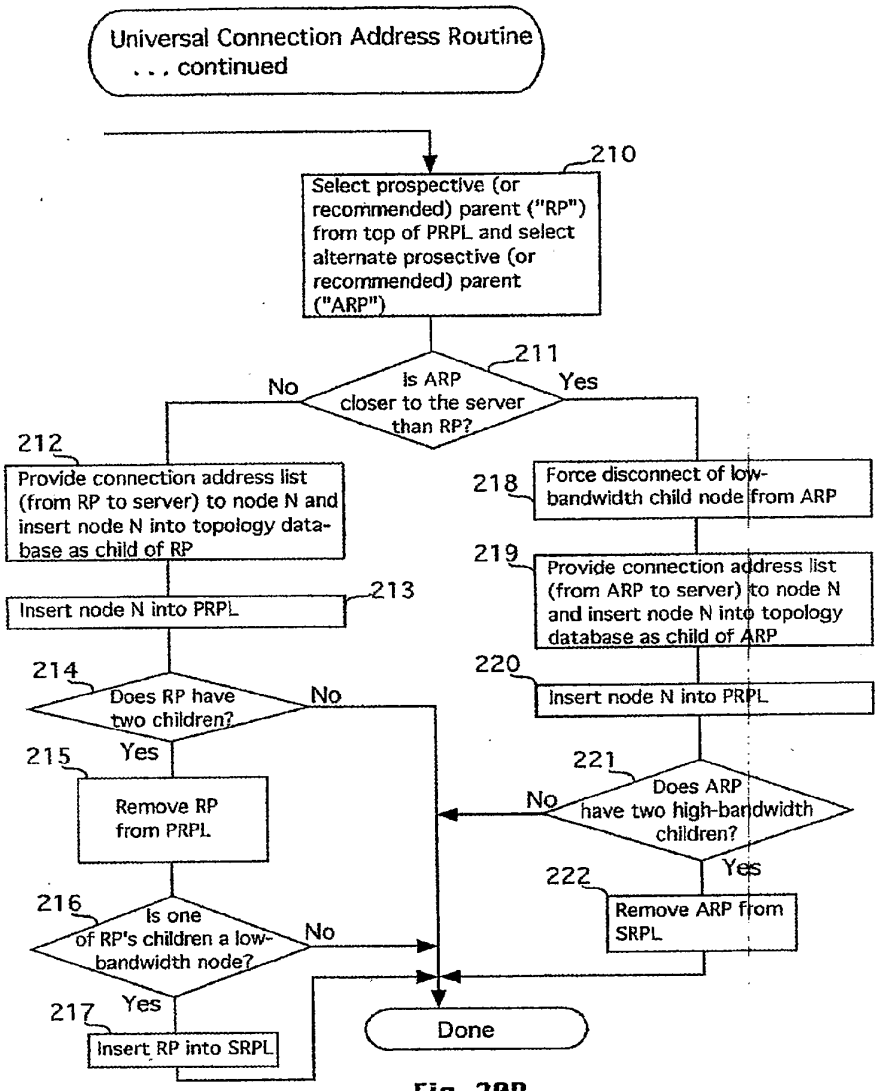

Universal Connection Address Routine
. . . continued
210
Select prospective (or recommended) parent ("RP") from top of PRPL and select alternate prosective (or recommended) parent ("ARP")
211
Is ARP closer to the server than RP?
No
Yes
212
Provide connection address list (from RP to server) to node N and insert node N into topology database as child of RP
213
Insert node N into PRPL
214
Does RP have two children?
No
Yes
215
Remove RP from PRPL
216
Is one of RP's children a low-bandwidth node?
No
Yes
217
Insert RP into SRPL
218
Force disconnect of low-bandwidth child node from ARP
219
Provide connection address list (from ARP to server) to node N and insert node N into topology database as child of ARP
220
Insert node N into PRPL
221
Does ARP have two high-bandwidth children?
No
Yes
222
Remove ARP from SRPL
Done

Fig. 20B

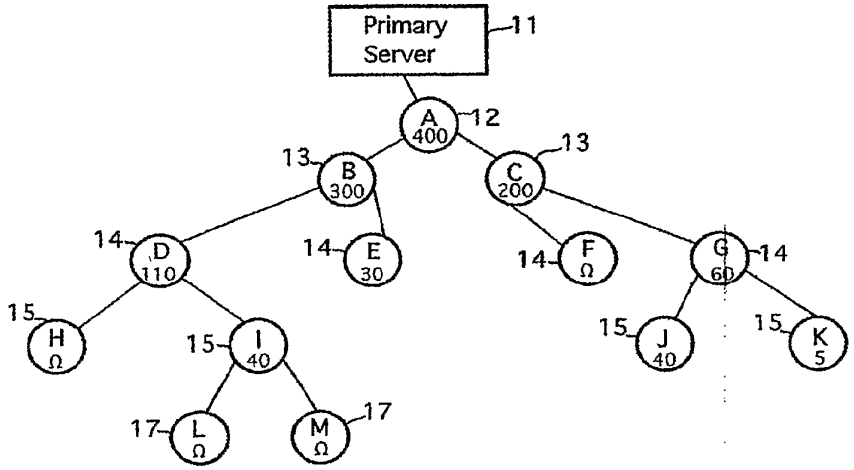

Primary Server
11
A 400
12
B 300
13
C 200
13
D 110
14
E 30
14
F Ω
14
G 60
14
H Ω
15
I 40
15
J 40
15
K 5
15
L Ω
17
M Ω
17

Fig. 21

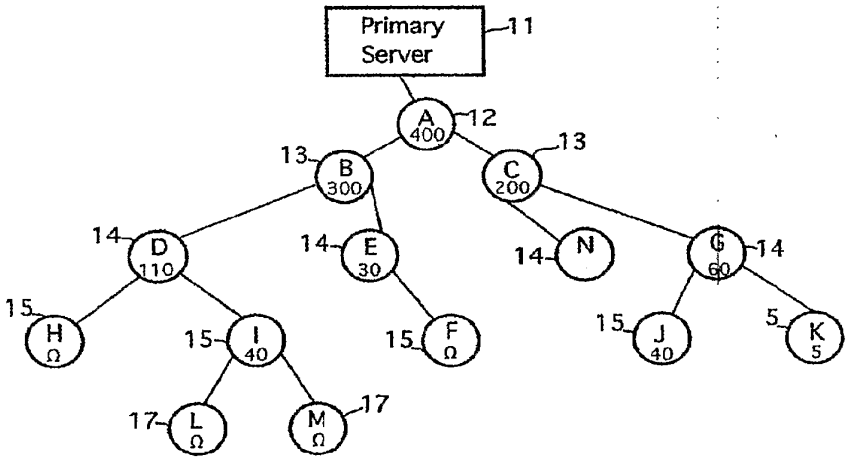

Primary Server
11
A 400
12
B 300
13
C 200
13
D 110
14
E 30
14
N
14
G 60
14
H Ω
15
I 40
15
F Ω
15
J 40
15
K 5
5
L Ω
17
M Ω
17

Fig. 22

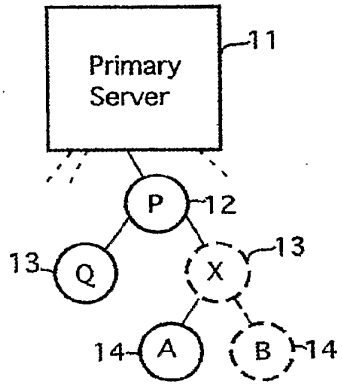


Fig. 23

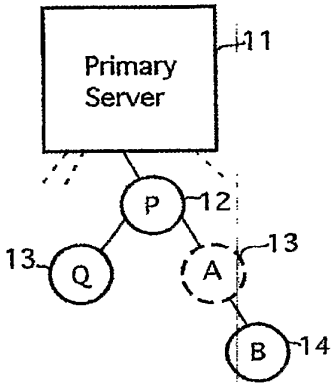


Fig. 24

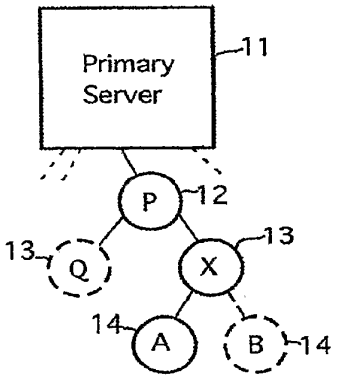


Fig. 25

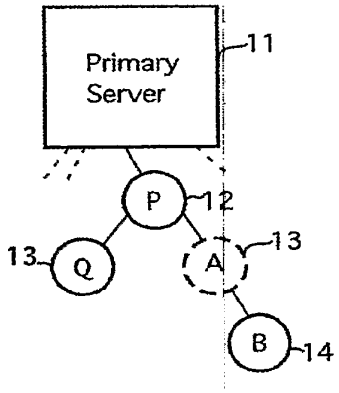


Fig. 26

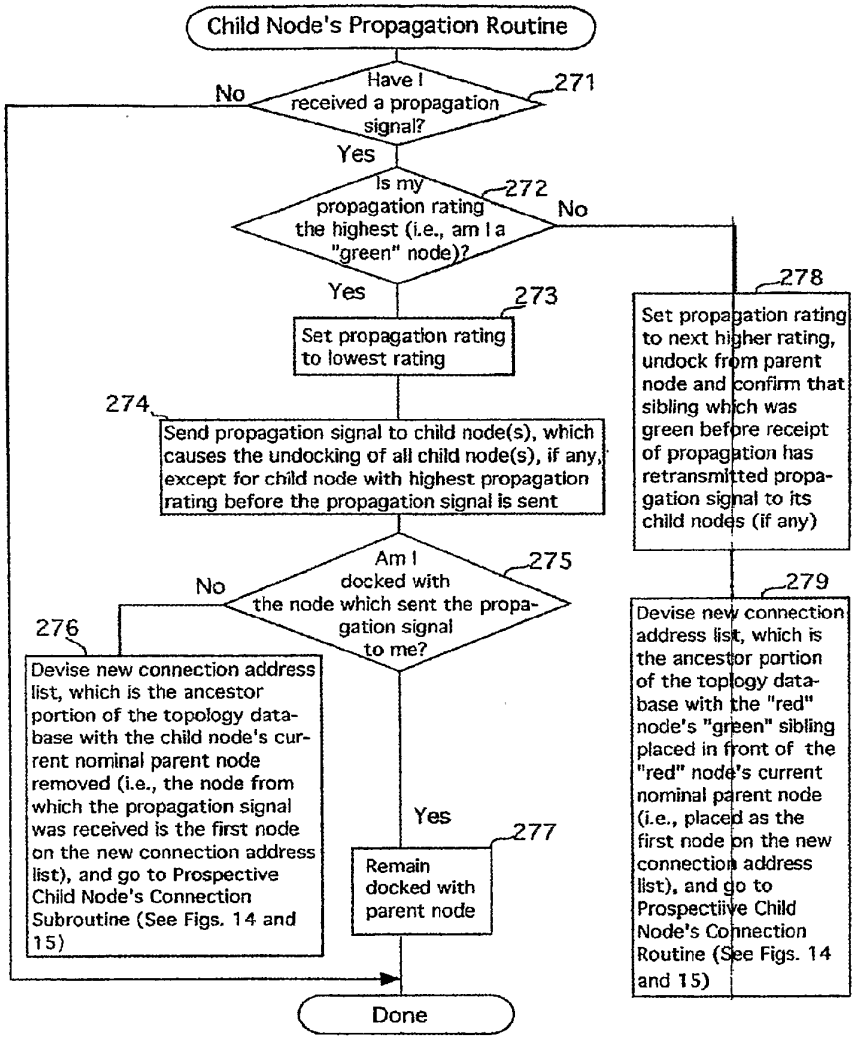

Child Node's Propagation Routine
Have I received a propagation signal?
271
No
Yes
Is my propagation rating the highest (i.e., am I a "green" node)?
272
No
Yes
273
Set propagation rating to lowest rating
274
Send propagation signal to child node(s), which causes the undocking of all child node(s), if any, except for child node with highest propagation rating before the propagation signal is sent
Am I docked with the node which sent the propagation signal to me?
275
No
Yes
276
Devise new connection address list, which is the ancestor portion of the topology database with the child node's current nominal parent node removed (i.e., the node from which the propagation signal was received is the first node on the new connection address list), and go to Prospective Child Node's Connection Subroutine (See Figs. 14 and 15)
277
Remain docked with parent node
278
Set propagation rating to next higher rating, undock from parent node and confirm that sibling which was green before receipt of propagation has retransmitted propagation signal to its child nodes (if any)
279
Devise new connection address list, which is the ancestor portion of the toplogy database with the "red" node's "green" sibling placed in front of the "red" node's current nominal parent node (i.e., placed as the first node on the new connection address list), and go to Prospectiive Child Node's Connection Routine (See Figs. 14 and 15)
Done

Fig. 27

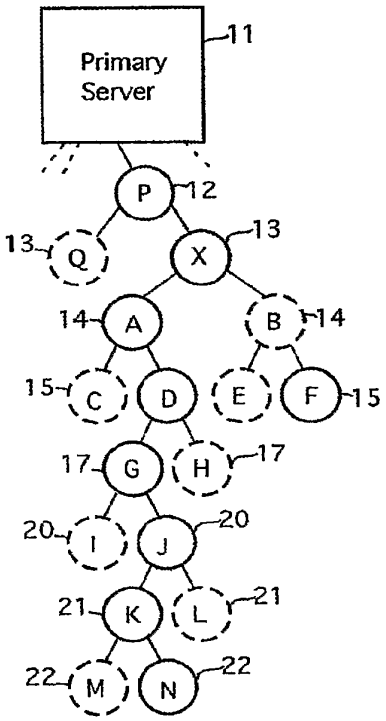

Primary Server
11
P
12
13
Q
X
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14
A
B
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15
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D
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Fig. 28

