IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial. No.:	TBD	Confirmation No.:	TBD
Examiner:	TBD	Art Unit:	TBD
Filed:	Herewith	Customer No.:	70560

Attorney Docket No.: 9401-00279 (P2007-02-01.2.11)

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

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.

Aylo Exhibit 1014
Aylo v. DISH, IPR2024-00518
Page 1 of 1422

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. 17/962,231 filed on October 7, 2022, which is a continuation of U.S. Patent Application Serial No. 16/876,579 filed on May 18, 2020 (now US Patent No. 11,470,138), which is a continuation of 16/004,056 filed on June 8, 2018 (now US Patent No. 10,659,513), 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 (now US Patent No. 9,571,551), 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 30, 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) 344 9885 or an email to brett@kwlaw.co. *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. 60-2406 for any fees that may be due.

Respectfully submitted,

KW Law, LLP

Dated: December 21, 2022

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

KW Law, LLP
Customer No. 70560
brett@kwlaw.co

PTO/SB/08a (02-18)
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Application Number	
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First Named Inventor	DAVID F. BRUECK
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Examiner Name	
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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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	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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	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	

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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.

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39,928

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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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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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	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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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	First Named Inventor	DAVID F. BRUECK
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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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	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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	23	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Durrant et. al.	
	24	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Gentric	
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	26	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Klemets	
	27	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Oplayo	
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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
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	Attorney Docket Number	9401-00279

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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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☒ 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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39,928

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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	9401-00279

SIGNATURE of Applicant or Patent Practitioner

Signature	/BRETT A. CARLSON/	Date	2022-12-21
Name	Brett A. Carlson	Telephone	480.241.8219
Registration Number	39,928		

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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)

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Signature	/Max Gratton/	Date (Optional)	7/6/2015
Name	Max S. Gratton		
Title	Director & Senior Corporate Counsel of DISH Technologies L.L.C.		

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Attorney Docket Number	9401-00279

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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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	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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	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.	
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	7	20060010003	A1	2006-01-12	Kruse	
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	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	
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	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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	Filing Date	
	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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.	☒

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	
	Filing Date	
	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

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)	2022-12-21
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.

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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.

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.

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	9401-00279
	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	State/Province	Country of Residence
SARATOGA SPRINGS	UT	US

Mailing Address of Inventor:

Address 1	962 NORTH RATTLER ROAD
Address 2	

City	State/Province	Postal Code	Country
SARATOGA SPRINGS	UT	84043	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	State/Province	Country of Residence
CEDAR HILLS	UT	US

Mailing Address of Inventor:

Address 1	10639 NORTH AVALON
Address 2	

City	State/Province	Postal Code	Country
CEDAR HILLS	UT	84062	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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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	863 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	dish@kwlaw.co	Add Email	Remove Email

Application Information:

Title of the Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING		
Attorney Docket Number	9401-00279	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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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	17962231	2022-10-07	

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
17962231	Continuation of	16876579	2020-05-18	11470138	2022-10-11

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
16876579	Continuation of	16004056	2018-06-08	10659513	2020-05-19

Prior Application Status	Patented	Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
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	9571511	2017-02-14

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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)
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
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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ 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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	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)	2022-12-21
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

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	9401-00279
	Application Number	
Title of Invention	APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING	

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Privacy Act Statement

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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 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 CooperationTreaty.

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.

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	
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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.	

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	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	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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	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	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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	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
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	7	2004021668	WO	A1	2004-03-11	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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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]
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	First Named Inventor	DAVID F. BRUECK
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	Examiner Name	
	Attorney Docket Number	9401-00279

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.

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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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39,928

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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).

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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First Named Inventor	DAVID F. BRUECK
Art Unit	
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	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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 NVALIDITY: 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	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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]	
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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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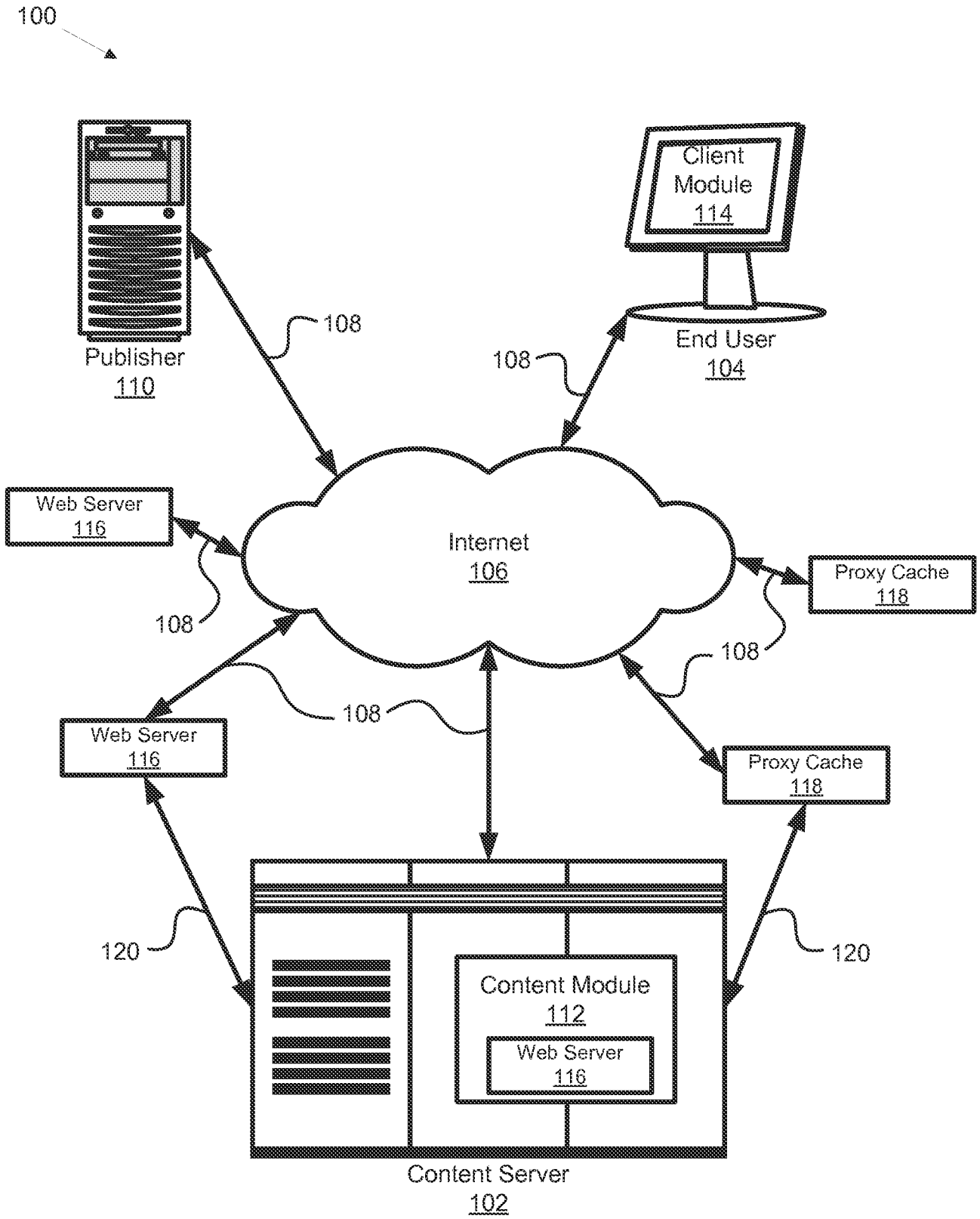