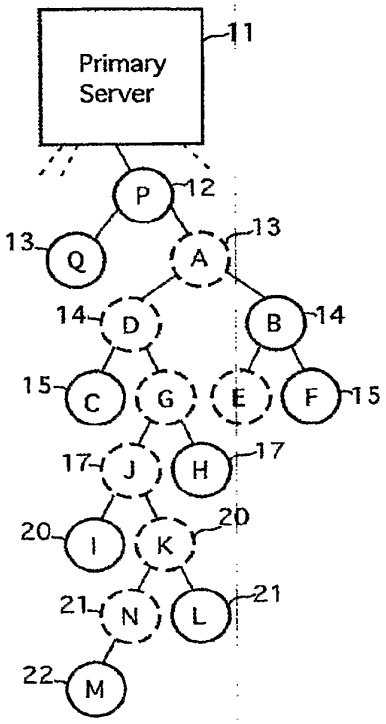

Primary Server
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Fig. 29

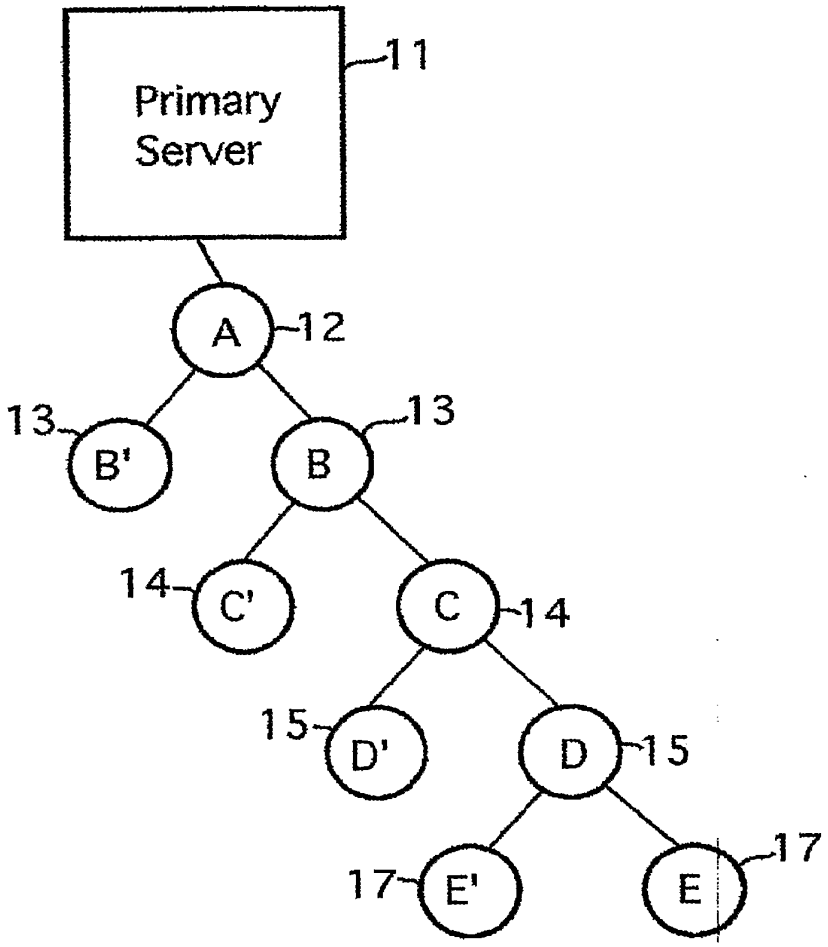


Fig. 30

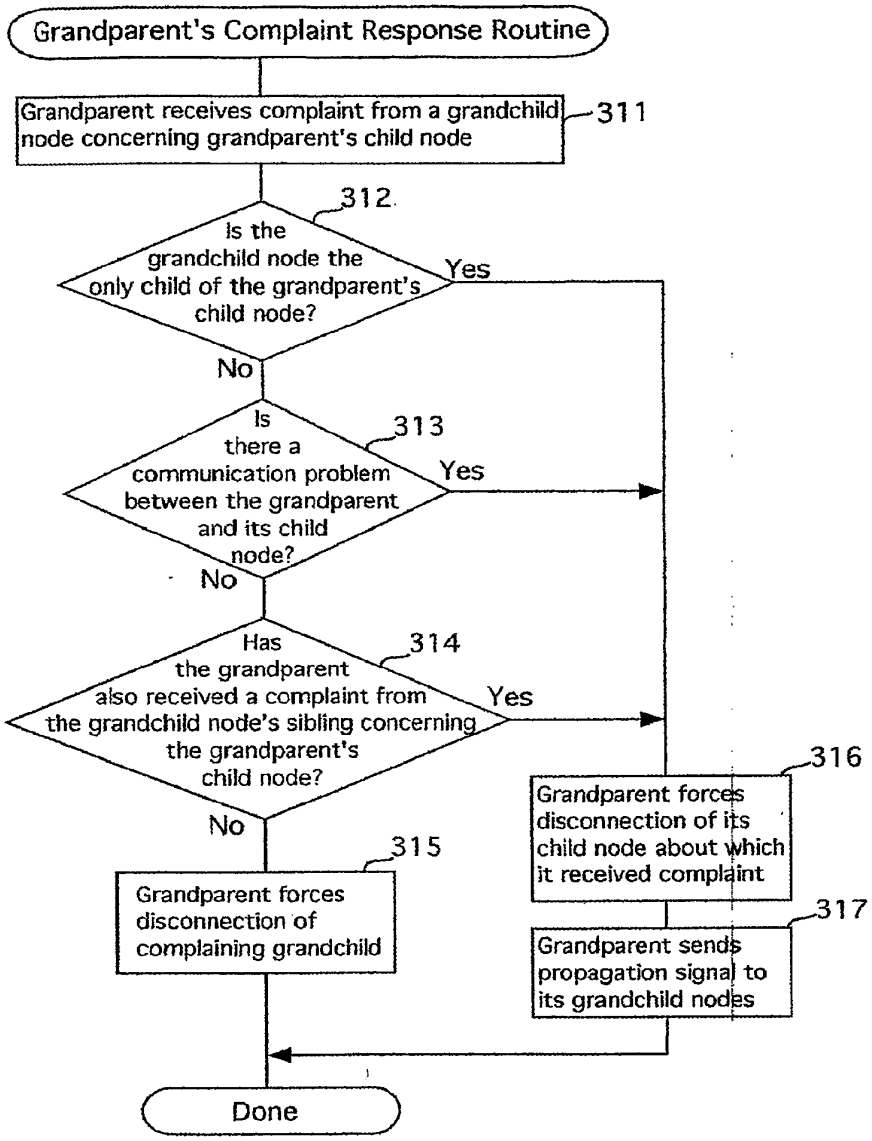

Grandparent's Complaint Response Routine
Grandparent receives complaint from a grandchild node concerning grandparent's child node
311
312
Is the grandchild node the only child of the grandparent's child node?
Yes
No
Is there a communication problem between the grandparent and its child node?
313
Yes
No
Has the grandparent also received a complaint from the grandchild node's sibling concerning the grandparent's child node?
314
Yes
No
Grandparent forces disconnection of its child node about which it received complaint
316
Grandparent forces disconnection of complaining grandchild
315
Grandparent sends propagation signal to its grandchild nodes
317
Done

Fig. 31

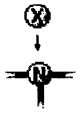


Fig. 32

Fig. 33A

Fig. 33B

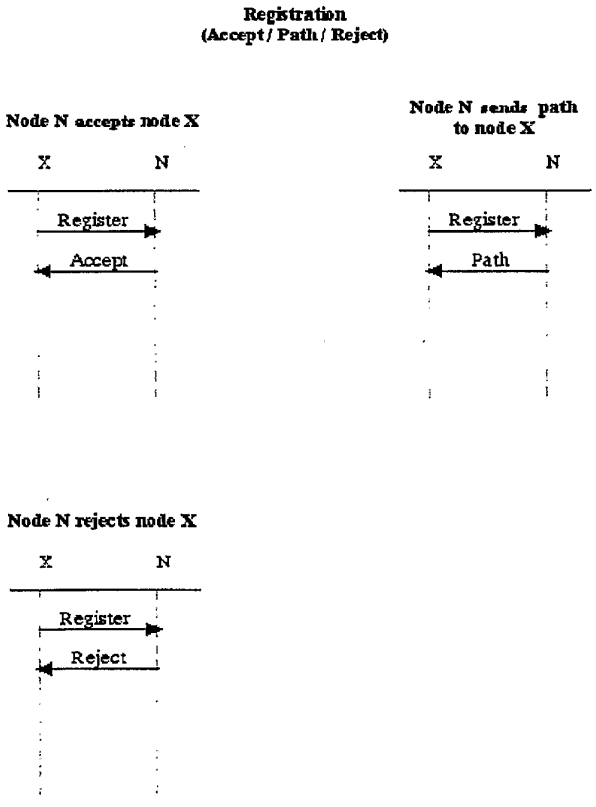


Fig. 33C

Fig. 34A Fig. 34B

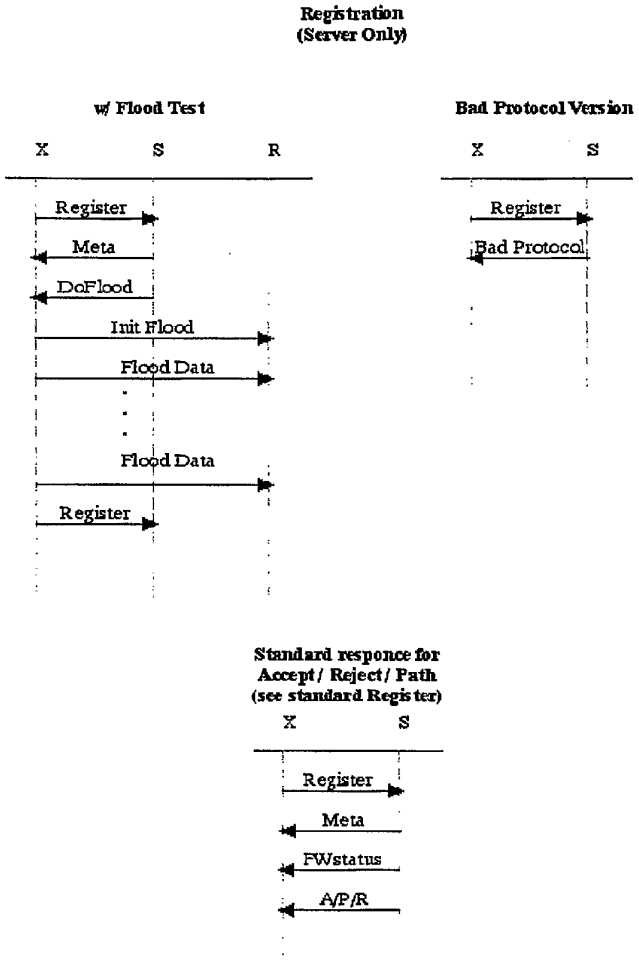


Fig. 34C

Fig. 35A

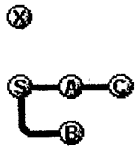
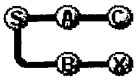


Fig. 35B



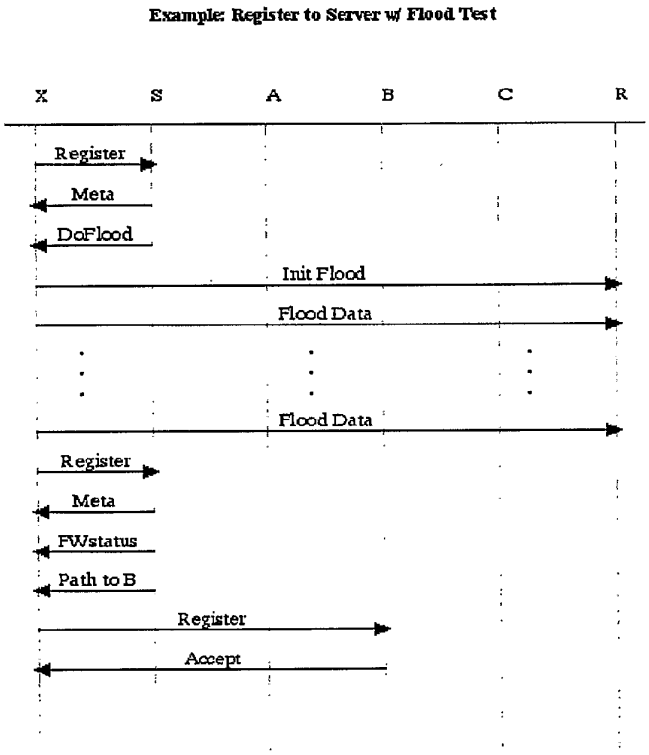
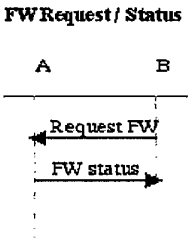


Fig. 36

Fig. 37



Fig. 38



27/31

Fig. 39A



Fig. 39B

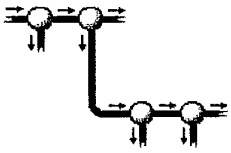
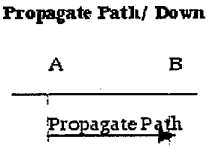


Fig. 40



28/31

Fig. 41A



Fig. 41B

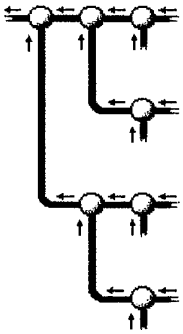


Fig. 42

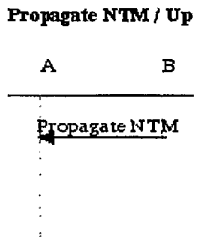


Fig. 43

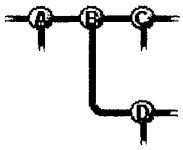


Fig. 44

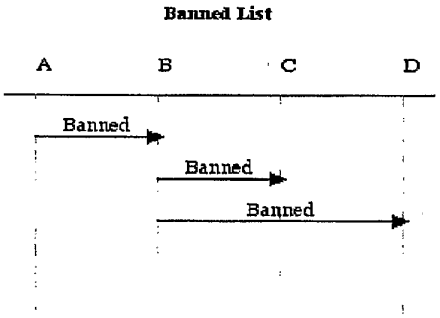


Fig. 43

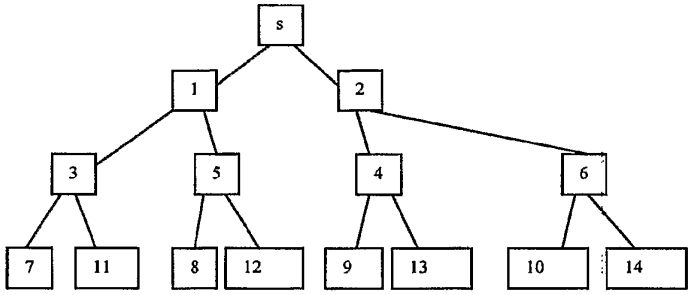


Fig. 46A

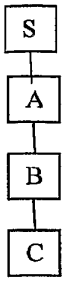


Fig. 46B

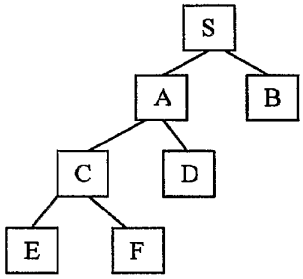
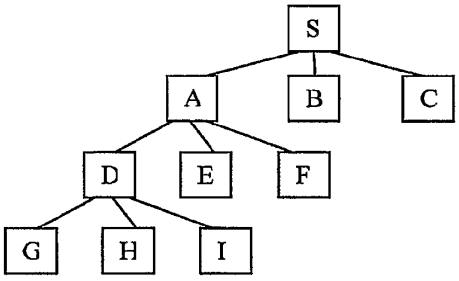


Fig. 46C



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(Not for submission under 37 CFR 1.99)

Application Number	16876579
Filing Date	2020-05-18
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	066.0141X1C9

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	2	7558869	B2	2009-07-07	Leon et al.	
	3	7707303	B2	2010-04-27	Albers et al.	
	4	7925781	B1	2011-04-12	Chan et al.	
	5	8880721	B2	2014-11-04	Hurst et al.	
	6	9344496	B2	2016-05-17	Hurst et al.	
	7	8683066	B2	2014-03-25	Hurst et al.	
	8	8686066	B2	2014-04-01	Kwampian et al.	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	9	6708213	B1	2004-03-16	Bommaiah et al.	
	10	6757796	B1	2004-06-29	Hofmann	
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	2	20030093790	A1	2003-05-15	Logan et al.	
	3	20030195977	A1	2003-10-16	Liu et al.	
	4	20040199655	A1	2004-10-07	Davies et al.	
	5	20040267956	A1	2004-12-30	Leon et al.	
	6	20040220926	A1	2004-11-04	Lamkin et al.	

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	Examiner Name	Chirag R. Patel
	Attorney Docket Number	066.0141X1C9

	7	20060010003	A1	2006-01-12	Kruse	
	8	20060277564	A1	2006-12-07	Jarman	
	9	20150058496	A1	2015-02-26	Hurst et al.	
	10	20100262711	A1	2010-10-14	Bouazizi	
	11	20050251832	A1	2005-11-10	Chiueh	
	12	20040221088	A1	2004-11-04	Lisitsa et al.	
	13	20040179032	A1	2004-09-16	Huang	
	14	20020161908	A1	2002-10-31	Benitez et al.	
	15	20030021282	A1	2003-01-30	Hospodor	
	16	20080120330	A1	2008-05-22	Reed et al.	
	17	20080120342	A1	2008-05-22	Reed et al.	

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	Examiner Name	Chirag R. Patel
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	18	20110307545	A1	2011-12-15	BOUAZIZI	
	19	20050262257	A1	2005-11-24	Major et al.	
	20	20030236904	A1	2003-12-25	Walpole et al.	

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	2	Krasic et al., QoS SCALABILITY FOR STREAMED MEDIA DELIVERY, Oregon Graduate Institute School of Science & Engineering Technical Report CSE 99-011, September 1999.	☒
	3	Huang et al., ADAPTIVE LIVE VIDEO STREAMING BY PRIORITY DROP, Portland State University PDXScholar, July 21, 2003.	☒

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	4	Walpole et al, A PLAYER FOR ADAPCTIVE MPEG VIDEO STREAMING OVER THE INTERNET, Oregon Graduate Institute of Science and Technology, October 25, 2012.	☒
	5	ALBANESE, ANDREW ET AL. "Priority Encoding Transmission", TR-94-039, August 1994, 36 pgs, International Computer Science Institute, Berkeley, CA.	☒
	6	BIRNEY, BILL "Intelligent Streaming", May 2003, Microsoft.	☒
	7	GOYAL, VIVEK K. "Multiple Description Coding: Compression Meets the Network," September 2001, pgs. 74-93, IEEE Signal Processing Magazine.	☒
	8	ON2 TECHNOLOGIES, INC. "TrueMotion VP7 Video Codec" White Paper, Document Version 1.0, January 10, 2005.	☒
	9	PATHAN, AL-MUKADDIM ET AL. "A Taxonomy and Survey of Content Delivery Networks" Australia, February 2007, available at http://www.gridbus.org/reports/CDN-Taxonomy.pdf.	☒
	10	PURI, ROHIT ET AL. "Multiple Description Source Coding Using Forward Error Correction Codes," October 1999, 5 pgs., Department of Electrical Engineering and Computer Science, University of California, Berkeley, CA.	☒
	11	WICKER, STEPHEN B. "Error Control Systems for Digital Communication and Storage," Prentice-Hall, Inc., New Jersey, USA, 1995, parts 1-6.	☒
	12	LIU, JIANGCHUAN ET AL. "Opportunities and Challenged of Peer-to-Peer Internet Video Broadcast," School of Computing Science, Simon Fraser University, British Columbia, Canada.	☒
	13	CLEMENT, B. "Move Networks closes $11.3 Million on First Round VC Funding," Page One PR, Move Networks, Inc. Press Releases, February 7, 2007, http://www.move.tv/press/press20070201.html.	☒
	14	MOVE NETWORKS, INC. "The Next Generation Video Publishing System," April 11, 2007; http://www.movenetworks.com/wp-content/uploads/move-networks-publishing-system.pdf.	☒

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	15	YOSHIMURA, TAKESHI ET AL. "Mobile Streaming Media CDN Enabled by Dynamic SMIL", NTT DoCoMo, Multimedia Laboratories and Hewlett-Packard Laboratories,dated May 7-11, 2002, ACM 1-58113-449-5/02/0005; http://www2002.org/CDROM/refereed/515/.	☒
	16	Nguyen, T. et al., Multiple Sender Distributed Video Streaming, IEEE TRANSACTINOS ON MULTIMEDIA, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 6, no. 2, April 1, 2004, pages 315-326, XP011109142, ISSN: 1520-9210, DOI: 10.1109/TMM.2003.822790.	☒

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	Art Unit	2454
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The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
Name/Print	Brett A. Carlson	Registration Number	39928

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Examiner Name	Patel, Chirag R.
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U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7577750	B2	2009-08-18	Shen et al.	
	2	6195680	B1	2001-02-27	Goldszmidt et al.	
	3	6449719	B1	2002-09-10	Baker	
	4	7369610	B2	2008-05-06	Xu et al.	
	5	7408984	B2	2008-08-05	Lu et al.	
	6	7523181	B2	2009-04-21	Swildens et al.	
	7	6976090	B2	2005-12-13	Ben-Shaul et al.	
	8	7240100	B1	2007-07-03	Wein et al.	

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	Attorney Docket Number	066.0141X1C9

	9	6850965	B2	2005-02-01	Allen	
	10	7334044	B1	2008-02-19	Allen	
	11	7760801	B2	2010-07-20	Ghanbari et al.	
	12	7099954	B2	2006-08-29	Li et al.	
	13	6760772	B2	2004-07-06	Zou et al.	
	14	7054911	B1	2006-05-30	Lango et al.	
	15	7797439	B2	2010-09-14	Cherkasova et al.	
	16	7477688	B1	2009-01-13	Zhang et al.	
	17	7054774	B2	2006-05-30	Batterberry et al.	
	18	5168356		1992-12-01	Acampora et al.	
	19	7818444	B2	2010-10-19	Brueck et al.	

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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	20	7599307	B2	2009-10-06	Seckni et al.	
	21	7093001	B2	2006-08-15	Yang et al.	
	22	6874015	B2	2005-03-29	Kaminsky et al.	
	23	6845107	B1	2005-01-18	Kitazawa et al.	
	24	6185736	B1	2001-02-06	Ueno	
	25	57685627		1998-06-16	Zhu et al.	
	26	7274740	B2	2007-09-25	van Beek et al.	
	27	7546355	B2	2009-06-09	Kalnitsky	
	28	7174385	B2	2007-02-06	Li	
	29	7376747	B2	2008-05-20	Hartop	
	30	7719985	B2	2010-05-18	Lee et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	31	7349358	B2	2008-03-25	Hennessey et al.	
	32	7194549	B1	2007-03-20	Lee et al.	
	33	6374289	B2	2002-04-16	Delaney et al.	
	34	7325073	B2	2008-01-29	Shao et al.	
	35	7609652	B2	2009-10-27	Kellerer et al.	
	36	6795863	B1	2004-09-21	Doty, Jr.	
	37	7817985	B2	2010-10-19	Moon	
	38	7788395	B2	2010-08-31	Bowra et al.	
	39	7536469	B2	2009-05-19	Chou et al.	
	40	7412531	B2	2008-08-12	Lango et al.	
	41	7295520	B2	2007-11-13	Lee et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	42	7054365	B2	2006-05-30	Kim et al.	
	43	6122660		2000-09-19	Baransky et al.	
	44	7391717	B2	2008-06-24	Kiemets et al.	
	45	7260640	B1	2007-08-21	Kramer et al.	
	46	7310678	B2	2007-12-18	Gunaseelan et al.	
	47	6618752	B1	2003-09-09	Moore et al.	
	48	6721723	B1	2004-04-13	Gibson et al.	
	49	6859839	B1	2005-02-22	Zahorjan et al.	
	50	7779135	B2	2010-08-17	Hudson et al.	
	51	7593333	B2	2009-09-22	Li et al.	
	52	5953506		1999-09-14	Kalra et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	53	6091775		2000-07-18	Hibi et al.	
	54	6091777		2000-07-18	Guetz et al.	
	55	6195680		2001-02-27	Goldszmidt et al.	
	56	6366614		2002-04-02	Pian et al.	
	57	6389473		2002-05-14	Carmel et al.	
	58	6486803	B1	2002-11-26	Luby et al.	
	59	6490627		2002-12-03	Kalra et al.	
	60	6510553		2003-01-21	Hazra	
	61	6574591		2003-06-03	Kleiman et al.	
	62	6604118		2003-08-05	Klleiman et al.	
	63	6731600		2004-05-04	Patel et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	64	5732183		2004-05-04	Graham	
	65	6968387		2005-11-22	Lanphear	
	66	7075986		2006-07-11	Girod et al.	
	67	7096271		2006-08-22	Omoigui et al.	
	68	7349976		2008-03-25	Glaser et al.	
	69	7408984	B2	2008-08-05	Lu et al.	
	70	4535355		1985-08-13	Arn et al.	
	71	8036265	B1	2011-10-11	Reynolds et al.	
	72	5687095		1997-11-11	Haskell et al.	
	73	7116894	B1	2006-10-03	Chatterton	
	74	7328243	B2	2008-02-05	Yaeger et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	75	7330908	B2	2008-02-12	Jungek	
	76	7653735	B2	2010-01-26	Mandato et al.	
	77	8612624	B2	2013-12-17	Brueck et al.	
	78	8868772	B2	2014-10-21	Major et al.	
	79	8402156	B2	2013-03-19	Brueck et al.	
	80	8370514	B2	2013-02-05	Hurst et al.	
	81	8880721	B2	2014-11-04	Hurst et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020161898	A1	2002-10-31	Hartop et al.	
	2	20050055425		2005-03-00	Lango et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	3	20050015509		2005-01-00	Sitaraman	
	4	20020131496		2002-09-00	Vasudevan et al.	
	5	20040083283	A1	2004-04-29	Sundaram et al.	
	6	20080219151	A1	2008-09-11	Ma et al.	
	7	20020152318	A1	2002-10-17	Menon et al.	
	8	20060080718	A1	2006-04-13	Gray et al.	
	9	20050120107	A1	2005-06-02	Kagan et al.	
	10	20040103444	A1	2004-05-27	Weinberg et al.	
	11	20050188051	A1	2005-08-25	Sneh	
	12	20030154239	A1	2003-08-14	Davis et al.	
	13	20040030547	A1	2004-02-12	Leaning et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	14	20040117427	A1	2004-06-17	Allen et al.	
	15	20030014684	A1	2003-01-16	Kashyap	
	16	20060206246	A1	2006-09-14	Walker	
	17	20050076136	A1	2005-04-07	Cho et al.	
	18	20030018966	A1	2003-01-23	Cook et al.	
	19	20040030599	A1	2004-02-12	Sie et al.	
	20	20050262257	A1	2005-11-24	Major et al.	
	21	20050033855	A1	2005-02-10	Moradi et al.	
	22	20010047423	A1	2001-11-29	Shao et al.	
	23	20030140159	A1	2003-07-24	Campbell et al.	
	24	20020176418	A1	2002-11-28	Hunt et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	25	20020169926	A1	2002-11-14	Pinckney, III, et al.	
	26	20020178330	A1	2002-11-28	Schlowsky-Fischer et al.	
	27	20050084166	A1	2005-04-21	Bonch et al.	
	28	20020091840	A1	2002-07-11	Pulier et al.	
	29	20080281803	A1	2008-11-13	Gentric	
	30	20061068295	A1	2006-07-27	Batterberry et al.	
	31	20060165166	A1	2006-07-27	Chou et al.	
	32	20020097750	A1	2002-07-25	Gunaseelan et al.	
	33	20020152317	A1	2002-10-17	Wang et al.	
	34	20030021166	A1	2003-01-30	Soloff	
	35	20040168052	A1	2004-08-26	Clisham et al.	

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	Attorney Docket Number	066.0141X1C9

	36	20050066063	A1	2005-03-24	Grigorovitch et al.	
	37	20050204046	A1	2005-09-15	Watanabe	
	38	20060059223	A1	2006-03-16	Klemets et al.	
	39	20060168290	A1	2006-07-27	Doron	
	40	20040260701	A1	2004-12-23	Lehikoinen et al.	
	41	20090055471	A1	2009-02-26	Kozat et al.	
	42	20080222235	A1	2008-09-11	Hurst et al.	
	43	20050185578	A1	2005-08-25	Padmanabham et al.	
	44	20070280255	A1	2007-12-06	Tsang et al.	
	45	20080037527	A1	2008-02-14	Chan et al.	
	46	20080205291	A1	2008-08-28	Li et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	47	20070094405	A1	2007-04-26	Zhang	
	48	20080184688	A1	2006-08-17	Ganguly et al.	
	49	20080263180	A1	2008-10-23	Hurst et al.	
	50	20080133766	A1	2008-06-05	Luo	
	51	20070079325	A1	2007-04-05	de Heer	
	52	20070067480	A1	2007-03-22	Beek et al.	
	53	20070030833	A1	2007-02-08	Pirzada et al.	
	54	20090055547	A1	2009-02-26	Hudson et al.	
	55	20090210549	A1	2009-08-20	Hudson et al.	
	56	20100098103	A1	2010-04-22	Xiong et al.	
	57	20090043906	A1	2009-02-12	Hurst et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	58	20020161911	A1	2002-10-31	Pinckney, III et al.	
	59	20060236219	A1	2006-10-19	Grigorovitch et al.	
	60	20080046939	A1	2008-02-21	Lu et al.	
	61	20060130118	A1	2006-06-15	Damm	
	62	20070204310	A1	2007-08-30	Hua et al.	
	63	20030065803	A1	2003-04-03	Heuvelman	
	64	20040049780	A1	2004-03-11	Gee	
	65	20060133809	A1	2006-06-22	Chow et al.	
	66	20020144276	A1	2002-10-03	Radford et al.	
	67	20020073167	A1	2002-06-13	Powell et al.	
	68	20020174434	A1	2002-11-21	Lee et al.	

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	Attorney Docket Number	066.0141X1C9

	69	20020188745		2002-12-12	Hughes et al.	
	70	20030005455	A1	2003-01-02	Bowers	
	71	20030067872	A1	2003-04-10	Harrell et al.	
	72	20030081582		2003-05-01	Jain et al.	
	73	20030107994		2003-06-12	Jacobs et al.	
	74	20030135631		2003-07-17	Li et al.	
	75	20030151753		2003-08-14	Li et al.	
	76	20030152036		2003-08-14	Quigg Brown et al.	
	77	20030204519	A1	2003-10-30	Sirivara et al.	
	78	20040003101	A1	2004-01-01	Roth et al.	
	79	20040030797	A1	2004-02-12	Akinlar et al.	

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	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	80	20040031054	A1	2004-02-12	Dankworth et al.	
	81	20040054551	A1	2004-03-18	Ausubel et al.	
	82	20040071209		2004-04-15	Burg et al.	
	83	20040093420		2004-05-13	Gamble	
	84	20040143672	A1	2004-07-22	Padmanabham et al.	
	85	20040170392		2004-09-02	Lu et al.	
	86	20050108414		2005-05-19	Taylor et al.	
	87	20050123058		2005-06-09	Greenbaum et al.	
	88	20070024705		2007-02-01	Richter et al.	
	89	20080028428		2008-01-31	Jeong et al.	
	90	20080056373		2008-03-06	Newlin et al.	

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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	91	20080162713		2008-07-03	Bowra et al.	
	92	20080195744		2008-08-14	Bowra et al.	
	93	20020029274	A1	2002-03-07	Allen	
	94	20060075446	A1	2006-04-06	Klemets et al.	
	95	20080104647	A1	2008-05-01	Hannuksela	
	96	20040220926	A1	2004-11-04	Lamkin et al.	
	97	20010013128	A1	2001-08-09	Hagai et al.	
	98	20030204602	A1	2003-10-30	Hudson et al.	
	99	20040010613	A1	2004-01-15	Apostolopoulos et al.	