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FIG. 1

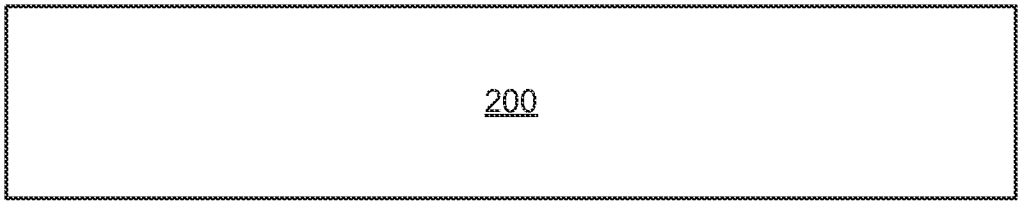


FIG. 2a

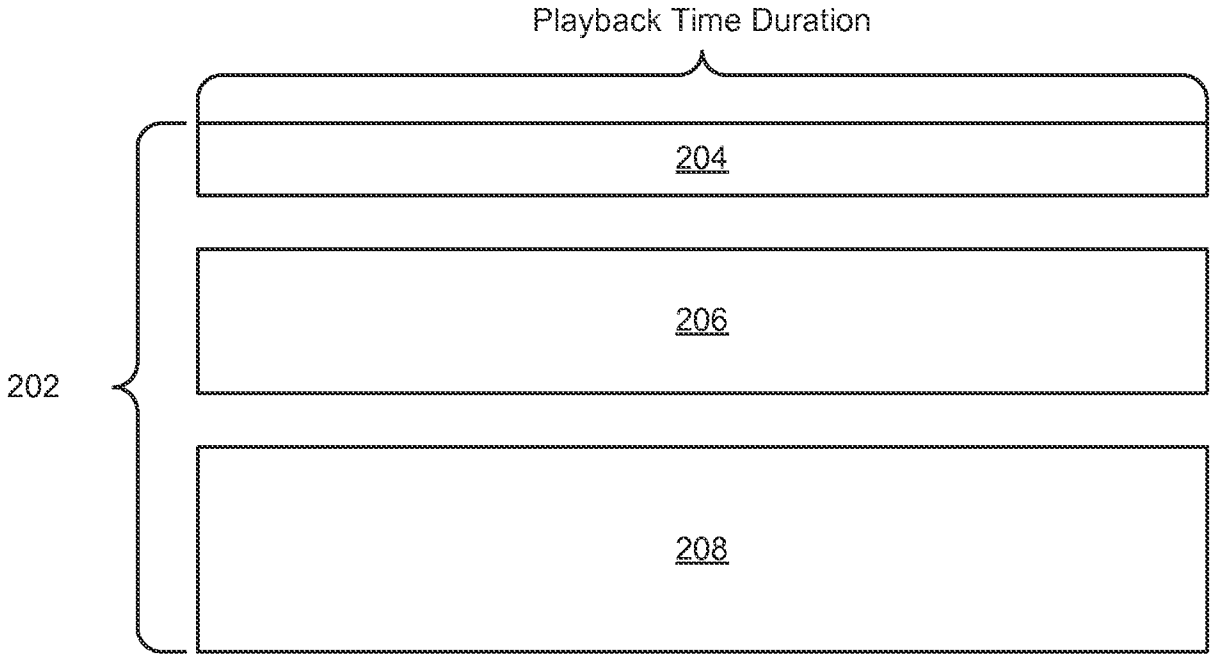


FIG. 2b

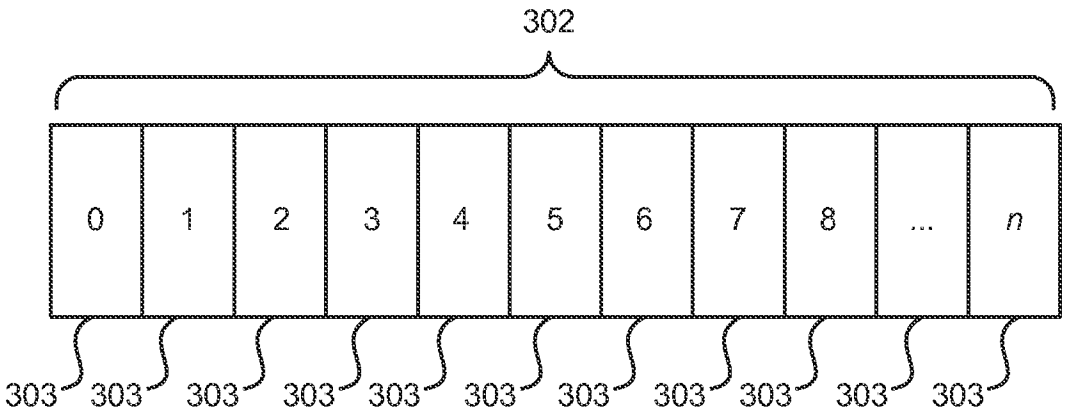

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FIG. 3a

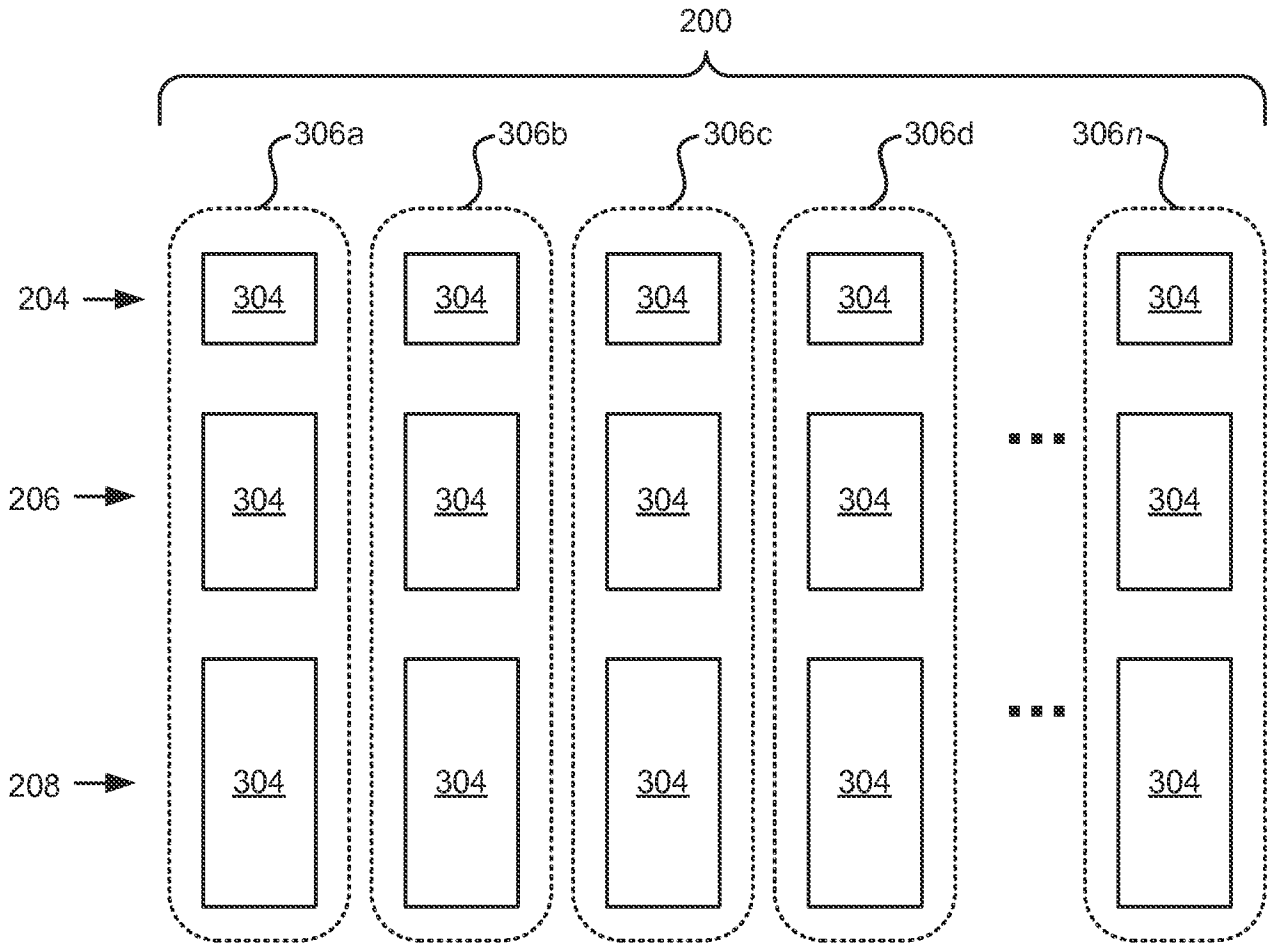

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FIG. 3b

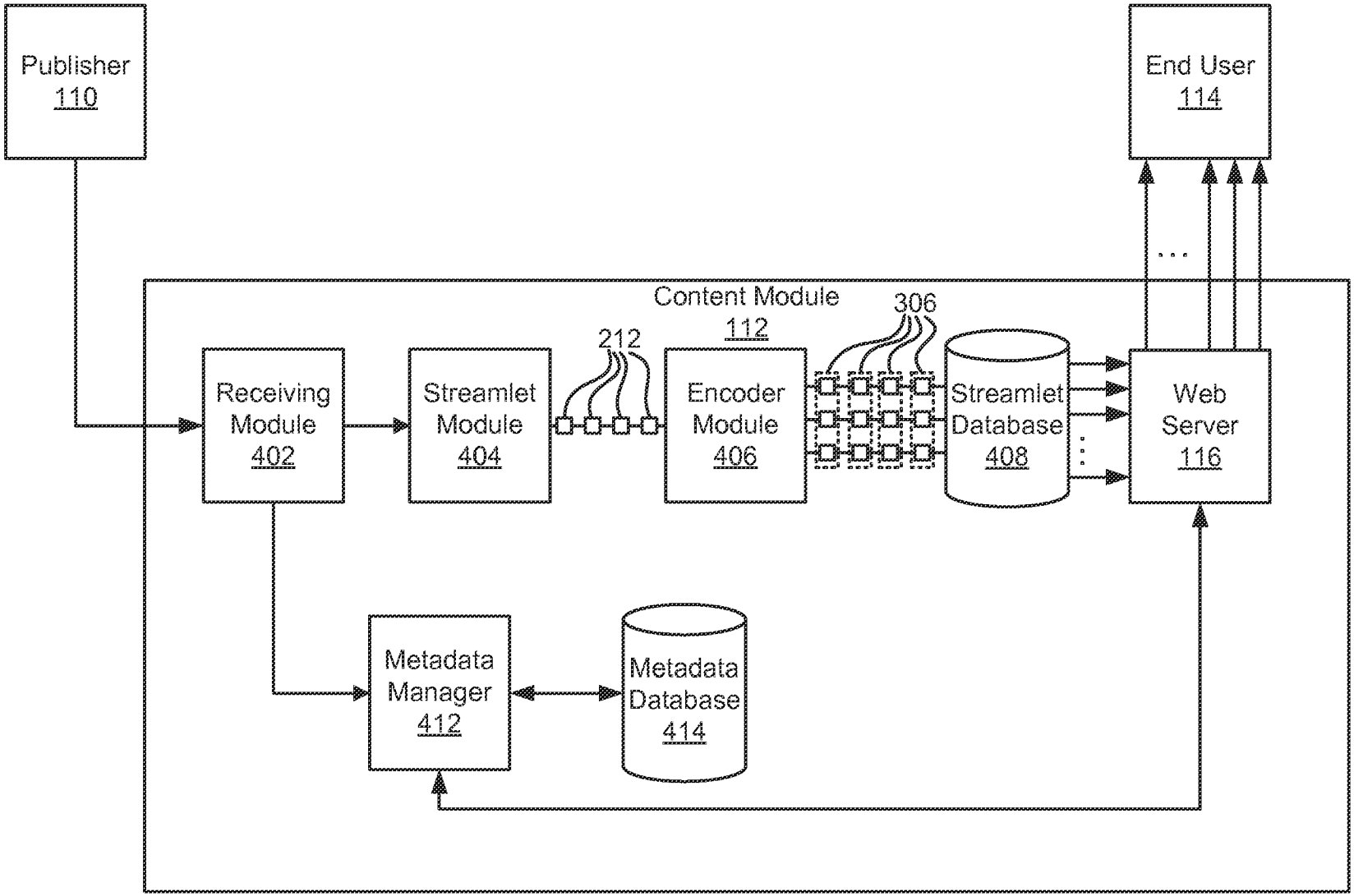

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Receiving
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Encoder
Module
406
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Manager
412
Metadata
Database
414

FIG. 4

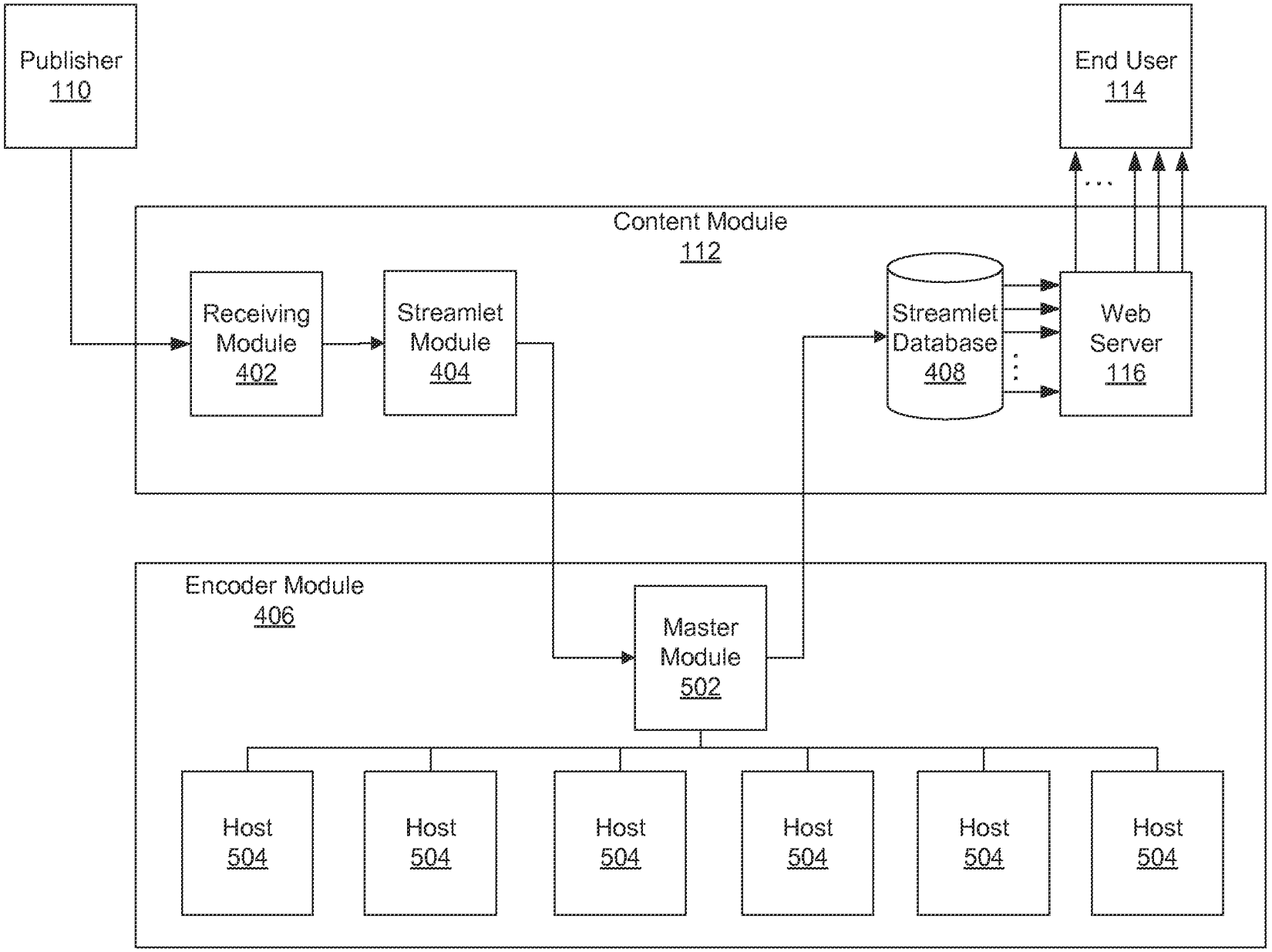

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Content Module
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402
Streamlet
Module
404
Streamlet
Database
408
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Server
116
Encoder Module
406
Master
Module
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Host
504
Host
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504