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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	1	2011004225	JP	A	2011-01-06	Hodoshima		
	2	2001067264	WO	A1	2001-09-13	Streamcenter, Inc.		
	3	200192752	JP		2001-04-06	Hitachi Information Systems Ltd.		
	4	2006010113	WO	A2	2006-01-26	Network Foundation Technologies, LLC		
	5	2004025405	WO	A2	2004-03-25	Thomson Licensing S.A.		
	6	2466482	CA	A1	2003-05-22	MusicMatch Inc.		
	7	2000-201343	JP		2000-07-18	Toshiba Corp.		
	8	0919952	EP	A1	1999-06-02	Mattavelli et al.		
	9	1670256	EP	A2	2006-06-14	Klements et al.		
	10	1777969	EP		2007-04-25	British Telcom		
	11	1298931	EP	A2	2003-04-02	Oplayo Oy		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	12	1202487	EP	A2	2002-05-02	Toshiba KK		
	13	1395014	EP	A1	2004-03-03	Matsushita Electric Ind. Co. Ltd.		
	14	2367219	GB	A	2002-03-27	Vintage Global		

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	1	FUJISAWA, HIROSHI ET AL. "Implementaton of Efficient Access Mechanism for Multiple Mirror-Servers" IPSJ SIG Technical Report, vol. 2004, no. 9 (2004-DPS-116), January 30, 2004, Information Processing Society of Japan, pp. 37-42.	☒
	2	LIU, JIANGCHUAN ET AL. "Adaptive Video Multicast Over the Internet" IEEE Computer Society, 2003.	☒
	3	'The meaning of performance factor---English-Japanese Weblio Dictionary", [online], February 24, 2012, [searched on February 24, 2012], the Internet <URL:http://ejje.weblio.jp/content/performance+factor>.	☒
	4	TSURU, ET AL. "Recent evolution of the Internet measurement and inference techniques", IEICE Technical Report, Vol. 103, No. 123, pp. 37-42, June 12, 2003.	☒
	5	REJAIE, REZA ET AL. "Architectural Considerations for Playback of Quality Adaptive Video OVer the Internet" University of Southern California, Information Sciences Institute, 1998.	☒
	6	ROY, SUMIT ET AL. "A System Architecture for Managing Mobile Streaming Media Services" Streaming Media Systems Group, Hewlett-Packard Laboratories, 2003.	☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
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	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

	7	XU, DONGYAN ET AL. "On Peer-to-Peer Media Streaming" Department of Computer Sciences, Purdue University, 2002.	☒
	8	KOZAMERINK, FRANC "Media Streaming Over the Internet - An Over of Delivery Technologies" EBU Technical Review, October 2002.	☒
	9	LIENHART, RAINER ET AL. "Challenges in Distributed Video Management and Delivery" Intel Corporation, EECS Dept., UC Berkeley, 2000-2002.	☒
	10	ZHANG, XINYAN ET AL. "CoolStreaming/DONet: A Data-Driven Overlay Network for Peer-to-Peer Live Media Streaming" IEEE 2005.	☒
	11	GUO, YANG "DirectStream: A Directory-Based Peer-to-Peer Video Streaming Service" LexisNexis, Elsevier B.V. 2007.	☒

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16876579
	Filing Date	2020-05-18
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Patel, Chirag R.
	Attorney Docket Number	066.0141X1C9

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2020-11-16
Name/Print	Brett A. Carlson	Registration Number	39928

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9

CONFIRMATION NO. 3720

70560
LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

PUBLICATION NOTICE

OC000000119661767

Title:APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Publication No.US-2020-0280594-A1
Publication Date:09/03/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 06/18/2020
LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
06/18/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@lkglobal.com
ipdept@dish.com

Office Action Summary	Application No. 16/876,579	Applicant(s) BRUECK et al.	
	Examiner CHIRAG R PATEL	Art Unit 2454	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on the filing on May 18, 2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-30 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 18 May 2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Double Patenting

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process... may obtain a patent therefor..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claims 1-2, 4-21, 23-26, 28 and 30 are rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-5, 7, 9-13, 16-19 and 23-28 of U.S. Patent No. 10,469,554. This is a statutory double patenting rejection.

Claims 1 and 2 of the instant application are a verbatim of claim 1 of the patent.

Claim 4 of the instant application is a verbatim of claim 2 of the patent.

Claim 5 of the instant application is a verbatim of claim 3 of the patent.

Claim 6 of the instant application is a verbatim of claim 4 of the patent.

Claim 7 of the instant application is a verbatim of claim 5 of the patent.

Claim 8 of the instant application is a verbatim of claim 7 of the patent.

Claim 11 of the instant application is a verbatim of claim 9 of the patent.

Claim 12 of the instant application is a verbatim of claim 10 of the patent.

Claim 13 of the instant application is a verbatim of claim 11 of the patent.

Claim 14 of the instant application is a verbatim of claim 12 of the patent.

Claim 15 of the instant application is a verbatim of claim 13 of the patent.

Claims 14 and 21 of the instant application are a verbatim of claim 16 of the patent.

Claim 15 of the instant application is a verbatim of claim 17 of the patent.

Claim 16 of the instant application is a verbatim of claim 18 of the patent.

Claim 17 of the instant application is a verbatim of claim 19 of the patent.

Claim 18 of the instant application is a verbatim of claim 23 of the patent.

Claim 19 of the instant application is a verbatim of claim 24 of the patent.

Claim 20 of the instant application is a verbatim of claim 25 of the patent.

Claims 23 and 26 of the instant application are a verbatim of claim 26 of the patent.

Claim 24 of the instant application is a verbatim of claim 27 of the patent.

Claim 25 of the instant application is a verbatim of claim 28 of the patent.

Claim 23 of the instant application is a verbatim of claim 26 of the patent.

Claims 28 and 30 of the instant application are a verbatim of claim 26 of the patent.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d

438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1-3, 6-8, 14, 17, 21-23, and 26-30 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 4, 5 and 7 of U.S. Patent No. 10,469,555. Although the claims at issue are not identical, they are not patentably distinct from each other

Claims 1-3 of the instant application is broader and obvious over claim 1 of the patent. It would have been obvious for duration of the streamlet of the patent to be a same portion of the

video of the instant application. It would have been obvious for the group of streamlets of the patent to include a first and second streamlet of the instant application which corresponds to the portion of the video. Other differences it would have been obvious for the one storage device storing live event video to be an archived content of the instant application.

Claim 6 of the instant application is anticipated by claim 4 of the patent.

Claim 7 of the instant application is anticipated by claim 5 of the patent.

Claim 8 of the instant application is anticipated by claim 7 of the patent.

Claims 14 and 21-22 of the instant application is broader and obvious over claim 1 of the patent similar to reasons above as for claims 1-3.

Claim 17 of the instant application is anticipated by claim 5 of the patent.

Claims 23 and 26-27 of the instant application is anticipated by claims 1 and 4 of the patent similar to reasons above as for claims 1-3

Claims 28-30 of the instant application is anticipated by claims 1 and 4 of the patent similar to reasons above as for claims 1-3

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Xu et al. (US 7,369,610) - Enhancement layer switching for scalable video coding.

Lango et al. – (US 2005/0055425) - Pre-computing streaming media payload method and apparatus.

Padmanabham et al. (US 2004/0143672) - System and method for distributing streaming content through cooperative networking.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chirag R Patel whose telephone number is (571)272-7966. The examiner can normally be reached on Monday to Friday from 8:00AM to 4:30PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton Burgess, can be reached on 571-272-3949. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pairdirect.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).

/Chirag R Patel/
Primary Examiner, Art Unit 2454

Notice of References Cited	Application/Control No. 16/876,579	Applicant(s)/Patent Under Reexamination BRUECK et al.	
	Examiner CHIRAG R PATEL	Art Unit 2454	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-7369610-B2	05-2008	Xu; Jizheng	H04N21/2662	375/240.08
*	B	US-20050055425-A1	03-2005	Lango, Jason	H04N7/17318	709/219
*	C	US-20040143672-A1	07-2004	Padmanabham, Venkata N.	H04L65/4084	709/231
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47
CLAIM		**DATE**								
Final	Original	06/12/2020								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
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	28	✓								
	29	✓								
	30	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/876,579	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
(H04N21/2662, H04N21/8456, H04L65/607,H04L65/608, H04L67/02	06/12/2020	C.P.

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
EAST	06/12/2020	C.P.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

Webgroup CZ a.s. Ex. 1002, Page 1321 of 1406

Bibliographic Data

Application No: 16/876,579

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /CHIRAG R PATEL/ (Examiner's Signature) | (Initials)

Title: APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
05/18/2020	709	2454	066.0141X1C9
RULE			

APPLICANTS

DISH Technologies L.L.C., Englewood, CO, UNITED STATES

INVENTORS

DAVID F. BRUECK SARATOGA SPRINGS, UT, UNITED STATES

MARK B. HURST CEDAR HILLS, UT, UNITED STATES

R. DREW MAJOR OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 16004056 06/08/2018 PAT 10659513

16004056 is a CON of 15414025 01/24/2017 PAT 9998516

15414025 is a CON of 14719122 05/21/2015 PAT 9571551

14719122 is a CON of 14106051 12/13/2013 PAT 9071668

14106051 is a CON of 13617114 09/14/2012 PAT 8612624

13617114 is a CON of 12906940 10/18/2010 PAT 8402156

12906940 is a CON of 11673483 02/09/2007 PAT 7818444

11673483 is a CIP of 11116783 04/28/2005 PAT 8868772

11116783 has PRO of 60566831 04/30/2004

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/26/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

LKGLOBAL (Dish Technologies L.L.C.)

7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253
UNITED STATES

FILING FEE RECEIVED

$7,320

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	("10659513").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 07:55
S2	8	(("9571551") or ("9071668") or ("8612624") or ("8402156") or ("7818444") or ("8868772") or ("10469554") or ("10659513")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 07:58
S3	2	(("73369610") or ("20050055425") or ("20030103571")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:29
S4	3	(("7369610") or ("20050055425") or ("20030103571")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:30
S5	27	encod$3 near2 streamlets with bitrates	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 10:36
S6	1	("9751551").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:45
S7	1	("9571551").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:46
S8	1	("8402156").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:53
S9	1	("7818444").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 10:55
S10	7	(("20080162713") or ("20040170392") or ("20040143672") or ("6486803") or ("20030204519") or ("6486803") or ("20030005455") or ("20040054551") or ("20040170392")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 11:02
S11	54	streamlets with bitrates	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 11:33
S12	74	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR	US-PGPUB; USPAT;	OR	ON	2020/06/12 12:37

		H04L67/02).CPC.) and streamlet near3 encod$3	USOCR; FPRS; EPO			
S13	0	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlet near3 encod$3 and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:03
S14	5	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and streamlets and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:03
S15	33,997	portions with stream and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:28
S16	1,761,238	portions with stream with bitrat$3and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:29
S17	24	portions with stream with bitrat$3 and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:29
S18	2	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and divid$3 with stream same bitrate and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:30
S19	3	((H04N21/2662 OR H04N21/8456 OR H04L65/607 OR H04L65/608 OR H04L67/02).CPC.) and (divid$3 split$3)with stream same bitrate and @rlad<"20040430"	US-PGPUB; USPAT; USOCR; FPRS; EPO	OR	ON	2020/06/12 13:30
S20	1	("10469554").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:26
S21	1	("10469554").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:44
S22	1	("10469555").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/06/12 14:47

EAST Search History (Interference)

<This search history is empty>

6/12/2020 5:39:27 PM
C:\Users\cpatel\Documents\EAST\Workspaces\16876579.wsp

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/876,579	05/18/2020	DAVID F. BRUECK	066.0141X1C9	3720

70560 7590 06/03/2020

LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

EXAMINER
PATEL, CHIRAG R

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
06/03/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dish@lkglobal.com
ipdept@dish.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 16/876,579	**Applicant(s)** BRUECK et al.	
	Examiner CHERYL P GIBSON BAYLOR	**Art Unit** OPET	**AIA (FITF) Status** No

1. THE REQUEST FILED 18 May 2020 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to CHERYL GIBSON BAYLOR at (571)272-3213. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/CHERYL GIBSON BAYLOR/ Paralegal Specialist, OPET	

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/876,579

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 100 =	1000
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 460 =	460
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	3180

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/876,579	05/18/2020		3180	066.0141X1C9	30	4

CONFIRMATION NO. 3720

70560
LKGLOBAL (Dish Technologies L.L.C.)
7010 E. COCHISE ROAD
SCOTTSDALE, AZ 85253

FILING RECEIPT

OC000000117254022

Date Mailed: 05/27/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

DAVID F. BRUECK, SARATOGA SPRINGS, UT;
MARK B. HURST, CEDAR HILLS, UT;
R. DREW MAJOR, OREM, UT;

Applicant(s)

DISH Technologies L.L.C., Englewood, CO

Assignment For Published Patent Application

DISH Technologies L.L.C., Englewood, CO

Power of Attorney: The patent practitioners associated with Customer Number 70560

Domestic Priority data as claimed by applicant

This application is a CON of 16/004,056 06/08/2018 PAT 10659513
which is a CON of 15/414,025 01/24/2017 PAT 9998516
which is a CON of 14/719,122 05/21/2015 PAT 9571551
which is a CON of 14/106,051 12/13/2013 PAT 9071668
which is a CON of 13/617,114 09/14/2012 PAT 8612624
which is a CON of 12/906,940 10/18/2010 PAT 8402156
which is a CON of 11/673,483 02/09/2007 PAT 7818444
which is a CIP of 11/116,783 04/28/2005 PAT 8868772
which claims benefit of 60/566,831 04/30/2004

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/26/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/876,579**

Projected Publication Date: 09/03/2020

Non-Publication Request: No

Early Publication Request: No
Title

APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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Document Description: Power of Attorney

PTO/AIA/82A (07-12)

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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	Unassigned
Filing Date	Unassigned
First Named Inventor	DAVID F. BRUECK
Title	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
Art Unit	Unassigned
Examiner Name	
Attorney Docket Number	066.0141X1C9

SIGNATURE of Applicant or Patent Practitioner

Signature	/BRETT A. CARLSON/	Date	2020-05-18
Name	Brett A. Carlson	Telephone	480.385.5060
Registration Number	39,928		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

[X] *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 70560

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

DISH Technologies L.L.C.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/M S Grafton/	Date (Optional)	7/6/2015
Name	Max S. Gratton		
Title	Director & Senior Corporate Counsel of DISH Technologies L.L.C.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/SB/424 (12-11)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	DAVID F. BRUECK	Nonprovisional Application Number (if known):	Herewith
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i), the prioritized examination fee set forth in 37 CFR 1.17(c), and if not already paid, the publication fee set forth in 37 CFR 1.18(d) have been filed with the request. The basic filing fee, search fee, examination fee, and any required excess claims and application size fees are filed with the request or have been already been paid.

2. The application contains or is amended to contain no more than four independent claims and no more than thirty total claims, and no multiple dependent claims.

3. The applicable box is checked below:

I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed oath or declaration under 37 CFR 1.63 is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /BRETT A. CARLSON/	Date 2020-05-18
Name (Print/Typed) Brett A. Carlson	Practitioner Registration Number 39,928

Note: *Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the form of the signature. If necessary, submit multiple forms for more than one signature, see below*.*

☑ *Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Filer:	Brett Carlson/Julie Graf
Attorney Docket Number:	066.0141X1C9

Filed as Large Entity

Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
REQUEST FOR PRIORITIZED EXAMINATION	1817	1	4000	4000
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	10	100	1000
INDEPENDENT CLAIMS IN EXCESS OF 3	1201	1	460	460

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous-Filing:				
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**7320**

Electronic Acknowledgement Receipt	
EFS ID:	39461774
Application Number:	16876579
International Application Number:	
Confirmation Number:	3720
Title of Invention:	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING
First Named Inventor/Applicant Name:	DAVID F. BRUECK
Customer Number:	70560
Filer:	Brett Carlson/Julie Graf
Filer Authorized By:	Brett Carlson
Attorney Docket Number:	066.0141X1C9
Receipt Date:	18-MAY-2020
Filing Date:	
Time Stamp:	14:57:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$7320
RAM confirmation Number	E20205HE58013692
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	20200518_ADS_066-0141X1C9.pdf	1823905 ef14709de8eafcfe97ceb6d9649c489ab6cf3b17	no	10
Warnings:					
Information:					
2		20200518_ConAppl_066-0141X1C9_P2007-02-01-2-7.pdf	14773111 5a0b50a0c154548893bd585064128b616e07fb98	yes	36
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Specification		1	28	
	Claims		29	35	
	Abstract		36	36	
Warnings:					
Information:					
3	Oath or Declaration filed	20200518_DeclarationOfJointInvs_066-0141X1C9.pdf	135215 98d341969b7e66dbccf545b2f138fadf294d0db5	no	3
Warnings:					
Information:					
4	Drawings-only black and white line drawings	20200518_Dwgs_066-0141X1C9.pdf	133801 e3ec7077c08c48b61e561c9ae9f1f2b97f7a3624	no	11
Warnings:					
Information:					
5	Power of Attorney	20200518_POA_066-0141X1C9.pdf	114418 3432aef93cb44197661de60bce07113ab6c3a0aa	no	2

Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
6	TrackOne Request	20200518_ReqForExam.pdf	140703 4fe05ab6a296bdbdcd3c961540843bae0365445c	no	2
Warnings:					
Information:					
7	Preliminary Amendment	20200518_PreliminaryAmendment_06-0141X1C9.pdf	149179 c9ade1c8adee2b3a97df2a4b7bb94ef85ca4c296	no	4
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	43027 5097de90893fd873f8e9fac2314314f1bad06efe	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	17313359		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	DAVID	F.	BRUECK	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	SARATOGA SPRINGS	State/Province	UT	Country of Residence	US

Mailing Address of Inventor:

Address 1	962 NORTH RATTLER ROAD		
Address 2			
City	SARATOGA SPRINGS	State/Province	UT
Postal Code	84043	Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	MARK	B.	HURST	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	CEDAR HILLS	State/Province	UT	Country of Residence	US

Mailing Address of Inventor:

Address 1	10639 NORTH AVALON		
Address 2			
City	CEDAR HILLS	State/Province	UT
Postal Code	84062	Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	R.	DREW	MAJOR	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

City	OREM	State/Province	UT	Country of Residence	US

Mailing Address of Inventor:

Address 1	363 WEST 600 SOUTH		
Address 2			
City	OREM	**State/Province**	UT
Postal Code	84058	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	70560		
Email Address	docketing@lkglobal.com	Add Email	Remove Email

Application Information:

Title of the Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING		
Attorney Docket Number	066.0141X1C9	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	11	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	◯ Limited Recognition (37 CFR 11.9)
Customer Number	70560		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)	
	Continuation of	16004056	2018-06-08	

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16004056	Continuation of	15414025	2017-01-24	9998516	2018-06-12

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15414025	Continuation of	14719122	2015-05-21	9571551	2017-02-14

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14719122	Continuation of	14106051	2013-12-13	9071668	2015-06-30

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14106051	Continuation of	13617114	2012-09-14	8612624	2013-12-17

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13617114	Continuation of	12906940	2010-10-18	8402156	2013-03-19
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12906940	Continuation of	11673483	2007-02-09	7818444	2010-10-19
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
11673483	Continuation in part of	11116783	2005-04-28	8868772	2014-10-21
Prior Application Status	Expired				Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)		
11116783	Claims benefit of provisional	60566831	2004-04-30		

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
● Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	DISH Technologies L.L.C.		
Mailing Address Information For Applicant:			
Address 1	9601 S. Meridian Blvd.		
Address 2			
City	Englewood	**State/Province**	CO
Country	US	Postal Code	80112
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☒

Organization Name	DISH Technologies L.L.C.