FIG. 5a

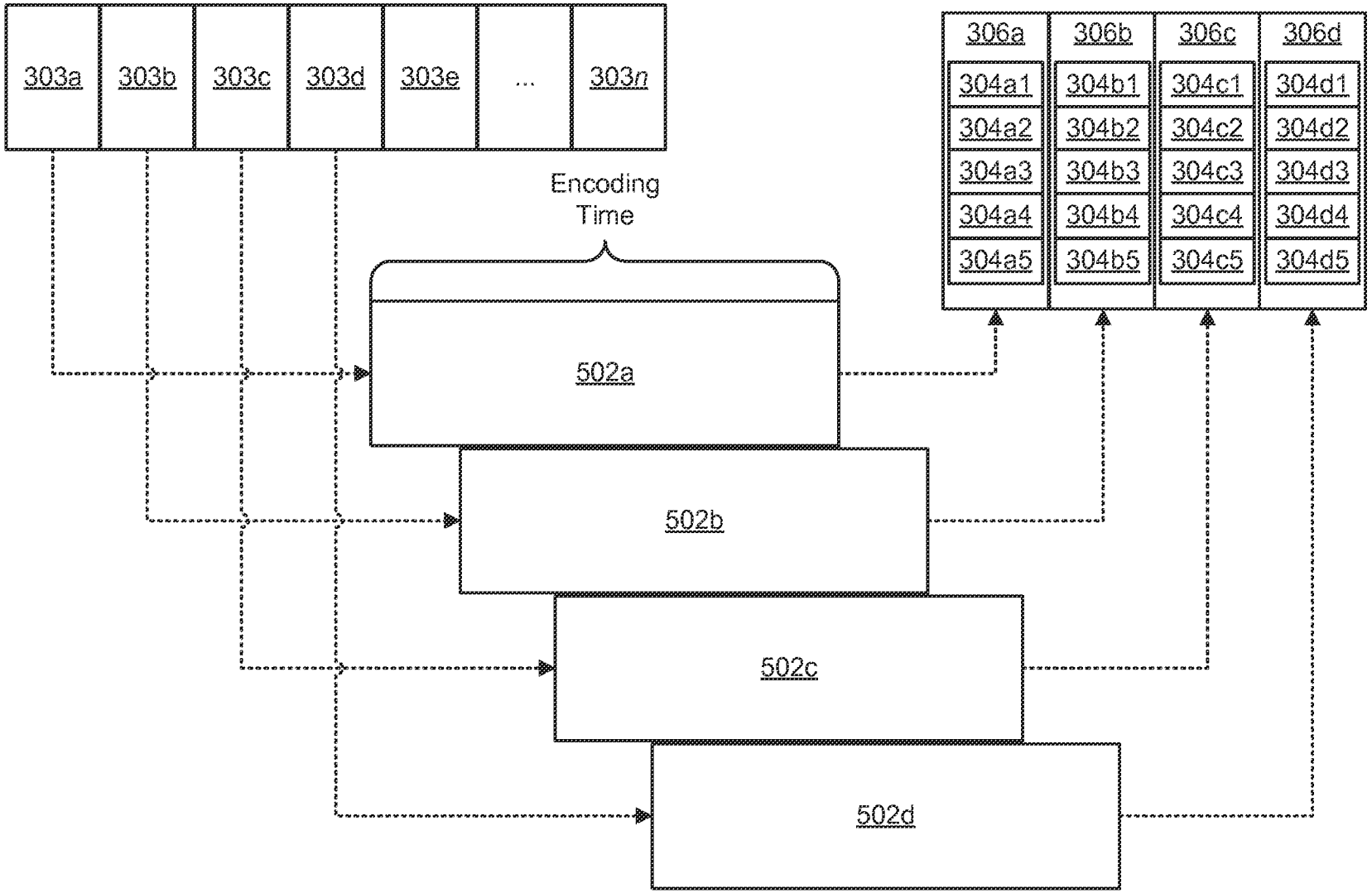

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303b
303c
303d
303e
...
303n
Encoding Time
502a
502b
502c
502d
306a
306b
306c
306d
304a1
304a2
304a3
304a4
304a5
304b1
304b2
304b3
304b4
304b5
304c1
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304c3
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304c5
304d1
304d2
304d3
304d4
304d5

FIG. 5b

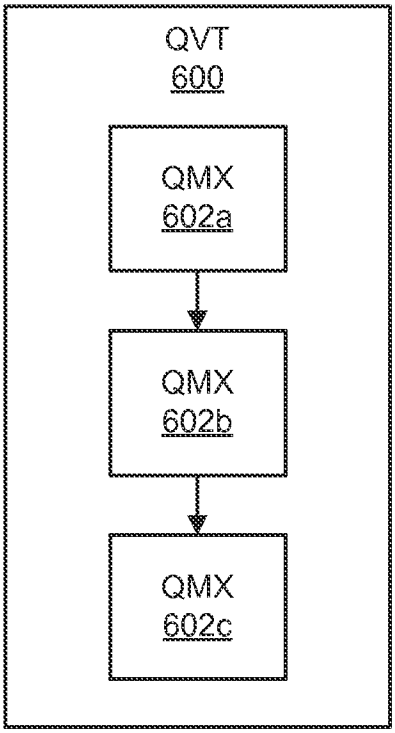


FIG. 6a

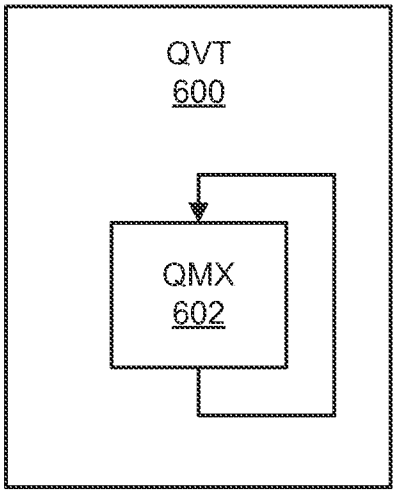


FIG. 6b

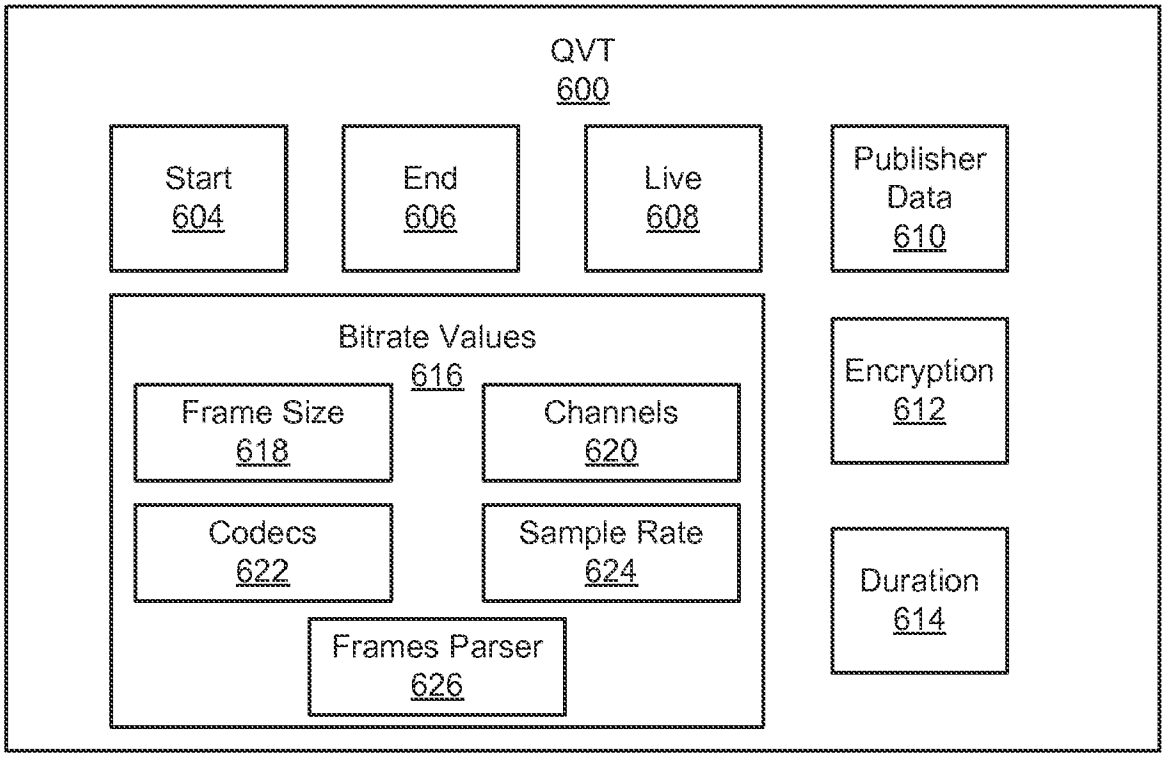


FIG. 6c

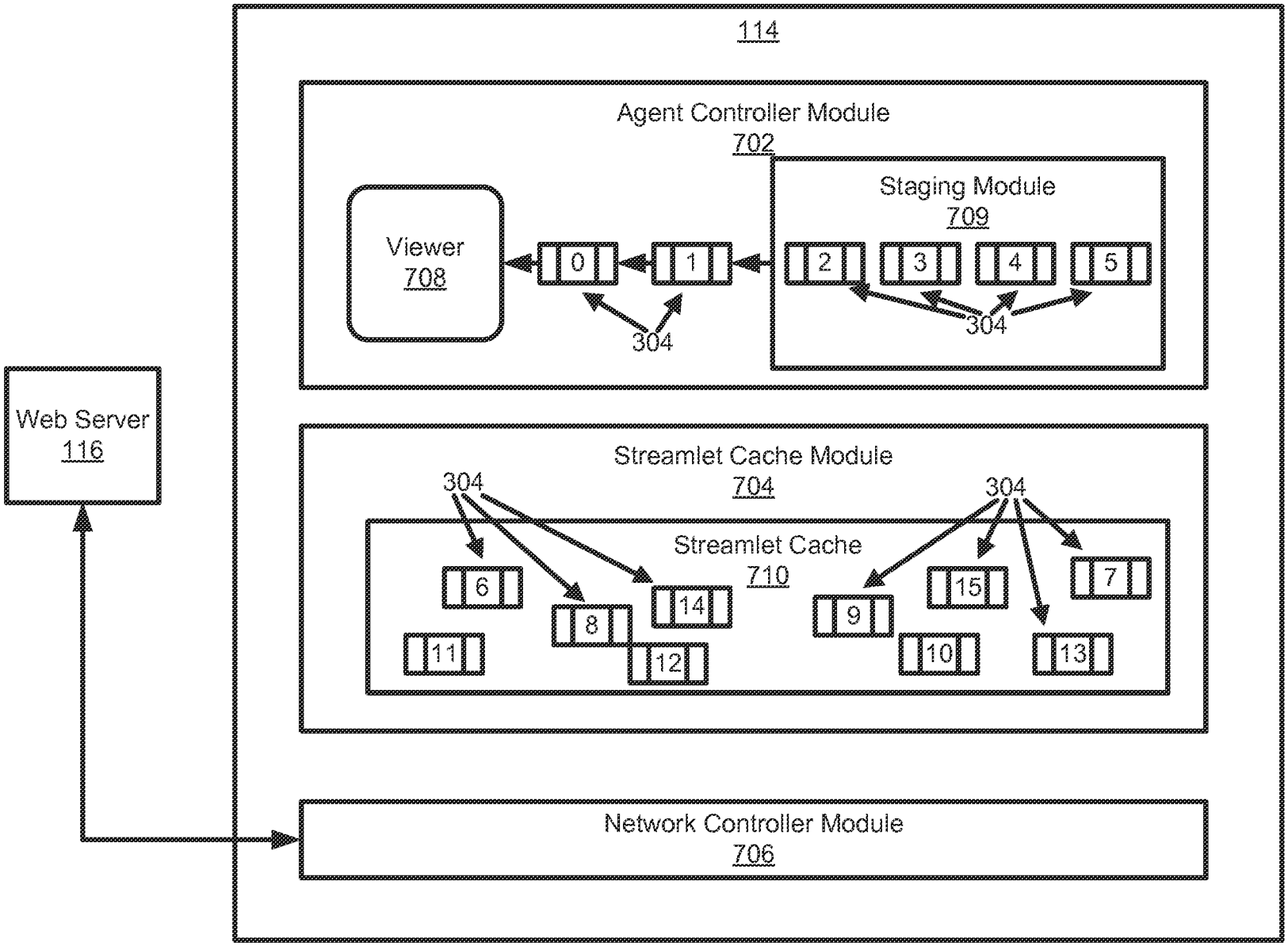

114
Agent Controller Module
702
Staging Module
709
Viewer
708
0
1
2
3
4
5
304
304
Web Server
116
Streamlet Cache Module
704
304
304
Streamlet Cache
710
6
14
8
12
11
9
15
7
10
13
Network Controller Module
706

FIG. 7

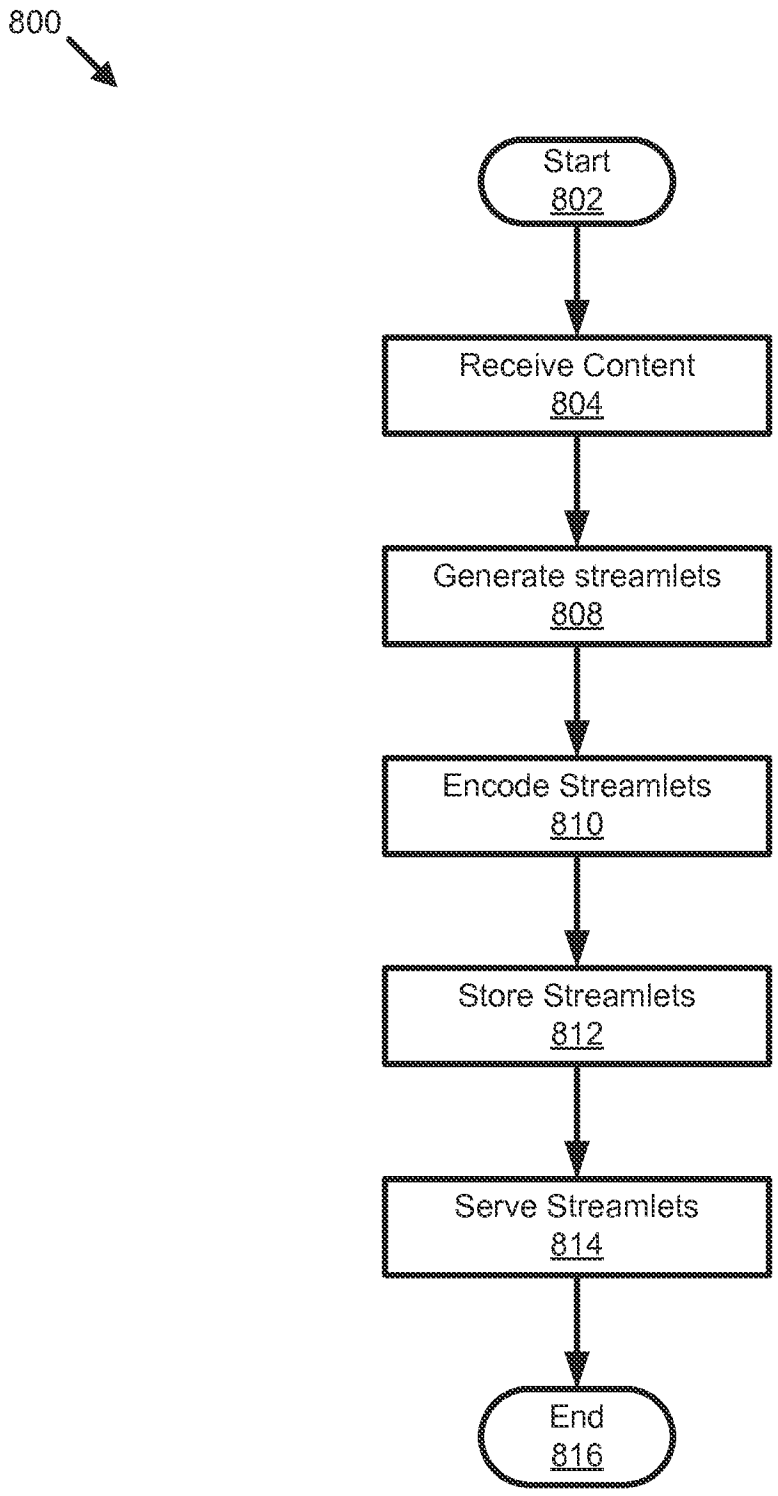

800
Start
802
Receive Content
804
Generate streamlets
808
Encode Streamlets
810
Store Streamlets
812
Serve Streamlets
814
End
816

FIG. 8

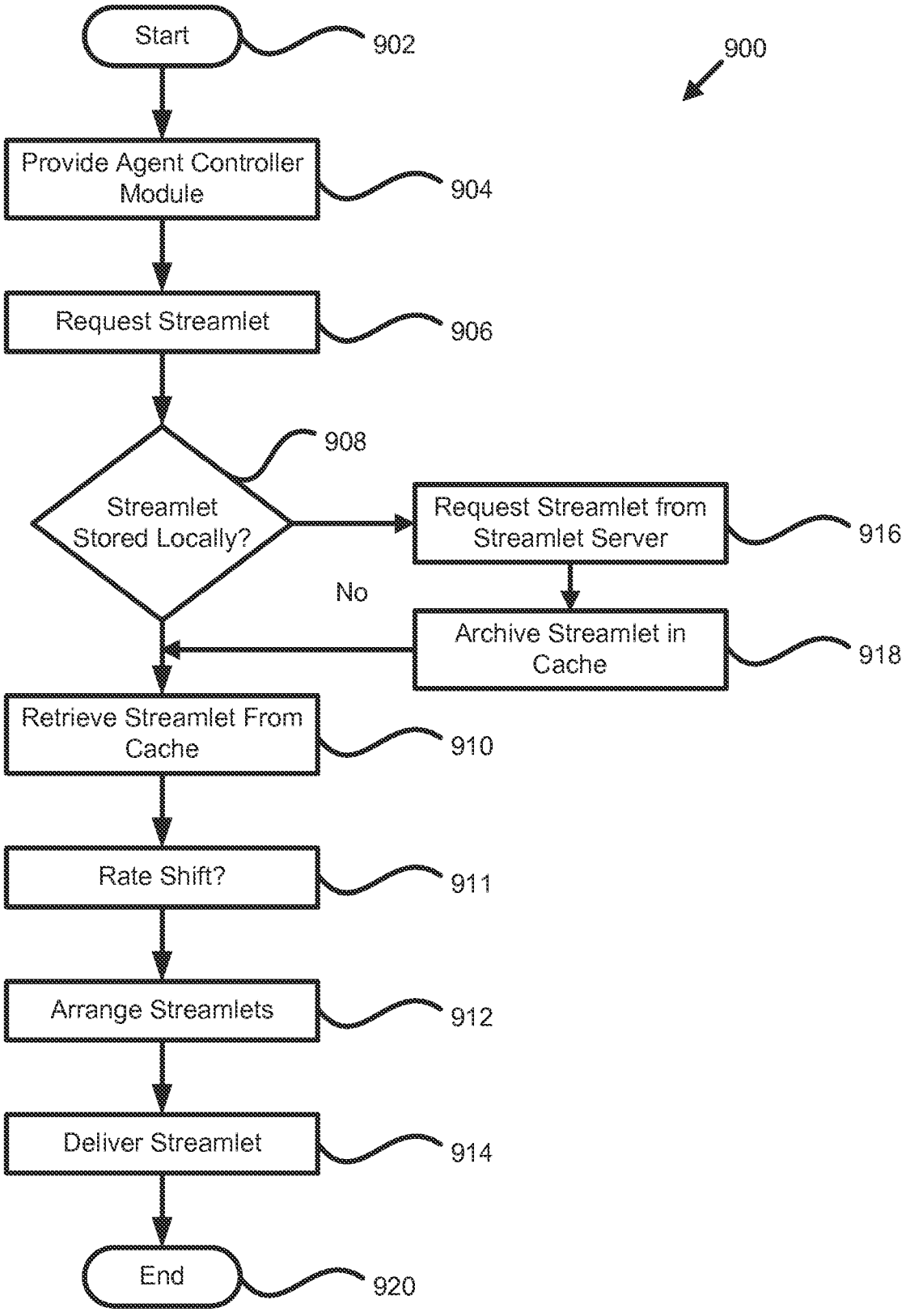

Start
902
900
Provide Agent Controller Module
904
Request Streamlet
906
908
Streamlet Stored Locally?
Request Streamlet from Streamlet Server
916
No
Archive Streamlet in Cache
918
Retrieve Streamlet From Cache
910
Rate Shift?
911
Arrange Streamlets
912
Deliver Streamlet
914
End
920

FIG. 9

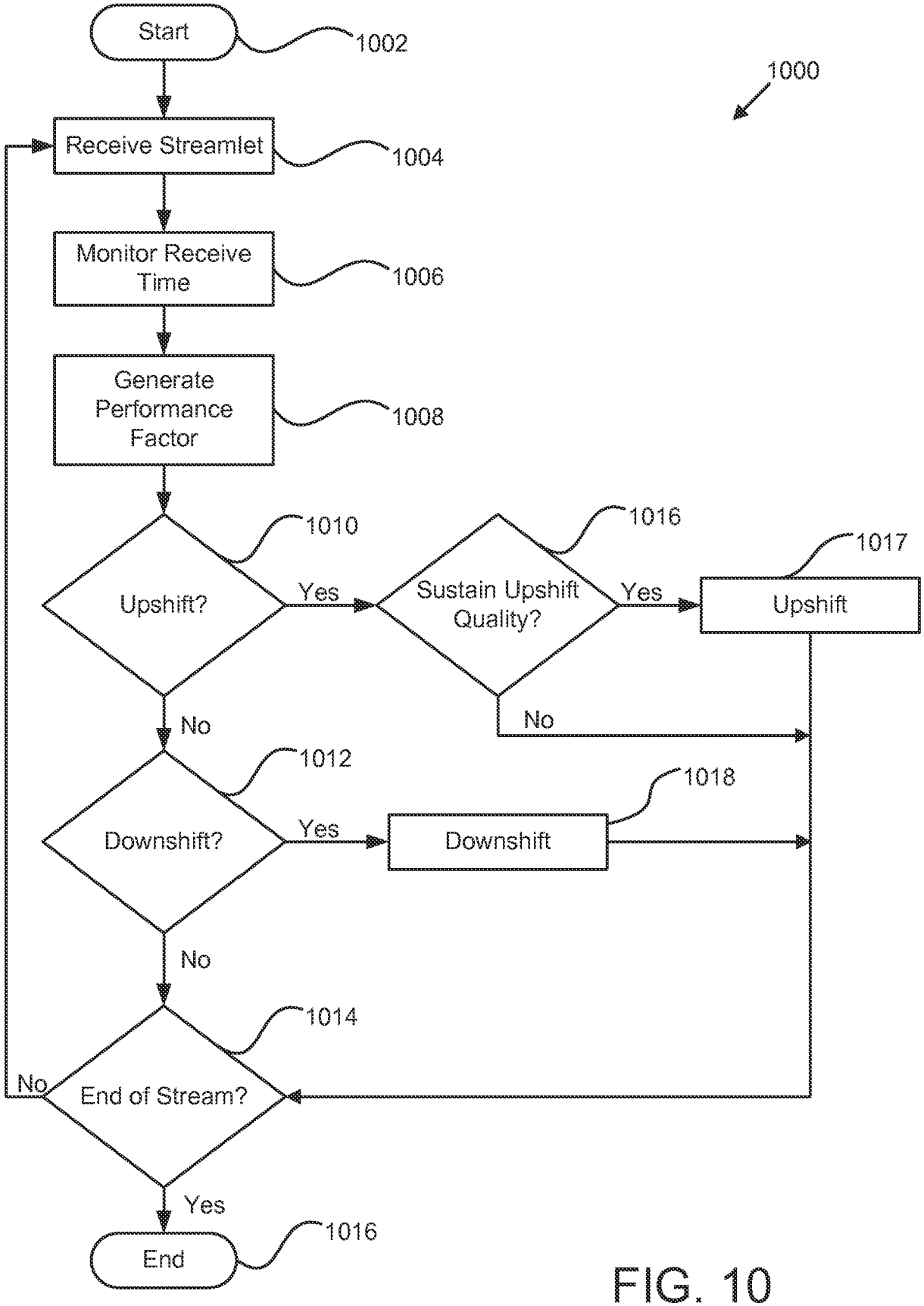

Start
1002
1000
Receive Streamlet
1004
Monitor Receive Time
1006
Generate Performance Factor
1008
1010
Upshift?
Yes
1016
Sustain Upshift Quality?
Yes
1017
Upshift
No
No
1012
Downshift?
Yes
1018
Downshift
No
1014
No
End of Stream?
Yes
1016
End

FIG. 10

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/069,450	12/21/2022 02:11:42 PM ET	9401-00279

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 #	8508	FILED BY	Blake Scheffey
PATENT CENTER #	61335290	AUTHORIZED BY	Brett Carlson
CUSTOMER #	70560	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	DAVID F. BRUECK

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 6960	E2022BKE12064621	Blake Scheffey

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1830	PROCESSING FEE, EXCEPT IN PROVISIONAL APPLICATIONS	140.00	1	140.00
1817	REQUEST FOR PRIORITIZED EXAMINATION	4200.00	1	4200.00
1111	UTILITY PATENT APPL. SEARCH FEE	700.00	1	700.00
1011	BASIC FILING FEE - UTILITY (PAPER FILING ALSO REQUIRES NON-ELECTRONIC FILING FEE UNDER 1.16(T))	320.00	1	320.00
1311	PATENT APPL. EXAMINATION FEE	800.00	1	800.00

1202	EACH CLAIM IN EXCESS OF 20	100.00	10	1000.00
			TOTAL AMOUNT:	**$7,160.00**

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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 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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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
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APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 31

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
9401-00279_ADS.pdf		10	Application Data Sheet	1781 KB
Warning: The attached version of the AIA/14 form is not the current version and data may not fully load to USPTO systems.				
9401-00279_Specification.pdf		36	-	14539 KB
9401-00279_Specification-SPEC.pdf	(1-28)	28	Specification	14776 KB
9401-00279_Specification-CLM.pdf	(29-35)	7	Claims	58 KB
9401-00279_Specification-	(36-36)	1	Abstract	44 KB