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	9601 S. Meridian Blvd.		
Address 2			
City	Englewood	**State/Province**	CO
Country i	US	Postal Code	80112
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/BRETT A. CARLSON/			Date (YYYY-MM-DD)	2020-05-18
First Name	Brett A.	Last Name	Carlson	Registration Number	39,928

Additional Signature may be generated within this form by selecting the Add button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	066.0141X1C9
	Application Number	
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APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Patent Application Number 11/673,483, filed on February 9, 2007, which is a continuation-in-part of Application No. 11/116,783, filed on April 28, 2005, which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on April 30, 2004, all of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0002] The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

DESCRIPTION OF THE RELATED ART

[0003] The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a server.

[0004] "Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

[0005] Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

[0006] Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

[0007] Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

[0008] Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for a moment and then slowly resumes the original

transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

[0009] The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

[0010] The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

[0011] From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

SUMMARY OF THE INVENTION

[0012] The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the above-discussed shortcomings in the art.

[0013] The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

[0014] The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about .1 and 5 seconds.

[0015] In one embodiment, a set of streamlets comprises a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media content to raw audio or raw video. The encoding module may include a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing variables selected from a group consisting of current encoding job completion percentage, average encoding job completion time, processor speed, and physical memory capacity.

[0016] A system of the present invention is also presented for adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of the media content having a predetermined length of time, and an encoding

Webgroup CZ a.s. Ex. 1002, Page 1356 of 1406

module configured to encode each streamlet as a separate content file and generate a set of streamlets.

[0017] The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid.

[0018] A method of the present invention is also presented for adaptive-rate content streaming. In one embodiment, the method includes receiving media content, segmenting the media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content file.

[0019] The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a portion of the media content having a predetermined length of time. In one embodiment, the method includes generating a set of streamlets comprising a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

[0020] Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing variables.

[0021] Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

[0022] Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one

or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

[0023] These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

Webgroup CZ a.s. Ex. 1002, Page 1358 of 1406

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

[0025] Figure 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of streaming content in accordance with the present invention;

[0026] Figure 2a is a schematic block diagram graphically illustrating one embodiment of a media content file;

[0027] Figure 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

[0028] Figure 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source streamlets;

[0029] Figure 3b is a schematic block diagram illustrating one embodiment of sets of streamlets in accordance with the present invention;

[0030] Figure 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

[0031] Figure 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention;

[0032] Figure 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention;

[0033] Figure 6a is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the present invention;

[0034] Figure 6b is a schematic block diagram illustrating an alternative embodiment of a VT in accordance with the present invention;

[0035] Figure 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present invention;

Webgroup CZ a.s. Ex. 1002, Page 1359 of 1406

[0036] Figure 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with the present invention;

[0037] Figure 8 is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

[0038] Figure 9 is a schematic flow chart diagram illustrating one embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

[0039] Figure 10 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0040] Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

[0041] Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

[0042] Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

[0043] Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

[0044] Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-

Webgroup CZ a.s. Ex. 1002, Page 1361 of 1406

readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate content streaming as described herein.

[0045] Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

[0046] Figure 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

[0047] In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For

Webgroup CZ a.s. Ex. 1002, Page 1362 of 1406

example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

[0048] Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

[0049] Figure 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media Video®, Quicktime Sorenson 3®, On2, OGG Vorbis, MP3, or Quicktime 6.5/ MPEG-4® encoded content.

[0050] Figure 2b is a schematic block diagram illustrating one embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per

Webgroup CZ a.s. Ex. 1002, Page 1363 of 1406

second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 208 may be encoded and compressed to 600 kbps.

[0051] Figure 3a is a schematic block diagram illustrating one embodiment of a stream 302 divided into a plurality of source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the streamlets 303 may be divided according to file size instead of a time index and duration.

[0052] Figure 3b is a schematic block diagram illustrating one embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course each set 306 may include more than the depicted three bitrates which are given by way of example only. One skilled in the art will recognize that any number of streams having different bitrates may be generated from the original content 200.

[0053] As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed

of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

[0054] Figure 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

[0055] The capture module 402 may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module 402 is configured to pass the content file to the streamlet module 404.

[0056] The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

[0057] The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in

Webgroup CZ a.s. Ex. 1002, Page 1365 of 1406

the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

[0058] In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to Figure 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with Figure 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

[0059] The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202 and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/ MPEG-4®. Alternatively, a custom encoding scheme may be employed.

[0060] The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodiment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. The metadata module 412 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

[0061] Once the streamlets 304 have been received and processed, the client module 114 may request streamlets 304 using HTTP from the web server 116. Using a standard protocol such as HTTP eliminates the need for network administrators to configure

Webgroup CZ a.s. Ex. 1002, Page 1366 of 1406

firewalls to recognize and pass through network traffic for a new, specialized protocol. Additionally, since the client module 114 initiates the request, the web server 116 is only required to retrieve and serve the requested streamlet 304. In a further embodiment, the client module 114 may be configured to retrieve streamlets 304 from a plurality of web servers 116.

[0062] Each web server 116 may be located in various locations across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

[0063] Figure 5a is a schematic block diagram illustrating one embodiment of an encoder module 406 in accordance with the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, servers, etc. In a further embodiment, the hosts 504 may be dedicated hardware, for example, cards plugged into a single computer.

[0064] The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw

streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

[0065] Upon encoding completion, the host 504 returns the set 306 to the master 502 so that the encoding module 406 may store the set 306 in the streamlet database 408. The master 502 is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory capacity.

[0066] For example, a host 504 may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

[0067] The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content file 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

[0068] The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay

between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

[0069] Figure 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of Figure 4) begins to capture the content file and the streamlet module 404 generates a first streamlet 303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of different bitrates). Figure 5b illustrates the encoding process generically as block 502 to graphically illustrate the time duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of streamlets will begin upon arrival of the streamlet from the capture module 402.

[0070] During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on. As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module 406. The delay may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively multiple low powered systems.

[0071] A system as described above beneficially enables multi-pass encoding of live events. Multi-pass encoding systems of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, however, may be encoded as many times as is deemed necessary.

Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

[0072] Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unencoded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

[0073] The parallel offset pipeline approach described with reference to Figure 5b beneficially allows for long or short encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to multiple profiles and optimizations only lengthens the encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

[0074] Returning now to Figure 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master 502. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively

Webgroup CZ a.s. Ex. 1002, Page 1370 of 1406

light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

[0075] Furthermore, hosts 504 may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host 504 experiences a crash or some failure, its encoding work is simply reassigned to another host.

[0076] The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

[0077] Figure 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

[0078] Figure 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

[0079] Figure 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to,

start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

[0080] A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may selectively skip offensive content without the processing requirements of editing the content.

[0081] Figure 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

[0082] In a further embodiment, the client module 114 may comprise a plurality of agent controller modules 702. Each agent controller module 702 may be configured to interface with one viewer 708. Alternatively, the agent controller module 702 may be configured to interface with a plurality of viewers 708. The viewer 708 may be a media player (not shown) operating on a PC or handheld electronic device.

[0083] The agent controller module 702 is configured to select a quality level of streamlets to transmit to the viewer 708. The agent controller module 702 requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to Figure 10.

[0084] The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and

Webgroup CZ a.s. Ex. 1002, Page 1372 of 1406

stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may be identified with a unique filename.

[0085] Additionally, the agent controller module 702 may be configured to anticipate streamlet 304 requests and pre-request streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffering wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 corresponding to specified index points within the content or within other content in anticipation of the end user 104 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

[0086] The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server

Webgroup CZ a.s. Ex. 1002, Page 1373 of 1406

116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

[0087] In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

[0088] In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

Webgroup CZ a.s. Ex. 1002, Page 1374 of 1406

[0089] When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet 304. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet 304. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response arrives before the first request response, the first request may be aborted.

[0090] Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

[0091] Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

Webgroup CZ a.s. Ex. 1002, Page 1375 of 1406

[0092] A single streamlet 304 request may be issued for an entire streamlet 304, or multiple requests may be issued, each for a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

[0093] In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

[0094] The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. Additionally, the order in which a particular method occurs may or may not strictly adhere to the order of the corresponding steps shown.

[0095] Figure 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content

from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

[0096] In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

[0097] In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

[0098] Figure 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a

Webgroup CZ a.s. Ex. 1002, Page 1377 of 1406

determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to Figure 10.

[0099] In one embodiment, the staging module 709 then arranges 912 the streamlets 304 into the proper order, and the agent controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

[0100] Referring now to Figure 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of Figure 9. The method 1000 starts and the agent controller module 702 receives 1004 a streamlet 304 as described above with reference to Figure 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time intervals Δ between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

[0101] Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given Δ may vary substantially from another. In order to compensate for this fluctuation, the agent controller module 702 calculates 1008 a performance ratio r across a window of n samples for streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

Webgroup CZ a.s. Ex. 1002, Page 1378 of 1406

[0102] Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 702 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor φ:

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j \right)^{\frac{1}{m}}$$

[0103] The policy determination about whether or not to upshift 1010 playback quality begins by comparing $\varphi_{current}$ with a trigger threshold Θ_{up}. If $\varphi_{current} \geq \Theta_{up}$, then an up shift to the next higher quality stream may be considered 1016. In one embodiment, the trigger threshold Θ_{up} is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger Θ_{up} is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is able to sustain 1016 upshift quality, then the agent controller module 702 will upshift 1017 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality stream's performance factor, φ_{higher}, with Θ_{up}. If $\varphi_{higher} \geq \Theta_{up}$ then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no," the agent controller module 702 will not attempt to upshift 1017 stream quality. If the end of the stream has been reached 1014, the method 1000 ends 1016.

[0104] If the decision on whether or not to attempt upshift 1010 is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold Θ_{down} is defined in a manner analogous to Θ_{up}. If $\varphi_{current} > \Theta_{down}$ then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality.

Webgroup CZ a.s. Ex. 1002, Page 1379 of 1406

However, if $\varphi_{current} \leq \Theta_{down}$, the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

[0105] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

Webgroup CZ a.s. Ex. 1002, Page 1380 of 1406

CLAIMS

What is claimed is:

1. A system for adaptive-rate content streaming of video playable on one or more end user stations over the Internet, the system comprising:

at least one storage device storing video, the video encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets encoded at a respective one of the plurality of different bitrates, each group of streamlets comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream.

2. The system of claim 1, wherein the video is a live event video.

3. The system of claim 1, wherein the video includes archived content.

4. The system of claim 1, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

Webgroup CZ a.s. Ex. 1002, Page 1381 of 1406

5. The system of claim 4, wherein the first and second durations are different.

6. The system of claim 1, further comprising: a plurality of web servers located at different locations across the internet, each web server configured to: receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams; retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one of the different copies to the requesting one of the end user stations over the one or more network connections.

7. The system of claim 1, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.

8. The system of claim 1, further comprising:

a first web server configured to: receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video; retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.

Webgroup CZ a.s. Ex. 1002, Page 1382 of 1406

9. The system of claim 8, wherein the first web server is further configured to: receive at least one virtual timeline request over the one or more internet connections from the one or more end user stations to retrieve a virtual timeline; and send the virtual timeline to the requesting one of the end user stations over the one or more network connections.

10. The system of claim 9, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.

11. The system of claim 10, wherein the virtual timeline defines a playlist for a user to view.

12. The system of claim 11, wherein the virtual timeline comprises a file that is configured to define a playlist for a user to view.

13. The system of claim 12, wherein the virtual timeline comprises at least one quantum media extension (QMX).

14. An end user station to stream a video over a network from a server for playback of the video, the content player device comprising:

a processor;

a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:

establish one or more network connections between the end user station and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;

wherein the video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group

comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bit rate of no less than 600 kbps; and wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates;

select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;

place a streamlet request to the server over the one or more network connections for the first streamlet of the selected stream; receive the requested first streamlet from the server via the one or more network connections; and

provide the received first streamlet for playback of the video.

15. The end user station of claim 14, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

16. The end user station of claim 15, wherein the first and second durations are different.

17. The end user station of claim 14, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.

Webgroup CZ a.s. Ex. 1002, Page 1384 of 1406

18. The end user station of claim 14, wherein the end user station is further configured to: request and receive a virtual timeline; and wherein one or more streamlet requests are based on the at least one virtual timeline.

19. The end user station of claim 18, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.

20. The end user station of claim 18, wherein the virtual timeline defines a playlist for a user to view.

21. The end user station of claim 14, wherein the video is a live event video.

22. The end user station of claim 14, wherein the video includes archived content.

23. A process executable by one or more servers to stream a video for playback by one or more end user stations, the process comprising:

storing, by the one or more servers, a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different one of the different bitrates than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

Webgroup CZ a.s. Ex. 1002, Page 1385 of 1406

receiving at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video;

retrieving from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and

sending the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.

24. The process of claim 23, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

25. The process of claim 23, wherein the first and second durations are different.

26. The process of claim 23, wherein the video is a live event video.

27. The process of claim 23, wherein the video includes archived content.

28. A process executable by a content player device to stream a video over a network from a server for playback of the video by the content player device, the process comprising:

establishing one or more network connections between the content player device and the server,

wherein the server accesses a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low

Webgroup CZ a.s. Ex. 1002, Page 1386 of 1406

quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video; wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

selecting, by the content player device, a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video;

placing a streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video; and

receiving the requested streamlet from the server via the one or more network connections; and rendering, by the content player device, the received streamlet for playback of the video.