ABST.pdf				
9401-00279__RequestForPrioritizedExamination.pdf		2	Track One Request	139 KB
9401-00279_PreliminaryAmendment.pdf		3	-	59 KB
9401-00279_PreliminaryAmendment-A.PE.pdf	(1-1)	1	Preliminary Amendment	24 KB
9401-00279_PreliminaryAmendment-SPEC.pdf	(2-2)	1	Specification	21 KB
9401-00279_PreliminaryAmendment-REM.pdf	(3-3)	1	Applicant Arguments/Remarks Made in an Amendment	32 KB
9401-00279_Drawings.pdf		11	Drawings-only black and white line drawings	673 KB
9401-00279_DeclarationOfJointInvs.pdf		3	Oath or Declaration filed	394 KB
9401-00279_POA.pdf		2	Power of Attorney	239 KB
9401-00279_IDS-1.pdf		22	Information Disclosure Statement (IDS) Form (SB08)	604 KB
9401-00279_IDS-2.pdf		8	Information Disclosure Statement (IDS) Form (SB08)	519 KB
9401-00279_IDS-3.pdf		5	Information Disclosure Statement (IDS) Form (SB08)	601 KB

9401-00279_IDS-4.pdf	9	Information Disclosure Statement (IDS) Form (SB08)	1013 KB
9401-00279_IDS-5.pdf	8	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
9401-00279_IDS-6.pdf	6	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
9401-00279_IDS-7.pdf	7	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
9401-00279_IDS-8.pdf	7	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
9401-00279_IDS-9.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	1010 KB
9401-00279_IDS-10.pdf	5	Information Disclosure Statement (IDS) Form (SB08)	1011 KB
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9401-00279_IDS-14.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	598 KB
9401-00279_IDS-14_NPL-1.pdf	52	Non Patent Literature	961 KB
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9401-00279_IDS-14_NPL-	6	Non Patent Literature	173 KB

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9401-00279_IDS-14_NPL-4.pdf	59	Non Patent Literature	2916 KB
9401-00279_IDS-14_NPL-5.pdf	63	Non Patent Literature	419 KB
9401-00279_IDS-14_NPL-6.pdf	31	Non Patent Literature	407 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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New Applications Under 35 U.S.C. 111

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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.

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	

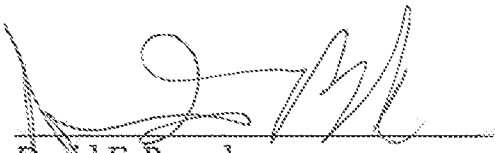
2. The above-identified patents and applications were made or authorized to be made by me. I believe that I am the inventor or an original joint inventor of a claimed invention in each of the applications and patents referenced above.

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

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

PTO/SB/424 (12-11)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	Brueck et al.	Nonprovisional Application Number (if known):	
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 December 21, 2022
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 _____ forms are submitted.

Privacy Act Statement

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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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	9401-00279

	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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	Attorney Docket Number	9401-00279

	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).

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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.

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	Attorney Docket Number	9401-00279

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)	2022-12-21
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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Application Number	
Filing Date	
First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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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	11470138		2022-10-11	Brueck et al.	

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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]

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	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	1	INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND RECOMMENDED DETERMINATION ON REMEDY AND BOND US Int'l Trade Commission Investigation No. 337-TA-1265 (September 9, 2022)	

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Examiner Signature		Date Considered	

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Name/Print	Brett A. Carlson	Registration Number	39928

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PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	1	Respondents' Reply to the Commission's November 18, 2022 Request for Written Submissions on the Issues Under Review and on Remedy, the Public Interest, and Bonding (Redacted) dated December 9, 2022 (52 pages).	
	2	[Public Version] Response of the Office of Unfair Import Investigations to the Commission's Request for Written Submissions on the Issues Under Review and on Remedy, Bonding, and the Public Interest (Redacted) dated December 2, 2022 (65 pages).	
	3	Notice of Commission Determination to Review the Final Initial Determination in Part; Request for Written Submissions on the Issues Under Review and on Remedy, the Public Interest, and Bonding dated November 18, 2022 (6 pages).	
	4	Complainants' Opening Submission on the Issues Under Review and on Remedy, the Public Interest, and Bonding (Redacted) dated December 2, 2022 (59 pages).	
	5	Respondents' Response to the Commission's November 18, 2022 Request for Written Submissions on the Issues Under Review and on Remedy, the Public Interest and Bonding (Redacted) dated December 2, 2022 (63 pages).	
	6	Complainants' Reply Submission to the Commission's Questions on the Issues Under Review and On Remedy, the Public Interest, and Bonding (Redacted) dated December 9, 2022 (31 pages).	

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CERTIFICATION STATEMENT

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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

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.

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;

[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-

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

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

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

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

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

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

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

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.

[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.

[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

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:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

[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.

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.

CLAIMS

What is claimed is:

1. A method for adaptive-rate content streaming of digital content, the method comprising:

connecting a client module of an end user station to at least one server over a network via at least one transmission control protocol (TCP) connection over the network;

requesting, by the client module, a first streamlet from the at least one server that corresponds to a first portion of the digital content encoded at a first bit rate;

determining, by a client module, a first current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received;

in response to the determining, the client module requesting from the at least one server a second streamlet that corresponds to a second portion of the digital content encoded at a second bit rate different than the first bit rate, the second portion immediately subsequently adjacent to the first portion of the digital content during presentation; and

arranging, by the client module, the first and second portions of the digital content, received from the at least one server, in order of ascending presentation time for output to a presentation device.

2. The method of claim 1, wherein the requesting the second streamlet comprises transmitting a hypertext transfer protocol (HTTP GET) request to the at least one server.

3. The method of claim 1, wherein the at least one server comprises at least two servers and wherein the requesting further comprises requesting, by the client module at least one streamlet from a first server of the at least two servers and at least one other streamlet from a second server of the at least two servers other than the first server.

4. The method of claim 1, wherein the digital content is stored on the at least one server in a plurality of streamlets, each of the plurality of streamlets corresponding to a different temporal portion of said digital content and wherein each of the first and second streamlets is requestable

by the client module without regard to whether the client module has previously requested other streamlets of the digital content.

5. The method of claim 1, wherein the digital content is stored by the at least one server in a plurality of streamlets, wherein each of the plurality of streamlets is a separate individually-requestable file.

6. The method of claim 1, further comprising:

determining, at the client module, an inability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at the second bit rate;

in response to the determining the inability to receive the data at the rate sufficient for presenting the digital content, requesting, by the client module, a third streamlet corresponding to a third portion of the digital content encoded at the first bit rate, the third portion immediately subsequently adjacent to the second portion of the digital content during presentation.

7. The method of claim 1, wherein the determining comprises:

generating, by the client module, a performance factor indicative of a second current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at the second bit rate.

8. The method of claim 7, wherein the requesting of the second portion comprises requesting the second portion responsive to the performance factor exceeding a first threshold, and wherein the second bit rate exceeds the first bit rate.

9. The method of claim 1, further comprising:

receiving the digital content at an encoder of the at least one server;

encoding the streamlets of the digital content in at least the first and second bit rates at the encoder; and

storing, at a streamlet database of the at least one server, at least a portion of the streamlets of the digital content in at least one of the first and second bit rates.

10. The method of claim 9, wherein encoding the streamlets comprises encoding the streamlets using a multi-pass encoding process.

11. An end user station for adaptive-rate content streaming of digital content comprising:

a client module configured to be connected to a network having at least one server and further configured to request digital content over the network via at least one transmission control protocol (TCP) connection, wherein at least two different copies of the digital content are each encoded at different bit rates and stored on the at least one server, wherein each copy of the digital content is divided into a plurality of streamlets, each of the plurality of streamlets of a corresponding copy comprising a different portion of the digital content during presentation, wherein corresponding streamlets across the at least two different copies comprise the same corresponding portions of the digital content during presentation, and wherein the client module streams the digital content by:

requesting a first streamlet from the at least one server;

automatically requesting from the at least one server subsequent portions of the digital content by requesting for each subsequent portion one of the streamlets from the different copies of the digital content dependent upon successive determinations by the client module to change a currently requested bit rate to a higher or lower bit rate, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive digital content at a rate sufficient for presenting the digital content as the digital content is received;

making the successive determinations to change the digital content bit rate based on the factor using the streamlets of one of the different copies of the digital content having the highest bit rate determined receivable for presentation so that the client module selects a higher bit rate one of the different copies when the factor is greater than a first threshold and selects a lower bit rate one of the different copies when the factor is less than a second threshold; and

arranging the streamlets requested from the at least one server in order of ascending presentation time for output to a presentation device.

12. The end user station of claim 11, wherein at least some streamlets are requested from the at least one server via a hypertext transfer protocol (HTTP) GET request.

13. The end user station of claim 11, wherein the at least one server comprises at least two servers and wherein at least one streamlet is requested from a first of the at least one server and at least one other streamlet is requested from a second server of the at least one server other than the first server.

14. The end user station of claim 11, wherein the client module repeatedly generates the factor based on a moving time window.

15. The end user station of claim 11, wherein the client module generates the factor based on a current read ahead margin.

16. The end user station of claim 11, wherein a first streamlet of each copy of the digital content has the same first duration and corresponds to a same first temporal portion of the digital content, wherein a second streamlet of each copy of the digital content have the same second duration and correspond to a same second temporal portion of the digital content.

17. The end user station of claim 16, wherein the first and second duration of the first streamlets of each copy are different from the durations of the second streamlets of each copy.

18. The end user station of claim 16, wherein each of the first streamlets has a first duration that is a range of 0.1 to 5 seconds.

19. The end user station of claim 11, wherein the client module is further configured to transmit at least one virtual timeline request to retrieve a virtual timeline corresponding to the digital content and to receive the virtual timeline from the at least one server; and arrange the streamlets requested from the at least one server using the virtual timeline.

20. The end user station of claim 11, wherein the client module is further configured to

output the streamlets requested from the at least one server to the presentation device in the order of ascending presentation time.

21. The end user station of claim 11, further comprising the presentation device to display the streamlets in the order of ascending presentation time.

22. A method executable by a client device to output rate-adaptive streams received via at least one transmission control protocol (TCP) connection with at least one server over a network, the method comprising:

receiving, by the client device, digital content from the at least one server via the at least one TCP connection over the network, wherein multiple different copies of the digital content encoded at different bit rates are stored as individually-requestable portions on the at least one server, wherein each of the individually-requestable portions of a corresponding copy of the digital content is a different portion of the digital content during presentation, wherein the individually-requestable portions across the different copies yield the same portions of the digital content upon presentation, and wherein the receiving comprises:

requesting by the client device a plurality of sequential individually-requestable portions of one of the copies from the at least one server;

automatically requesting by the client device from the at least one server subsequent portions of the digital content by requesting for each such portion one of the individually-requestable portions from one of the copies dependent upon successive determinations by the client device to change a requested bit rate to a higher or lower bit rate one of the different copies, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received, individually-requestable wherein the factor relates to a performance of the network; and

making the successive determinations whether to change the requested bit rate based on the factor to achieve continuous presentation of the digital content using the individually-requestable portions of the highest bit rate one of the copies determined receivable at that time at a rate sufficient for presenting the digital content as the individually-requestable

portions of the digital content are received, wherein the making of the successive determinations to change the requested bit rate comprises:

requesting a subsequent individually-requestable portion from a higher bit rate one of the different copies than a currently requested one of the different copies when the at least one factor is greater than a first threshold; and

requesting a subsequent individually-requestable portion from a lower bit rate one of the different copies than the currently requested one of the different copies when the at least one factor is less than a second threshold; and

arranging the individually-requestable portions requested from the at least one server in order of ascending presentation time for output to a presentation device.

23. The method of claim 22, wherein the automatically requesting comprises requesting at least some individually-requestable portions via a hypertext transfer protocol (HTTP) GET request.

24. The method of claim 22, wherein the at least one server comprises at least two servers and wherein the client device requests at least one streamlet from a first server of the at least two servers and at least one other streamlet from a second server of the at least two servers other than the first server.

25. The method of claim 22, wherein the digital content is stored on the at least one server in a plurality of streamlets, each of the plurality of streamlets corresponding to a different temporal portion of said digital content and wherein each of the individually-requestable portions is requestable by the client device without regard to whether the client device has previously requested other individually-requestable portions of the digital content.

26. The method of claim 22, wherein the at least one TCP connection comprises a plurality of different TCP connections, and wherein the requesting of the plurality of sequential individually-requestable portions includes requesting sub-parts of the individually-requestable portions over different ones of the plurality of different TCP connections, and wherein the arranging includes reassembling the individually-requestable portions from the requested sub-parts.

27. The method of claim 22, wherein the making the successive determinations to change the requested bit rate comprises: determining if the higher bit rate one of the different copies can be received at a rate sufficient for presenting the digital content as the digital content is received.

28. The method of claim 22, wherein the factor is indicative of a delay or a loss in one or more of the at least one TCP connections.

29. The method of claim 22, wherein the at least one server comprises a cache server of a network infrastructure operator.

30. The method of claim 22, further comprising:

outputting the received content to the presentation device.

ABSTRACT OF THE DISCLOSURE

An apparatus for multi-bit rate 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 bit rate, 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.

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Art Unit	
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Attorney Docket Number	9401-00279

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	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.	
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	9	6112239		2000-08-29	Kenner et al.	
	10	6154744		2000-11-28	Kenner et al.	
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	2	20030061305	A1	2003-03-27	Copley 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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	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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	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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Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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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	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.	

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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	20020156912	A1	2002-10-24	Hurst et al.	

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	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	

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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	0365683	EP	A1	1990-05-02	OTSUKA PHARMA 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.	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.	☒
	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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	Examiner Name	
	Attorney Docket Number	9401-00279

	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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[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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☒ 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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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Application Number	
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	Attorney Docket Number	9401-00279

	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	
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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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R. DREW MAJOR, OREM, UT;

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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 17/962,231 10/07/2022
which is a CON of 16/876,579 05/18/2020 PAT 11,470,138
which is a CON of 16/004,056 06/08/2018 PAT 10,659,513
which is a CON of 15/414,025 01/24/2017 PAT 9,998,516
which is a CON of 14/719,122 05/21/2015 PAT 9,571,551
which is a CON of 14/106,051 12/13/2013 PAT 9,071,668
which is a CON of 13/617,114 09/14/2012 PAT 8,612,624
which is a CON of 12/906,940 10/18/2010 PAT 8,402,156
which is a CON of 11/673,483 02/09/2007 PAT 7,818,444
which is a CIP of 11/116,783 04/28/2005 PAT 8,868,772
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: 01/17/2023
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 18/069,450**
Projected Publication Date: 04/27/2023
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.

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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.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 18/069,450

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	320
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	700
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	800
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 100 =	1000
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x =	0
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
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1820

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	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

70560 7590 02/16/2023

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
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EXAMINER	
CENTRAL, DOCKET	

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
02/16/2023	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

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 18/069,450	**Applicant(s)** BRUECK et al.	
	Examiner FIKIRTE A GEREMEW	**Art Unit** OMBL	**AIA (FITF) Status** No

1. THE REQUEST FILED 21 December 2022 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 FIKIRTE GEREMEW at (703) 756-1930. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/FIKIRTE A GEREMEW/ PROGRAM SUPPORT ASSISTANT, OMBL	

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

70560 7590 03/16/2023

KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
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EXAMINER	
PATEL, CHIRAG R	

ART UNIT	PAPER NUMBER
2454	

NOTIFICATION DATE	DELIVERY MODE
03/16/2023	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

Office Action Summary	Application No. 18/069,450	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 December 21. 2022.

☐ 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) 1-11 and 22 is/are rejected.

8) ☑ Claim(s) 12-21 and 23-30 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 December 21, 2022 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 12/21/22 (x14).

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

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 § 2146 *et seq.* 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 11 and 22 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 3-4 and 8 of U.S. Patent No. 8,868,772 in view of Carmel et al. – hereinafter Carmel (US 6,389,473)

Instant Application	U.S. Patent No. 8,868,772
11. 11. An end user station for adaptive-rate content streaming of digital content comprising:	1. A method for presenting rate-adaptive streams, the method comprising:
a client module configured to be connected to a network having at least one server and further configured to request digital content over the network via at least one transmission control protocol (TCP) connection,	streaming by a media player operating on an end user station a video from a set of one or more servers,
wherein at least two different copies of the digital content are each encoded at different bit rates and stored on the at least one server,	wherein each of a plurality of different copies of the video encoded at different bit rates is stored as multiple files on the set of servers,
wherein each copy of the digital content is divided into a plurality of streamlets,	
each of the plurality of streamlets of a corresponding copy comprising a different portion of the digital content during presentation,	wherein each of the multiple files yields a different portion of the video on playback,

wherein corresponding streamlets across the at least two different copies comprise the same corresponding portions of the digital content during presentation, and	wherein the multiple files across the different copies yield the same portions of the video on playback, each of said files having a time index such that the files whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video, and
wherein the client module streams the digital content by: requesting a first streamlet from the at least one server;	wherein the streaming comprises: requesting by the media player a plurality of sequential ones of the files of one of the copies *from the set of servers* over a plurality of Transmission Control Protocol (TCP) connections based on the time indexes;
automatically requesting from the at least one server subsequent portions of the digital content by requesting for each subsequent portion one of the streamlets from the different copies of the digital content dependent upon successive determinations by the client module to change a currently requested bit rate to a higher or lower bit rate,	automatically requesting by the media player from the set of servers over the plurality of TCP connections subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies,
the automatically requesting including repeatedly generating a factor indicative of a current ability to receive digital content at a rate sufficient for presenting the digital content as the digital content is received;	said automatically requesting including, repeatedly generating a set of one or more factors indicative of the current ability to sustain the streaming of the video using the files from different ones of the copies, wherein the set of one or more factors relate to the performance of the network; and
making the successive determinations to change the digital content bit rate based on the factor using the streamlets of one of the different copies of the digital content having the highest bit rate determined receivable for presentation	*making the successive determinations to shift the playback quality based on at least one of the set of factors to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at that time;* and presenting the video by playing back with the media player on the end user station the requested files in order of ascending playback time.

so that the client module selects a higher bit rate one of the different copies when the factor is greater than a first threshold	3. The method of claim 1, wherein said making the successive determinations to shift comprises*: upshifting to a higher quality one of the different copies when the at least one factor is greater than a first threshold*; and determining if the higher quality playback can be sustained.
and selects a lower bit rate one of the different copies when the factor is less than a second threshold; and	4. The method of claim 3, wherein said making the successive determinations to shift comprises *downshifting to a lower quality one of the different copies when the at least one factor is less than a second threshold*.
arranging the streamlets requested from that least one server in order of ascending presentation time for output to a presentation device.	8. The method of claim 1, wherein said presenting comprises sequentially arranging the requested files from the different copies in the order of ascending playback time for playback with the media player on the end user station.

The patents claims fail to teach a client module configured to be connected to a network having at least one server and further configured to request digital content over the network via at least one transmission control protocol (TCP) connection, and dividing wherein each copy of the digital content is divided into a plurality of streamlets, which are independently requestable by the client

Carmel discloses client module configured to be connected to a network having at least one server and further configured to request digital content over the network via at least one transmission control protocol (TCP) connection (Col 6 line 50 – Col 7 line 2; After preparing the multimedia sequence, computer 34 uploads the sequence over network 28, preferably using the Internet File Transfer Protocol (FTP). Alternatively, other Internet protocols may be used, such as the TCP/IP, UDP or RT(x) protocols; Fig. 1) and

dividing wherein each copy of the digital content is divided into a plurality of streamlets, (Col 2 lines 1-21; a transmitting computer generates a data stream and broadcasts the data stream via a network server to a plurality of clients. The data stream is divided into a sequence of segments or slices of the data, preferably time slices, wherein the data are preferably compressed. Each slice is preferably assigned a respective slice index. The transmitting computer uploads the sequence of slices to the server substantially in real time, preferably using an Internet protocol, most preferably the File Transfer Protocol (FTP), as is known in the art; The clients download the data stream from the server, preferably using an Internet protocol, as well, most preferably the Hypertext Transfer Protocol (HTTP), or alternatively, using other protocols, such as UDP or RTP, which are similarly known in the art))

It would have been obvious for the teachings of the patent at the time of invention to be able to independently request streamlets of data at higher or lower quality based upon the current determined factor in a client server networking using TCP protocol and use the slice index to maintain proper synchronization of the playback when playing the stream. This would have been beneficial to maintain synchronization allows the broadcast to go on substantially in real time without the use of special-purpose hardware.. (Carmel, Col 2 lines 1-21)

Claim 22 of the instant application is rejected for similar reasons as claim 11 over claims 1, 3-4 and 8 of the patent as discussed above.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject

matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 4-5 and 9 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jacobs et al. – hereinafter Jacobs (US 2004/0172478) in view of Carmel (US 6,389,473)

As per claim 1, Jacbos discloses a method for adaptive-rate content streaming of digital content, the method comprising:

connecting a client module of an end user station to at least one server over a network ([0022] 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.)

via at least one transmission control protocol (TCP) connection over the network; ([0024];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)

requesting, by the client module, a stream from the at least one server that corresponds to a first portion of the digital content encoded at a first bit rate; ([0036]; The client may initially request that the server transmit the first stream at a transmission rate of 1000 kbit/s.)

determining, by a client module, a first current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received; in response to the determining, the client module requesting from the at least one server a second stream that corresponds to a second portion of the digital content encoded at a second bit rate different than the first bit rate, ([0036];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 500 kbit/s, since the client will only be removing data from the buffer at a rate of 500 kbit/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.)

arranging, by the client module, the first and second portions of the digital content, received from the at least one server, in order of ascending presentation time for output to a presentation device. ([0026]; With reference to FIG. 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, [0028] Packets are then sent to the decoder 508, 509 where the packets are decoded into 20 ms blocks of audio samples or to video pictures. In the case of pictures, these are rendered to a window on the display 508.)

Jacobs fails to disclose the client module requesting first and second streamlets, the second portion immediately subsequently adjacent to the first portion of the digital content during presentation.

Carmel discloses the client module requesting first and second streamlets, the second portion immediately subsequently adjacent to the first portion of the digital content during presentation. (Col 2 lines 1-21; a transmitting computer generates a data stream and broadcasts the data stream via a network server to a plurality of clients. The data stream is divided into a sequence of segments or slices of the data, preferably time slices, wherein the data are preferably compressed. Each slice is preferably assigned a respective slice index. The transmitting computer uploads the sequence of slices to the server substantially in real time, preferably using an Internet protocol, most preferably the File Transfer Protocol (FTP), as is known in the art)

It would have been obvious at the time of invention for the teachings of Jacobs for the client module to request the independently request the individual streamlet at the 1st or 2nd bitrate depending based upon a determination of a current ability to receive the packets from the

client-side module. This would have been beneficial to maintain synchronization allows the broadcast to go on substantially in real time without the use of special-purpose hardware. (Carmel, Col 2 lines 1-21)

As per claim 4, Jacobs / Carmel disclose the method of claim 1. Carmel discloses wherein the digital content is stored on the at least one server in a plurality of streamlets, each of the plurality of streamlets corresponding to a different temporal portion of said digital content and wherein each of the first and second streamlets is requestable by the client module without regard to whether the client module has previously requested other streamlets of the digital content. (Col 2 lines 1-21; a transmitting computer generates a data stream and broadcasts the data stream via a network server to a plurality of clients. The data stream is divided into a sequence of segments or slices of the data, preferably time slices, wherein the data are preferably compressed. Each slice is preferably assigned a respective slice index. The transmitting computer uploads the sequence of slices to the server substantially in real time, preferably using an Internet protocol, most preferably the File Transfer Protocol (FTP), as is known in the art; The clients download the data stream from the server, preferably using an Internet protocol, as well, most preferably the Hypertext Transfer Protocol (HTTP), or alternatively, using other protocols, such as UDP or RTP, which are similarly known in the art)

As per claim 5, Jacobs / Carmel disclose the method of claim 1. Carmel discloses wherein the digital content is stored by the at least one server in a plurality of streamlets, wherein each of the plurality of streamlets is a separate individually requestable file.(Col 2 lines 1-21; a transmitting computer generates a data stream and broadcasts the data stream via a network server to a plurality of clients. The data stream is divided into a sequence of segments or slices of the data, preferably time slices, wherein the data are preferably compressed. Each slice is preferably assigned a respective slice index. The transmitting computer uploads the

sequence of slices to the server substantially in real time, preferably using an Internet protocol, most preferably the File Transfer Protocol (FTP), as is known in the art; The clients download the data stream from the server, preferably using an Internet protocol, as well, most preferably the Hypertext Transfer Protocol (HTTP), or alternatively, using other protocols, such as UDP or RTP, which are similarly known in the art)

As per claim 9, Jacobs / Carmel disclose the method of claim 1. Carmel discloses further comprising: receiving the digital content at an encoder of the at least one server; encoding the streamlets of the digital content in at least the first and second bit rates at the encoder; and storing, at a streamlet database of the at least one server, at least a portion of the streamlets of the digital content in at least one of the first and second bit rates. (Col 4 lines 39-47; In still another preferred embodiment, encoding the slices includes encoding slices at a plurality of different quality levels, such that the files corresponding to a given one of the slices have a different, respective data size for each of the quality levels. Preferably, downloading the sequence includes determining a data bandwidth of the network between the server and the client computer and selecting one of the quality levels responsive to the determined bandwidth.)