29. The process of claim 28, wherein the video includes archived content.

30. The process of claim 28, wherein the video is a live event video.

Webgroup CZ a.s. Ex. 1002, Page 1387 of 1406

ABSTRACT OF THE DISCLOSURE

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

Webgroup CZ a.s. Ex. 1002, Page 1388 of 1406

DECLARATION OF JOINT INVENTORS RELATING TO PATENTS AND APPLICATIONS ENTITLED "APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING"

This is a joint declaration and statement made by David F. Brueck, Mark B. Hurst, and R. Drew Major. We the undersigned each hereby declare and state that, to the best of our information and belief:

1. Each of us (David F. Brueck, Mark B. Hurst, and R. Drew Major) contributed to the inventorship of the following United States Patents and the following pending application:

US Patents:	US Patent Application
US7818444	Serial No. 15/414,025
US8402156	
US8612624	
US9071668	
US9571551	

2. The above-identified patents and applications were made or authorized to be made by me. I believe that I am the inventor or an original joint inventor of a claimed invention in each of the applications and patents referenced above.

3. Although R. Drew Major was initially omitted as an inventor, I understand that he is now being added as a joint inventor. I agree to the change of inventorship and I have no disagreement with regard to the change in inventorship. To the best of my information and belief, Mr. Major's earlier omission was made without deceptive intent.

4. I hereby declare that all statements made herein of my own knowledge are true and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements in this declaration are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both, and

that willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted by:



David F. Brueck

27 Oct 2017

Date

Mark B. Hurst

Date

R. Drew Major

Date

Webgroup CZ a.s. Ex. 1002, Page 1390 of 1406

1001 by fine or imprisonment of not more than five (5) years, or both, and that willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted by:

David F. Brueck	Date
Mark B. Hurst	11/6/17 Date
R. Drew Major	11/6/17 Date

Webgroup CZ a.s. Ex. 1002, Page 1391 of 1406

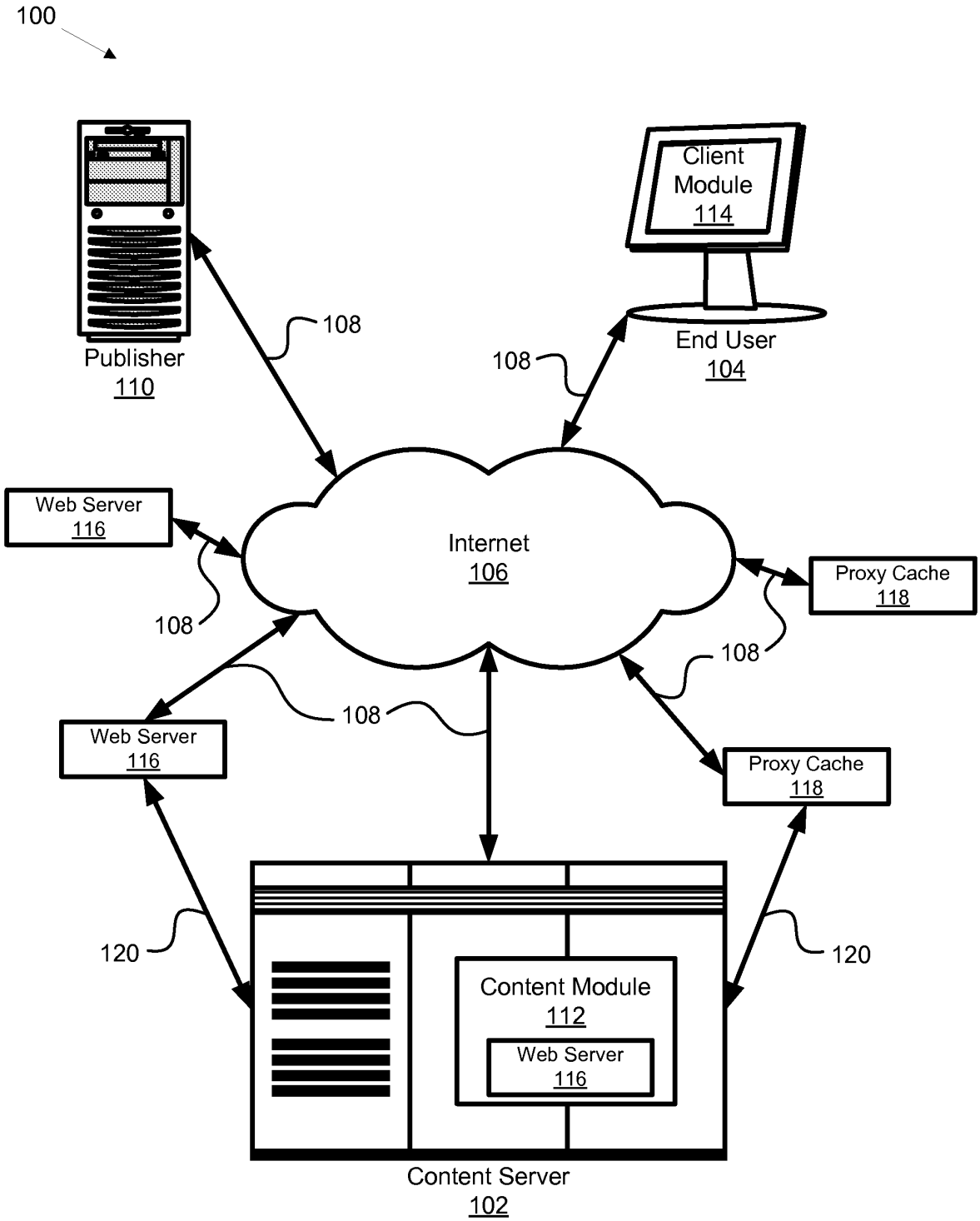

100
Publisher
110
108
Client
Module
114
End User
104
108
Web Server
116
Internet
106
Proxy Cache
118
108
108
108
Web Server
116
Proxy Cache
118
120
120
Content Module
112
Web Server
116
Content Server
102

FIG. 1

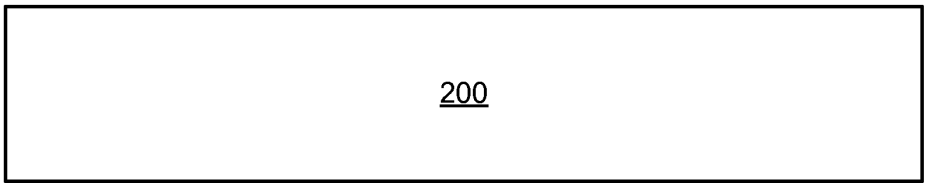


FIG. 2a

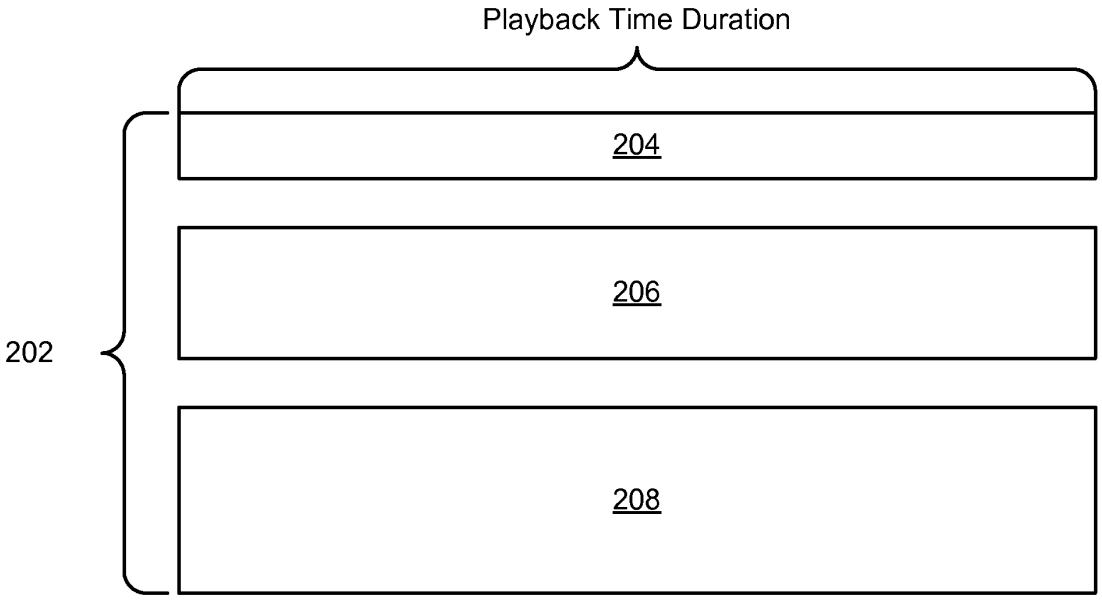


FIG. 2b

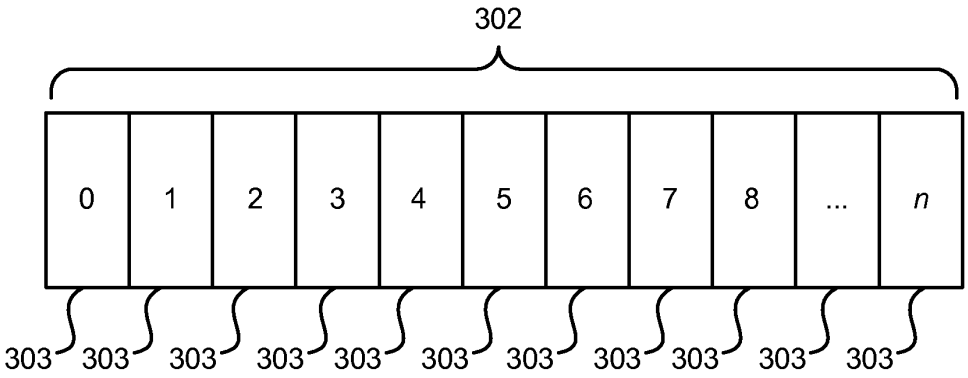

302
0
1
2
3
4
5
6
7
8
...
n
303
303
303
303
303
303
303
303
303
303
303

FIG. 3a

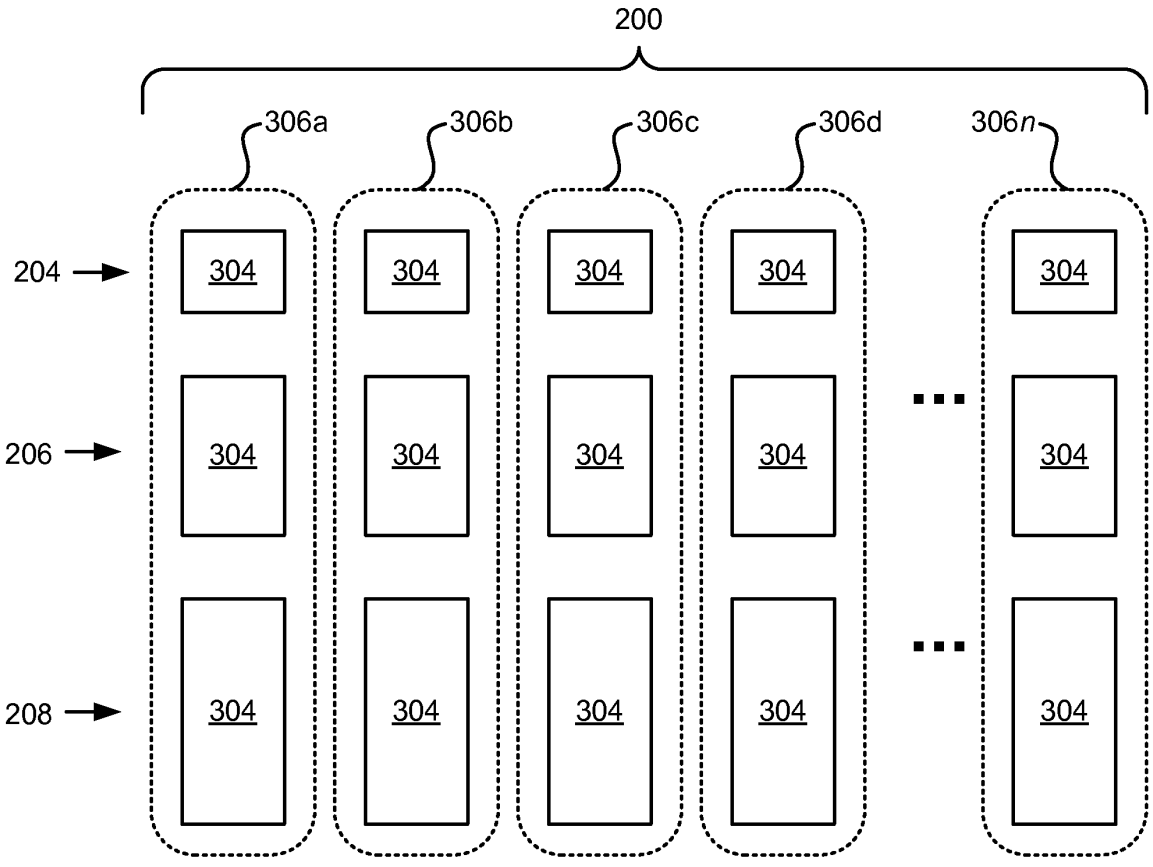

200
306a
306b
306c
306d
306n
204
206
208
304

FIG. 3b

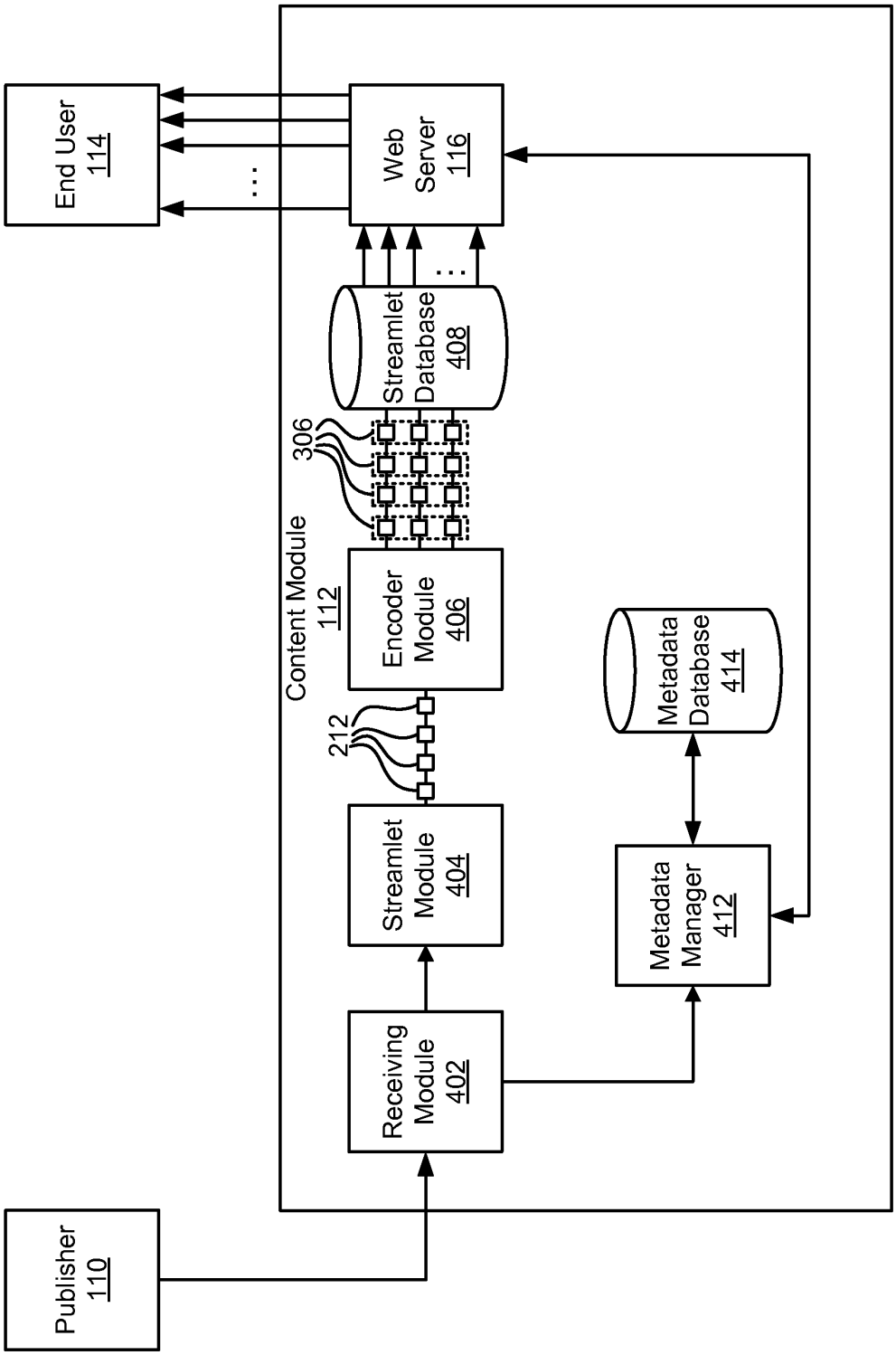

Publisher
110
End User
114
Web
Server
116
Content Module
112
Receiving
Module
402
Streamlet
Module
404
Encoder
Module
406
Streamlet
Database
408
Metadata
Manager
412
Metadata
Database
414
212
306