Claim 2 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jacobs (US 2004/0172478) / Carmel (US 6,389,473) further in view of Lee et al. – hereinafter Lee (US 7,996,450)

As per claim 2, Jacobs / Carmel disclose the method of claim 1. The combined teachings of Jacobs/ Carmel fail to disclose wherein the requesting the second streamlet comprises transmitting a hypertext transfer protocol (HTTP GET) request to the at least one server.

Lee discloses transmitting a hypertext transfer protocol (HTTP GET) request to the at least one server. (Col 7 lines 15-24; The servlet engine 106 receives HTTP GET requests from the client 102 and maps the received HTTP requests to the servlet dependent on the servlet's URL. The popup servlet 122 includes standard methods including a doGet method 400, a doPost method 402)

It would have been obvious at the time of invention for the combined teachings of Jacobs / Carmel to be modified so that the HTTP request to the second streamlet is an HTTP get request. This would have beneficial to quickly access the streams by selecting the destination location within the online remote storage.

Claim 3 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jacobs (US 2004/0172478) / Carmel (US 6,389,473) further in view of Pulier et al. – hereinafter Pulier (US 2002/0091840)

As per claim 3, Jacobs / Carmel disclose the method of claim 1. The combined teachings of Jacobs / Carmel fail to disclose wherein the at least one server comprises at least two servers and wherein the requesting further comprises requesting, by the client module at least one streamlet from a first server of the at least two servers and at least one other streamlet from a second server of the at least two servers other than the first server.

Pulier discloses wherein the at least one server comprises at least two servers and wherein the requesting further comprises requesting, by the client module at least one streamlet from a first server of the at least two servers and at least one other streamlet from a second server of the at least two servers other than the first server. ([0019]; If the MPH process finds an available provider to host the streaming media, it selects that provider at step 116. During its first pass through the list of providers, the MPH process selects the first available provider and uses it to begin streaming the media file. Later in the MPH process, if the first provider fails to

maintain acceptable bandwidth, the next available provider on the list is selected to continue hosting the media file; [0021] After the stream switcher module is triggered at step 128, the stream switcher module pauses the media stream, records the current play time, and begins checking through the list of providers for the next available one. At decision block 130, the stream switcher module looks for the next available provider who has not yet been selected. If it finds one, that provider is selected)

It would have been obvious at the time of invention for the combined teachings of Jacobs / Carmel to be modified so that the client module requests the first streamlet from the first server and the second streamlet from the second server as this would have resulted in benefits of providing the end user with the best possible viewing experiences. (Pulier, [0007])

Claims 6-8 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jacobs (US 2004/0172478) / Carmel (US 6,389,473) further in view of Omoigui et al. – hereinafter Omoigui (US 7,096,271)

As per claim 6, Jacobs / Carmel disclose the method of claim 1. Carmel discloses the third portion immediately subsequently adjacent to the second portion of the digital content during presentation. (Col 2 lines 1-21; a transmitting computer generates a data stream and broadcasts the data stream via a network server to a plurality of clients. The data stream is divided into a sequence of segments or slices of the data, preferably time slices, wherein the data are preferably compressed. Each slice is preferably assigned a respective slice index.)

The combined teachings of Jacobs / Carmel fail to disclose determining, at the client module, an inability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at the second bit rate; in response to the determining the inability to receive the data at the rate sufficient for presenting the digital content, requesting, by the client module, a third streamlet corresponding to a third portion of the digital content

encoded at the first bit rate, the third portion immediately subsequently adjacent to the second portion of the digital content during presentation

Omoigui disclose further comprising: determining, at the client module, an inability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at a selected bit rate; in response to the determining the inability to receive the data at the rate sufficient for presenting the digital content, requesting, by the client module, a third streamlet corresponding to a third portion of the digital content encoded at the lower bit rate. (Col 9 lines 25-38; Client 104 also includes a master control 230 that coordinates the overall presentation of the media content, as discussed in more detail below; Col 14 lines 37-67; The monitored and programmed values are used to determine whether the bandwidth allotted to streaming the data or the processing capacity has been exceeded (step 354). Such changes can result, for example, due to a user request for a faster playback speed, or a reduction in the amount of bandwidth or processing capacity that can be devoted to streaming or playing back of the multimedia content. If the allotted bandwidth or processing capacity has been exceeded, then master control 230 selects a stream(s) to be altered (step 356).; Fig. 9: item 354, 356; Col 15 lines 38-54;)Master control 230 also alters the selected stream(s) to take advantage of the excess bandwidth or processing capacity. This alteration is analogous to that of step 358, or alternatively may be to "undo" whatever alteration was previously performed for the stream in step 358)

It would have been obvious at the time of invention for the combined teachings of Jacobs / Carmel to be modified so that the client module requests a third streamlet in the sequence at the 1st bitrate when the bandwidth data or processing capacity at the client is exceeded. This would have been advantages to deliver users a better experience when viewing the streamed data by preventing buffer overrun.

As per claim 7, Jacobs / Carmel disclose the method of claim 1. The combined teachings of Jacobs / Carmel fail to disclose wherein the determining comprises: generating, by the client module, a performance factor indicative of a second current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at the second bit rate.

Omoigui discloses generating, by the client module, a performance factor indicative of a second current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received at the second bit rate. (Col 9 lines 25-38; Client 104 also includes a master control 230 that coordinates the overall presentation of the media content, as discussed in more detail below.; Col 15 lines 23-37; Returning to step 352, master control 230 also checks whether there is excess bandwidth or processing capacity that it can use (step 360). Such excess bandwidth or processing capacity can arise, for example, due to a reduction in the playback speed of the multimedia content or extra capacity or bandwidth being devoted to streaming or playback of the multimedia content. If such excess bandwidth or processing capacity is detected, master control 230 selects a stream(s) to alter (step 362). This selection process is analogous to that of step 356, except that the ordering of streams may be "reversed".)

It would have been obvious at the time of invention for the combined teachings of Jacobs / Carmel to be modified so a performance factor is generated based upon the client module receiving the digital content at the second bitrate. This would have been advantages to deliver users a better experience when viewing the streamed data by providing a higher bitrate.

As per claim 8, Jacobs / Carmel disclose the method of claim 7. Omoigui discloses wherein the requesting of the second portion comprises requesting the second portion responsive to the performance factor exceeding a first threshold, and wherein the second bit rate exceeds the first bit rate. (Col 9 lines 25-38; Client 104 also includes a master control 230

that coordinates the overall presentation of the media content, as discussed in more detail below.; Col 15 lines 23-37; Returning to step 352, master control 230 also checks whether there is excess bandwidth or processing capacity that it can use (step 360). Such excess bandwidth or processing capacity can arise, for example, due to a reduction in the playback speed of the multimedia content or extra capacity or bandwidth being devoted to streaming or playback of the multimedia content. If such excess bandwidth or processing capacity is detected, master control 230 selects a stream(s) to alter (step 362). This selection process is analogous to that of step 356, except that the ordering of streams may be "reversed".)

Claim 10 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Jacobs (US 2004/0172478) / Carmel (US 6,389,473) further in view of Lu et al. – hereinafter Lu (US 2008/0225959)

As per claim 10, Jacobs/ Carmel disclose the method of claim 9. The combined teachings of Jacobs / Carmel fail to disclose wherein encoding the streamlets comprises encoding the streamlets using a multi-pass encoding process.

Lu discloses wherein encoding the streamlets comprises encoding the streamlets using a multi-pass encoding process. ([0010]; there is provided a system and method for MPEG video coding with information look-ahead that utilizes two MPEG encoder devices. The first encoder device functions as an information collector, which information is then used by an on-line processor. Taking the advantage of the time delay between the inputs of the two encoder devices, the processor employs an efficient algorithm to jointly derive the best coding strategy for the all incoming frames in a look-ahead window by exploiting the information not only about the past and current frames but additionally the future frames. The second encoder, which operates at the same constant bit rate as the first encoder, uses the coding strategy from the processor as the guide to encode the incoming frames.)

It would have been obvious at the time of invention for the combined teachings of Jacobs / Carmel to be modified so that the streamlets are encoded using multi-pass encoding features as it allows for further adaptability of the bitrate to optimize the streams for the clients.

Allowable Subject Matter

Claims 11-30 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: A thorough review of the prior art teaches portions of the claim language with respect to client-side monitoring of the ability to receive the streamlet at the current bitrate, the client adjusting the higher and lower bitrates based upon the determination and the parsing and encoding of the stream into a plurality of streamlets, it fails to disclose or render obvious,

"automatically requesting from the at least one server subsequent portions of the digital content by requesting for each subsequent portion one of the streamlets from the different copies of the digital content dependent upon successive determinations by the client module to change a currently requested bit rate to a higher or lower bit rate, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive digital content at a rate sufficient for presenting the digital content as the digital content is received; making the successive determinations to change the digital content bit rate based on the factor using the streamlets of one of the different copies of the digital content having the highest bit rate determined receivable for presentation so that the client module selects a higher bit rate one of the different copies when the factor is greater than a first threshold and selects a lower bit rate one of the different copies when the factor is less than a second threshold"

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.

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/Chirag R Patel/
Primary Examiner, Art Unit 2454

Notice of References Cited	Application/Control No. 18/069,450	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-20040172478-A1	09-2004	Jacobs, Richard J	H04N21/2402	709/233
*	B	US-7996450-B1	08-2011	Lee; Sharon A.	G06F16/972	725/121
*	C	US-20080225959-A1	09-2008	Lu; Ligang	H04N19/102	375/E7.154
	D					
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	18/069,450	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04L47/30, H04L65/80, H04L47/263, H04L47/10	03/09/2023	C.P.

CPC Combination Sets - Searched*		
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US Classification - Searched*			
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Search Notes		
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PE2E Search	03/08/2023	C.P.
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H04L	H04L47/30, H04L65/80, H04L47/263, H04L47/10	03/09/2023	C.P.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/069,450	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

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CLAIMS

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

CLAIM		DATE								
Final	Original	03/09/2023								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
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	11	✓								
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	14	O								
	15	O								
	16	O								
	17	O								
	18	O								
	19	O								
	20	O								
	21	O								
	22	✓								
	23	O								
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	26	O								
	27	O								
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	29	O								
	30	O								

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(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
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	Examiner Name	
	Attorney Docket Number	9401-00279

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	Attorney Docket Number	9401-00279

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	Art Unit	
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	Attorney Docket Number	9401-00279

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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
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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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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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.

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(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	23	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Durrant et. al.	
	24	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Gentric	
	25	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Kitamura	
	26	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Klemets	
	27	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Oplayo	
	28	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") QOAS	
	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	
	33	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Walker	

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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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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

EXAMINER SIGNATURE			
Examiner Signature	/CHIRAG R PATEL/	Date Considered	03/09/2023

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	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

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)	2022-12-21
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:

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)).

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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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	6389473	B1	2002-05-14	Carmel et al.	

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	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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	Application Number	18/069450
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	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

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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	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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	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	First Named Inventor	David F. Brueck
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	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	Examiner Name	
	Attorney Docket Number	9401-00279

	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).

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	03/09/2023

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☒ See attached certification statement.

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A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Brett A. Carlson/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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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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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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PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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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	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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	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	Attorney Docket Number	9401-00279

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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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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	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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	Application Number	18/069450
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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	7	2004021668	WO	A1	2004-03-11	KONIN-KLIJKE PHILIPS ELECTRONICS N.V.		

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

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OR

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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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39,928

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Apparatus system and method for adaptive-rate shifting of streaming content



WO EP US JP KR AU CA DK ES PT · KR101082642B1 · 로버트 토퍼 매이저 · 에코스타 테크놀로지스 엘.엘.씨

Priority 2004-04-30 · Filed 2006-11-30 · Granted 2011-11-10 · Published 2011-11-10

The apparatus for variable rate conversion of streaming content includes an agent controller module 402 configured to simultaneously request a plurality of streamlets 212. The agent controller module 402 is further configured to continuously monitor streamlet requests and subsequent responses and ...

Wireless video transmission system

US · US8018850B2 · Petrus J. L. Van Beek · Sharp Laboratories Of America, Inc.



Priority 2004-02-23 · Filed 2004-04-21 · Granted 2011-09-13 · Published 2011-09-13

A transmission systems suitable for video.

Apparatus, system, and method for multi-bitrate content streaming

US · US20170134470A1 · David F. Brueck · Echostar Technologies L.L.C.



Priority 2004-04-30 · Filed 2017-01-24 · Published 2017-05-11

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 ...

Wireless video transmission



EP US JP • EP1521476A1 • Petrus J.L. Van Beek • Sharp Kabushiki Kaisha
Priority 2003-09-30 • Filed 2004-09-29 • Published 2005-04-06
In a video coding system for transmission over a wireless link, the available bandwidth is dynamically estimated in order to perform dynamic rate control. For estimating the available bandwidth, the sender transmits video data packets in bursts, and the receiver estimates the available bandwidth ...