FIG. 4

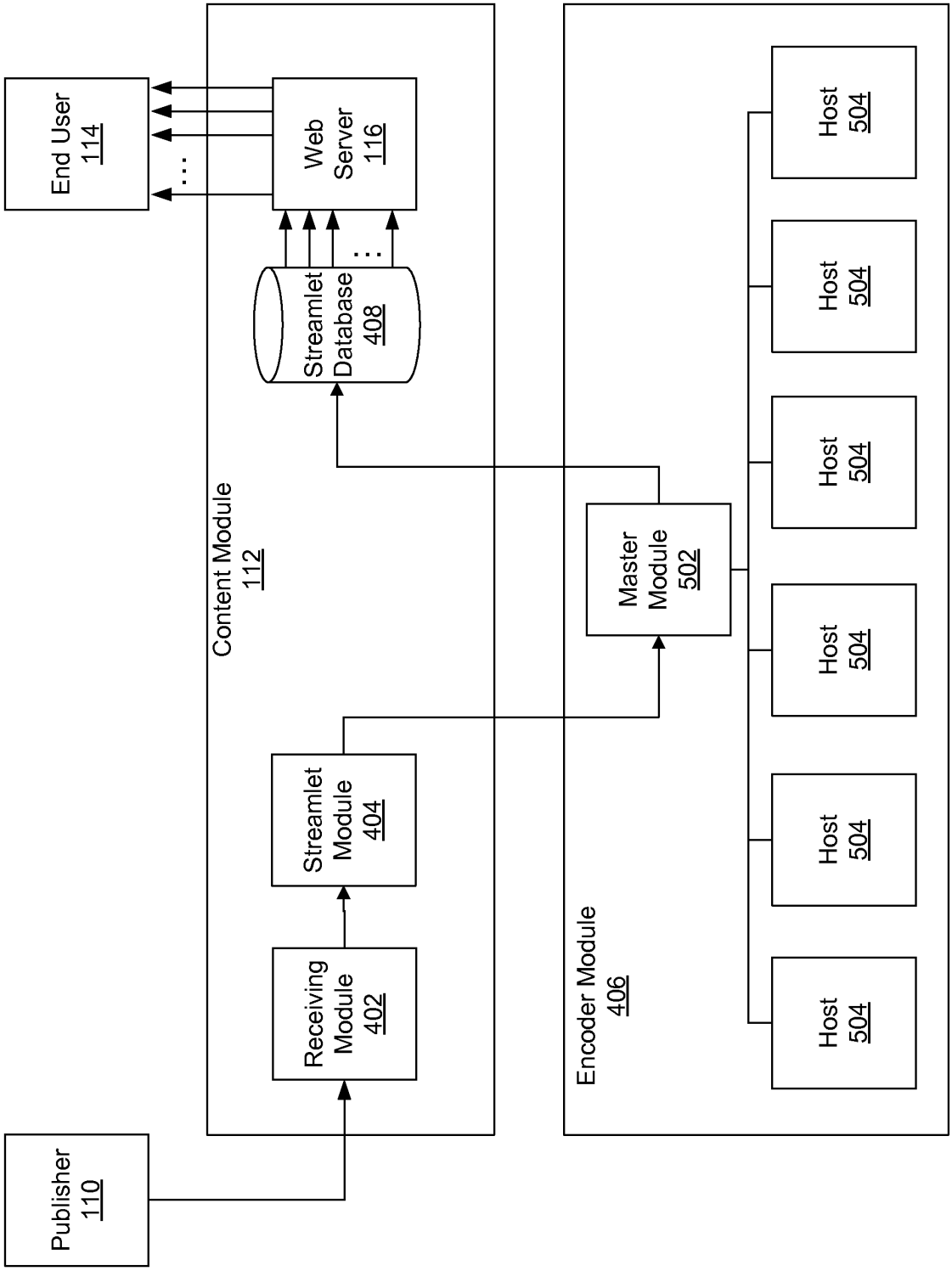

End User
114
Web
Server
116
Streamlet
Database
408
Content Module
112
Streamlet
Module
404
Receiving
Module
402
Publisher
110
Master
Module
502
Encoder Module
406
Host
504
Host
504
Host
504
Host
504
Host
504
Host
504

FIG. 5a

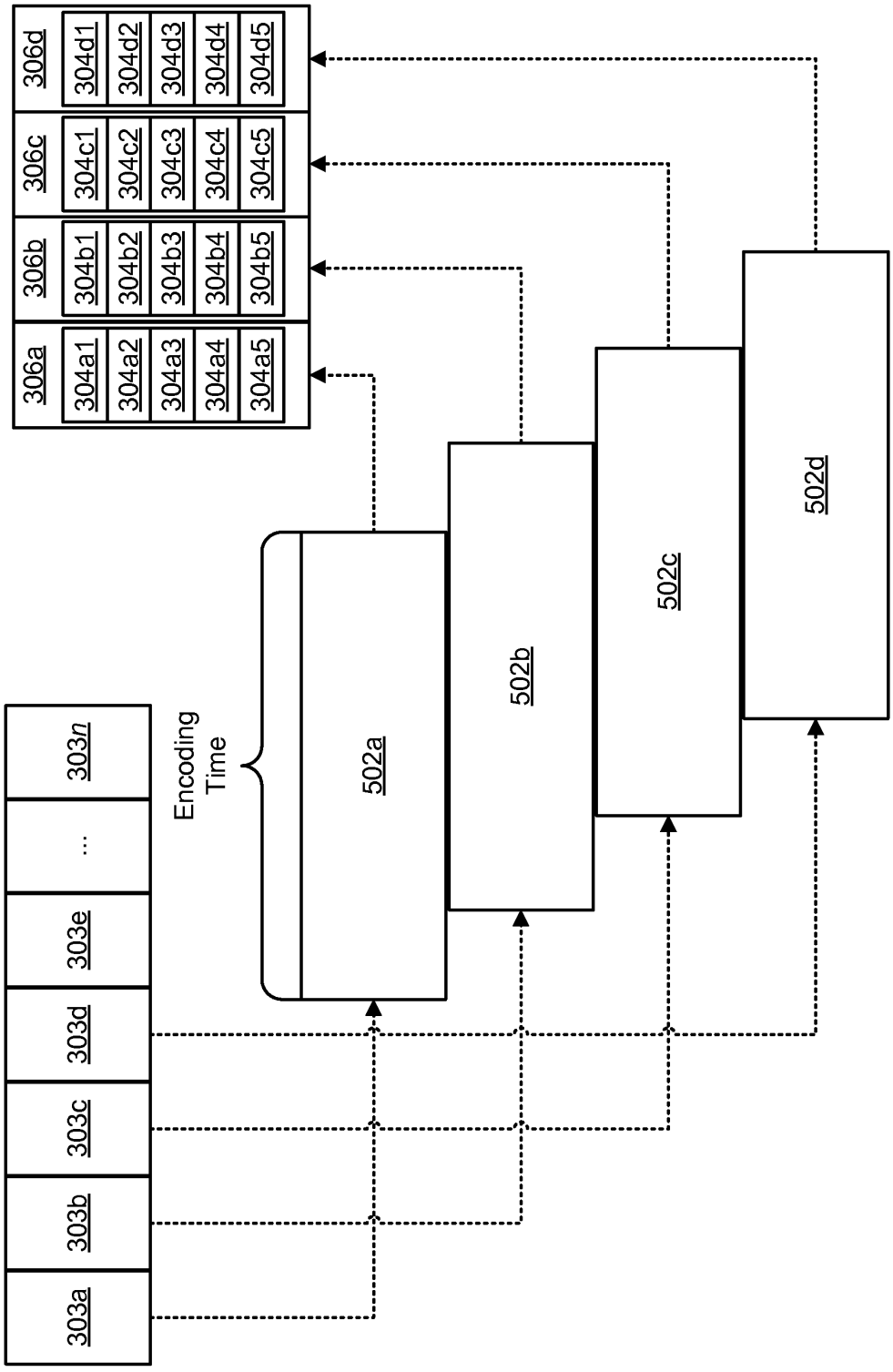

303a
303b
303c
303d
303e
...
303n
Encoding Time
502a
502b
502c
502d
306a
304a1
304a2
304a3
304a4
304a5
306b
304b1
304b2
304b3
304b4
304b5
306c
304c1
304c2
304c3
304c4
304c5
306d
304d1
304d2
304d3
304d4
304d5

FIG. 5b

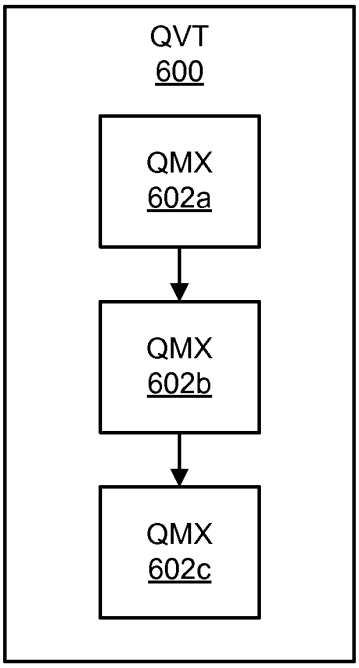


FIG. 6a

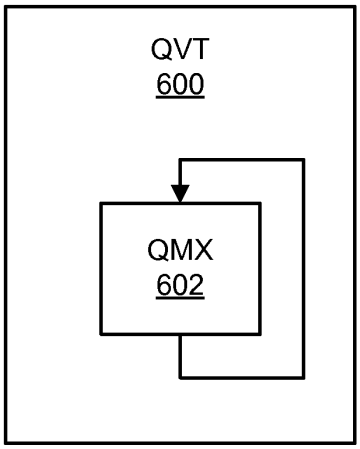


FIG. 6b

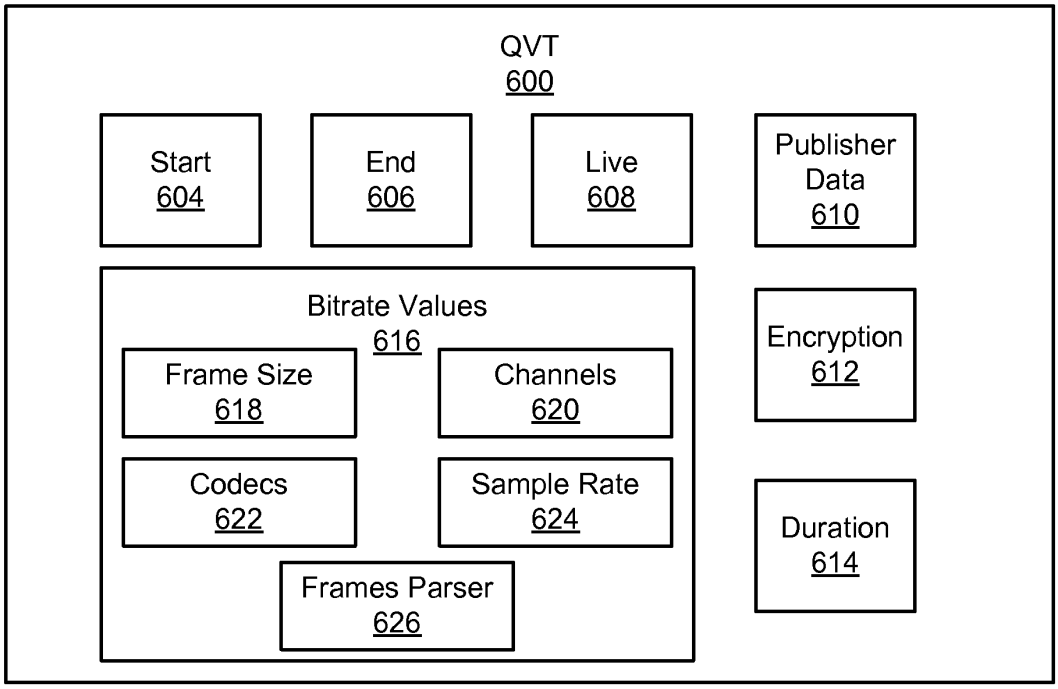


FIG. 6c

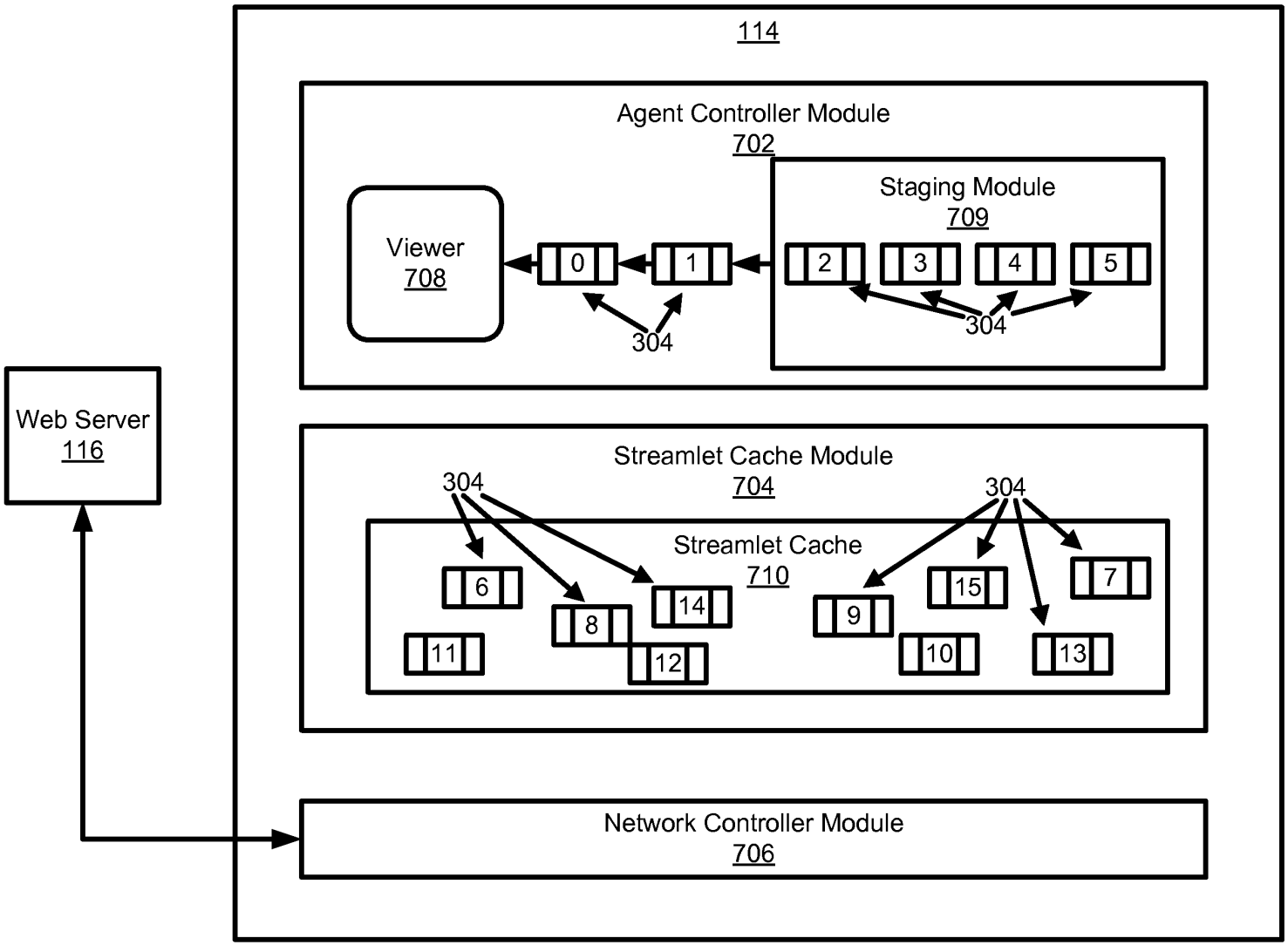


FIG. 7

Webgroup CZ a.s. Ex. 1002, Page 1399 of 1406

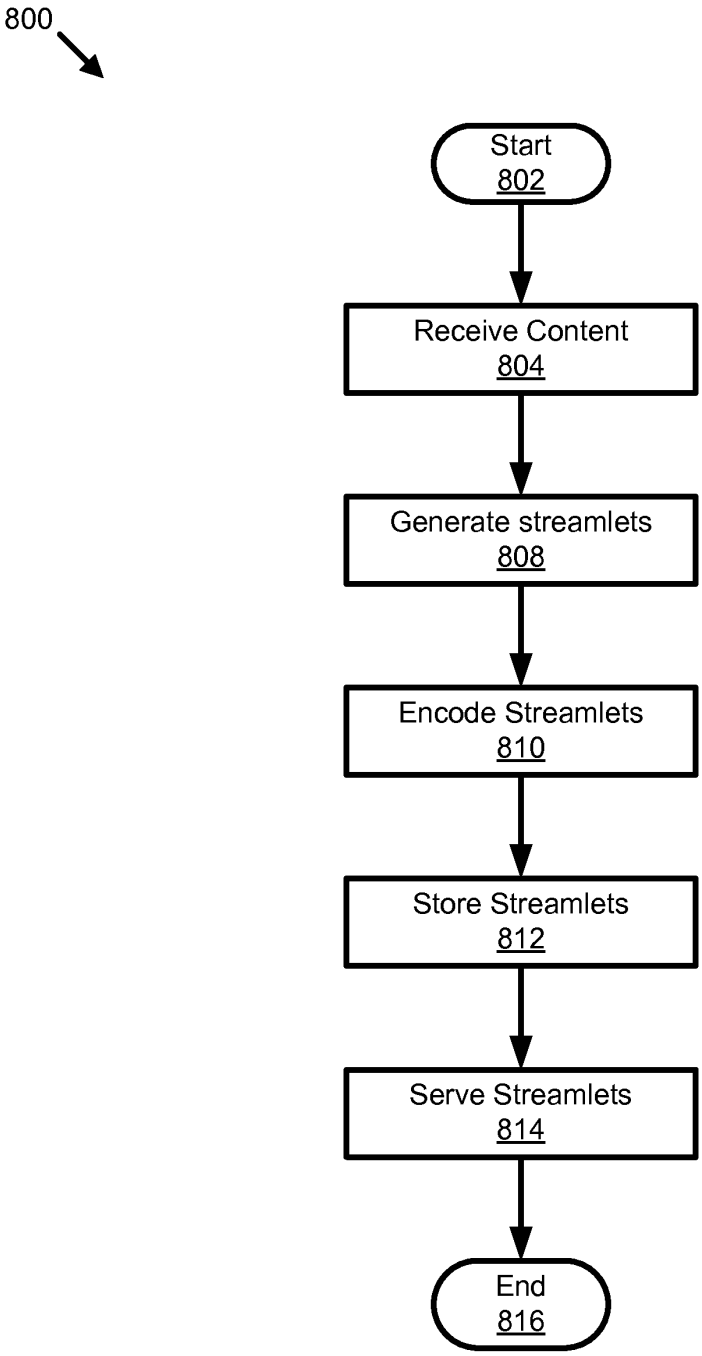

800
Start
802
Receive Content
804
Generate streamlets
808
Encode Streamlets
810
Store Streamlets
812
Serve Streamlets
814
End
816

FIG. 8

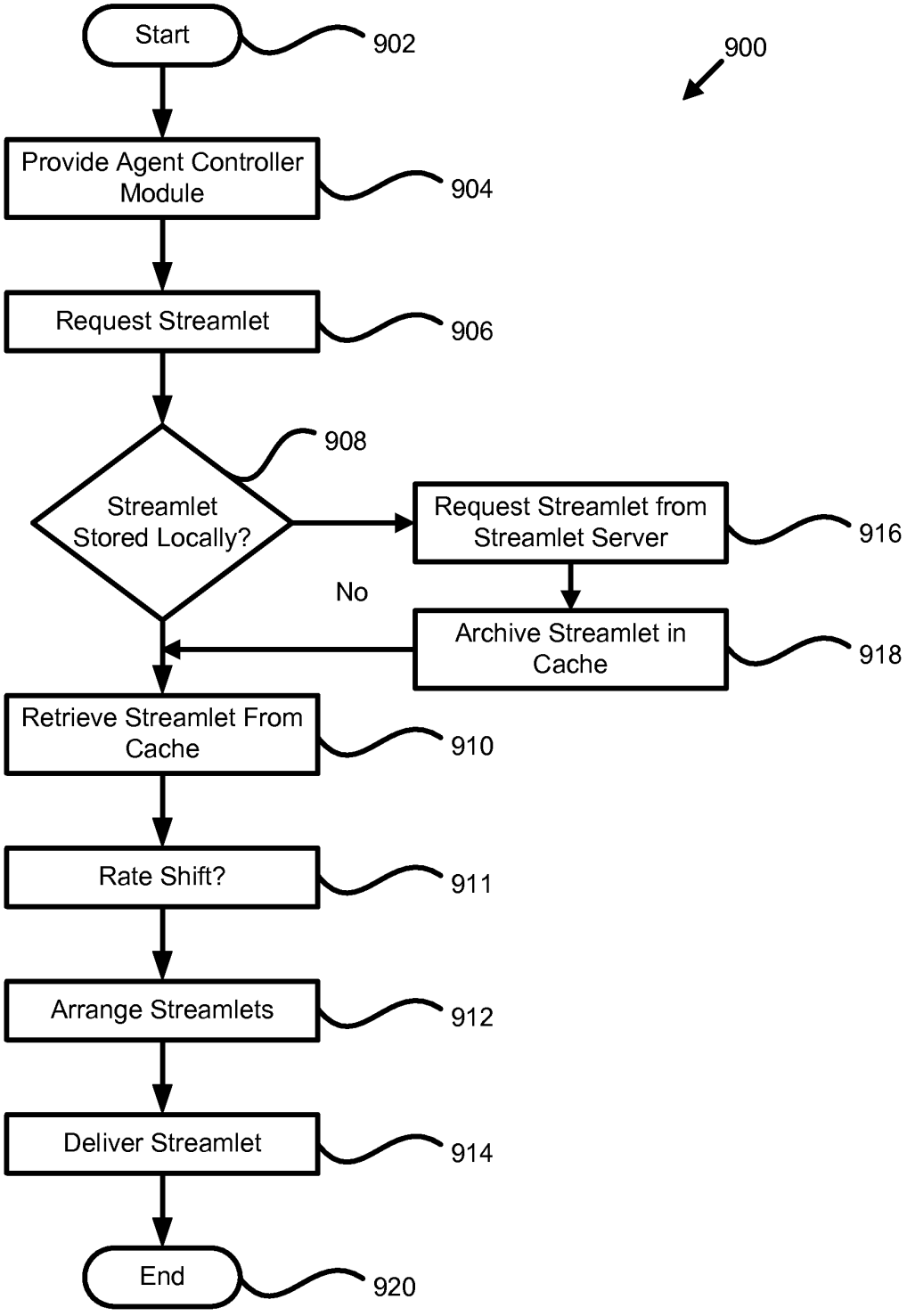

Start
902
900
Provide Agent Controller Module
904
Request Streamlet
906
908
Streamlet Stored Locally?
Request Streamlet from Streamlet Server
916
No
Archive Streamlet in Cache
918
Retrieve Streamlet From Cache
910
Rate Shift?
911
Arrange Streamlets
912
Deliver Streamlet
914
End
920

FIG. 9

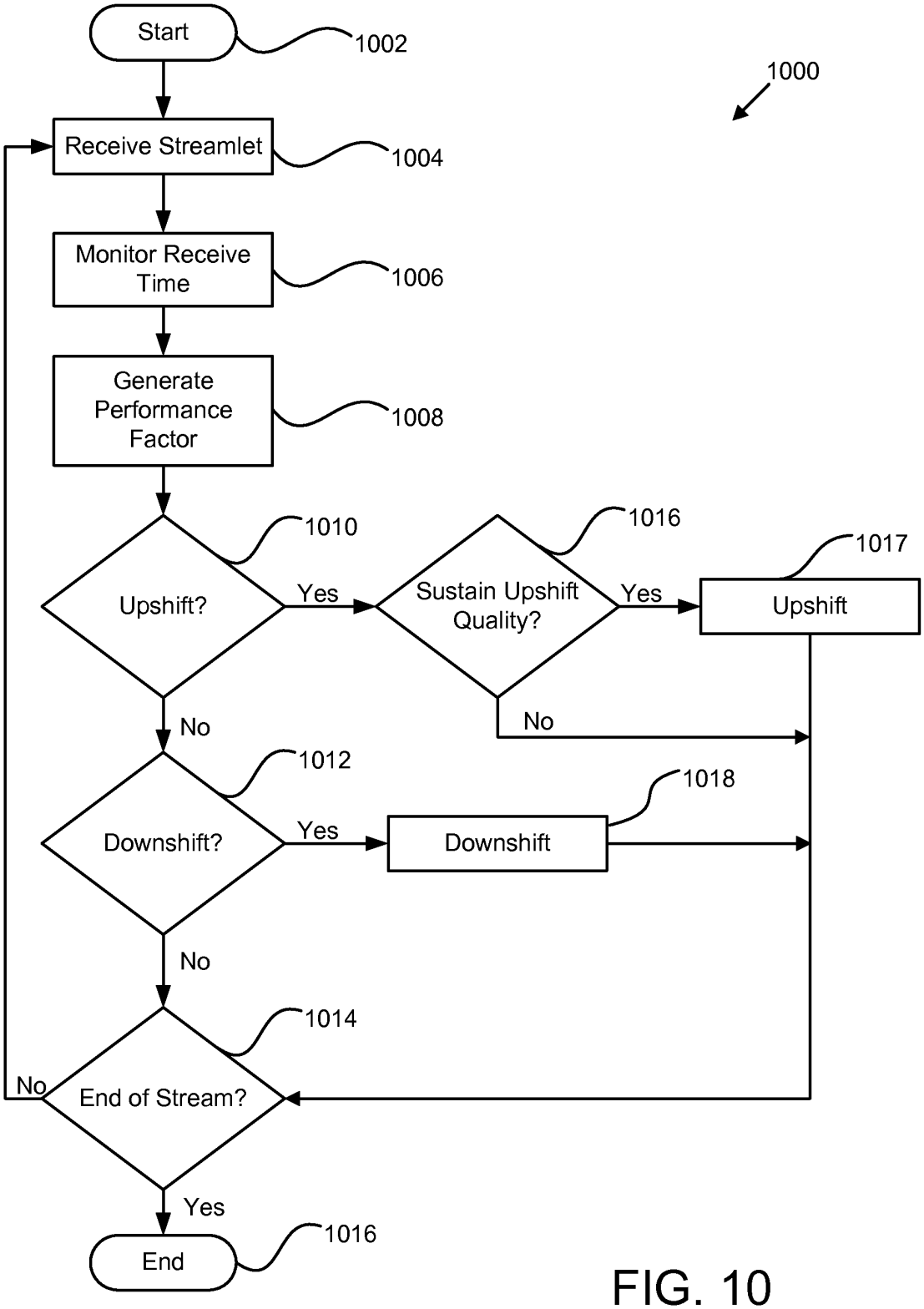

Start
1002
1000
Receive Streamlet
1004
Monitor Receive Time
1006
Generate Performance Factor
1008
1010
Upshift?
Yes
1016
Sustain Upshift Quality?
Yes
1017
Upshift
No
No
1012
Downshift?
Yes
1018
Downshift
No
1014
No
End of Stream?
Yes
1016
End

FIG. 10

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial. No.:	TBD	Confirmation No.:	TBD
Examiner:	TBD	Art Unit:	TBD
Filed:	Herewith	Customer No.:	70560
Title:	**APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING**		

Attorney Docket No.: 066.0141x1C9

PRELIMINARY AMENDMENT

Mail Stop AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

FILED ELECTRONICALLY USING THE PTO-EFS SYSTEM

Commissioner:

Please amend the above-referenced application prior to examination.

Amendments to the Specification begin on the following page (page 2).

Remarks begin on page 3 of this paper.

AMENDMENTS TO THE SPECIFICATION

PLEASE AMEND PARAGRAPH 0001 OF THE SPECIFICATION AS FOLLOWS:

[0001] This application is a continuation of U.S. Patent Application Serial No. 16/004,056 filed on June 8, 2018, which is a continuation of U.S. Patent Application Serial No. 15/414,025 (now US Patent No. 9,998,516) filed on January 24, 2017, which is a continuation of U.S. Patent Application No. 14/719,122 filed on May 21, 2015, which is a continuation of U.S. Patent Application No. 14/106,051 filed on December 13, 2013 (now U.S. Patent No. 9,071,668), which is a continuation of U.S. Patent Application Serial No. 13/617,114, filed on September 14, 2012 (now US Patent No. 8,612,624), which is a continuation of U.S. Patent No. 12/906,940 filed on October 18, 2010 (now US Patent No. 8,402,156), which is a continuation of U.S. Patent Application Number 11/673,483, filed on February 9, 2007 (now US Patent No. 7,818,444), which is a continuation-in-part of Application No. 11/116,783, filed on April 28, 2005 (now U.S. Patent No. 8,868,772), which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on April 31, 2004, all of which are incorporated herein by reference.

REMARKS

This preliminary amendment is being filed at the same time as the attached application to update the priority information in paragraph 0001. Please enter the foregoing amendments prior to substantive examination. No new matter has been added, and support for all of the claimed features can be found in the originally-filed application.

This application is being filed as a "Track One" application with a certification and request for prioritized examination. If any documents or fees that are required to process this application as a Track One application are not submitted herewith, ***please consider this as a petition under Rule 181 (or any other appropriate rule) for appropriate relief, and as authorization to charge Deposit Account No. 50-2091 for any fees that may be due***, including any fees to process the Track One application and any associated petitions or other documents.

Should the Examiner have any suggestions that would advance prosecution at any time during prosecution, we would welcome a telephone call to (480) 385-5069 or an email to bcarlson@lkglobal.com. *Recognizing that Internet communications are not secure, we hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. We understand that a copy of these communications will be made of record in the application file. (MPEP 502.03). Without limiting the foregoing, we further authorize the use of email for informal correspondence, including the exchange of proposed amendments or other draft documents.*

If any additional documents or fees are required to consider this submittal or to otherwise prevent abandonment of this application, please consider this as a petition and request for any needed relief and as authorization to charge Deposit Account No. 50-2091 for any fees that may be due.

Respectfully submitted,

LORENZ & KOPF, LLC

Dated: May 18, 2020

By: /Brett A. Carlson /
Brett A. Carlson
Reg. No. 39,928

bcarlson@lkglobal.com
480-385-5069

LORENZ & KOPF, LLC (*formerly Ingrassia, Fisher & Lorenz, PC*)
Customer No. 70560