Adaptive streaming of high-quality video over wireless LANs

Google Scholar • citeseerx.ist.psu.edu • Van Beek P • Visual Communications and Image Processing 2004
Published 2004
... of the users, or to the **capabilities** of the **client** devices. For example, ... However, increasing M means the buffer size at the sender **side** ... The second set of results illustrates the **ability** of the ...

A study of video streaming delivery protocols for efficient video-on demand services

Google Scholar • search.proquest.com • Chung Y
Published 2004
... The **client** has full-function VCR **capabilities**, including ... destination does not have the **capability** to reassemble fragments. ... At the **client side**, when a protocol allocate more than one video ...

Apparatus, system, and method for adaptive-rate shifting of streaming content

AU • AU2011213730B2 • Mark Burrows Hurst • Echostar Technologies L.L.C.
Priority 2004-04-30 • Filed 2011-08-17 • Granted 2013-08-01 • Published 2013-08-01
APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF STREAMING CONTENT s Apparatus for adaptive-rate shifting of streaming content includes an agent controller module 402 configured to simultaneously request a plurality of streamlets 212. The agent controller module 402 is further ...

Switching between bit-streams in video transmission



US ZA • US7706447B2 • Marta Karczewicz • Nokia Corporation
Priority 2001-01-03 • Filed 2002-01-03 • Granted 2010-04-27 • Published 2010-04-27
CROSS-REFERENCE TO RELATED APPLICATIONS This application is the U.S. National Phase of International Application PCT/FI02/0004 filed Jan. 3, 2002 and published in English on Jul. 11, 2002 under International Publication No. WO 02/054776 A1 which in turn claims priority from U.S. application Ser.

Switching between bit-streams in video transmission



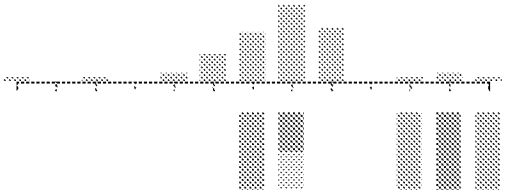
WO EP US CN JP BR CA EE HK HU MX • EP1356684B1 • Marta Karczewicz • Nokia Technologies Oy
Priority 2001-01-03 • Filed 2002-01-03 • Granted 2016-08-03 • Published 2016-08-03
A method for transmitting video information, in which at least a first bit-stream (510) and a second bit-stream are formed from the video information, the first bit-stream (510) comprises a first set of frames comprising at least one video frame, and the second bit-stream (520) comprises a second ...

Method for achieving end-to-end quality of service negotiation for distributed ...

WO EP US CN JP • WO2002078259A1 • Davide Mandato • Sony International (Europe) Gmbh
Priority 2001-03-27 • Filed 2002-03-11 • Published 2002-10-03
This invention presents a framework for achieving dynamic End-to End QoS negotiation and control coordination, with distributed multimedia applications. The framework builds upon dynamic capability negotiations and specification of Adaptation Paths and (alternative) QoS Contracts, based on user ...

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Relative count of top 5 values

Assignees	Inventors	CPCs
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Numecent Holdings, Inc.		3.7%
Nicholas Ryan		3.7%
Endeavors Technology, Inc.		3.7%
Echostar Technologies L.L.C.		3.7%

18069450IP

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Search #	Timestamp	Results	Page
1	2023-03-09 03:19 UTC	29,831,872	3
2	2023-03-09 03:19 UTC	29,831,872	4
3	2023-03-09 03:19 UTC	7,039,354	4
4	2023-03-09 03:24 UTC	4,389,514	4
5	2023-03-09 03:25 UTC	4,299,576	4
6	2023-03-09 03:26 UTC	4,299,576	4

Content: Patents + NPL (192)

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1 **2023-03-09 03:19 UTC | 29,831,872 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text

segment stream into individual files multiple bitrates requestable by the user

Concept Modifiers: None

Filters: None

2 **2023-03-09 03:19 UTC | 29,831,872 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
segment stream into individual files multiple bitrates request by the user

Concept Modifiers: None

Filters: None

3 **2023-03-09 03:19 UTC | 7,039,354 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Same as Search 2

Concept Modifiers: None

Filters (1):
Publication Date: To 2004-04-30

4 **2023-03-09 03:24 UTC | 4,389,514 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
segment stream into individual streamlet multiple bitrates request by the user

Concept Modifiers: None

Filters: Same as Search 3

5 **2023-03-09 03:25 UTC | 4,299,576 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
segment stream into individual streamlet multiple bitrates request by the user adaptive

Concept Modifiers: None

Filters: Same as Search 3

6 **2023-03-09 03:26 UTC | 4,299,576 results from**

De-Dup: None | **Relevance Cut-off:** None | **Sort:** Relevance

Main Concept: Text
segment stream into individual streamlet multiple bitrates request client-side adaptive

Concept Modifiers: None

Filters: Same as Search 3

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Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	18/069450
Filing Date	
First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18/069450
	Filing Date	
	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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	/CHIRAG R PATEL/	Date Considered	03/09/2023

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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.

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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.

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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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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.

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First Named Inventor	David F. Brueck
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	Examiner Name	
	Attorney Docket Number	9401-00279

	1	Respondents' Reply to the Commission's November 18, 2022 Request for Written Submissions on the Issues Under Review and on Remedy, the Public Interest, and Bonding (Redacted) dated December 9, 2022 (52 pages).
	2	[Public Version] Response of the Office of Unfair Import Investigations to the Commission's Request for Written Submissions on the Issues Under Review and on Remedy, Bonding, and the Public Interest (Redacted) dated December 2, 2022 (65 pages).
	3	Notice of Commission Determination to Review the Final Initial Determination in Part; Request for Written Submissions on the Issues Under Review and on Remedy, the Public Interest, and Bonding dated November 18, 2022 (6 pages).
	4	Complainants' Opening Submission on the Issues Under Review and on Remedy, the Public Interest, and Bonding (Redacted) dated December 2, 2022 (59 pages).
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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.	
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	14	7054911	B1	2006-05-30	Lango et al.	
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	18	5168356		1992-12-01	Acampora 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.	
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	24	6185736	B1	2001-02-06	Ueno	
	25	57685627		1998-06-16	Zhu 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.	
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	38	7788395	B2	2010-08-31	Bowra et al.	
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	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.	
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	50	7779135	B2	2010-08-17	Hudson et al.	
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	52	5953506		1999-09-14	Kalra et al.	

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	53	6091775		2000-07-18	Hibi et al.	
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	55	6195680		2001-02-27	Goldszmidt et al.	
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	58	6486803	B1	2002-11-26	Luby et al.	
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	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.	
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	70	4535355		1985-08-13	Arn et al.	
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	72	5687095		1997-11-11	Haskell et al.	
	73	7116894	B1	2006-10-03	Chatterton	
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	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.	
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

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	Attorney Docket Number	9401-00279

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	Attorney Docket Number	9401-00279

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

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SIGNATURE

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-12-21
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Bibliographic Data

Application No: 18/069,450

Foreign Priority claimed: ○ Yes ◉ No

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

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

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/21/2022	709	2454	9401-00279
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APPLICANTS

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

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	5	20030135863	A1	2003-07-17	VanDer Schaar	

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	1	0365683	EP	A1	1990-05-02	OTSUKA PHARMA CO LTD		X

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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.	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.	☒

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18/069450
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	First Named Inventor	David F. Brueck
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	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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☒ See attached certification statement.

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

None

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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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	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.	
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	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.	
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	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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	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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	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/)	
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	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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	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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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18/069450
	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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 NVALIDITY: 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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	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

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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☐ 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)	2022-12-21
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.

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PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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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
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	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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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	First Named Inventor	DAVID F. BRUECK
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	Attorney Docket Number	9401-00279

	34	Claim Chart Against U.S. Patent No. 10,469,554 ("'554 patent") Wang	
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	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	

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Signature	/BRETT A. CARLSON/	Date (YYYY-MM-DD)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39,928

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PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	31	client-side SAME adaptive ADJ bit$2rate near2 streaming	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:03 PM
L2	1145	client SAME adaptive ADJ bit$2rate near2 streaming	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:03 PM
L3	0	client SAME adaptive ADJ bit$2rate near2 streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L4	0	adaptive ADJ bit$2rate near2 streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L5	12	adaptive ADJ bit$2rate AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L6	73	BRUECK ADJ DAVID.in.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:20 PM
L7	2524	adaptive ADJ streaming WITH client	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:26 PM
L8	4	adaptive ADJ streaming WITH client AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:26 PM
L9	36	adaptive ADJ streaming WITH client-side	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:28 PM
L10	147	dash SAME client-side	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:32 PM
L11	259	("10469554"|"10469555"|"10757156"|"10951680"|"11470138"|"20010013128"|"20010047423"|"20020002708"|"20020029274"|"20020044528"|"20020073167"|"20020091840"|"20020097750"|"20020131496"|"20020144276"|"20020152317"|"20020152318"|"20020156912"|"20020161898"|"20020161908"|"20020161911"|"20020169926"|"20020170062"|"20020174434"|"20020176418"|"20020178330"|"20020188745"|"20030005455"|"20030009578"|"20030014684"|"20030018966"|"20030021166"|"20030021282"|"20030055995"|"20030061305"|"20030065803"|"20	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 04:00 PM

		030067872"|"20030067 875"|"20030072376"|"2 0030081582"|"2003009 3790"|"20030107994"|" 20030135631"|"200301 35863"|"20030140159"| "20030151753"|"20030 152036"|"20030154239 "|"20030195977"|"2003 0204519"|"2003020460 2"|"20030233464"|"200 30236904"|"200302369 06"|"20040003101"|"20 040010613"|"20040030 547"|"20040030599"|"2 0040030797"|"2004003 1054"|"20040049780"|" 20040054551"|"200400 71209"|"20040083283"| "20040093420"|"20040 103444"|"20040117427 "|"20040136327"|"2004 0143672"|"2004016805 2"|"20040170392"|"200 40179032"|"200401996 55"|"20040202109"|"20 040220926"|"20040221 088"|"20040260701"|"2 0040260827"|"2004026 7956"|"20050015509"|" 20050033855"|"200500 55425"|"20050066063"| "20050076136"|"20050 084166"|"20050108414 "|"20050120107"|"2005 0123058"|"2005017761 8"|"20050185578"|"200 50188051"|"200502040 46"|"20050207569"|"20 050251832"|"20050262 257"|"20060010003"|"2 0060059223"|"2006007 5446"|"20060080718"|" 20060130118"|"200601 33809"|"20060165166"| "20060168290"|"20060 206246"|"20060236219 "|"20060277564"|"2006 1068295"|"2007002470 5"|"20070030833"|"200 70067480"|"200700793 25"|"20070094405"|"20 070204310"|"20070280 255"|"20080022343"|"2 0080028428"|"2008003 7527"|"20080046939"|" 20080056373"|"200800 86570"|"20080104647"|					

		"20080120330"|"20080120342"|"20080133766"|"20080162713"|"20080184688"|"2008019574 4"|"20080205291"|"20080219151"|"20080222235"|"20080263180"|"20080281803"|"20090043906"|"20090055471"|"20090055547"|"20090210549"|"20100098103"|"20100262711"|"20110307545"|"20150058496"|"4535355"|"5168356"|"5267334"|"5404446"|"5414455"|"5424455"|"5544318"|"5687095"|"5732183"|"57685627"|"5841432"|"5867230"|"5933603"|"5941951"|"5953506"|"5966015"|"5966025"|"5996025"|"6003030"|"6091775"|"6091777"|"6112239"|"6122660"|"6154744"|"6172672"|"6181867"|"6185736"|"6195680"|"6292383"|"6292834"|"6366614"|"6374289"|"6389473"|"6449719"|"6486803"|"6490627"|"6498897"|"6510553"|"6574591"|"6604118"|"6618752"|"6625643"|"6637031"|"6665726"|"6708213"|"6721723"|"6731600"|"6757796"|"6760772"|"6766407"|"6795863"|"6845107"|"6850965"|"6859839"|"6874015"|"6968387"|"6976090"|"7047307"|"7054365"|"7054774"|"7054911"|"7075986"|"7093001"|"7096271"|"7099954"|"7116894"|"7174385"|"7194549"|"7240100"|"7260640"|"7274740"|"7295520"|"7310678"|"7325073"|"7328243"|"7330908"|"7334044"|"7349358"|"7349976"|"7369610"|"7376747"|"7386627"|"7391717"|"7408984"|"7412531"|"7477688"|"7523181"|"7536469"|"7546355"|"7558869"|"7577750"|"7593333"|"7599307"|"7609652"|"7653735"|"7707					

		303"|"7719985"|"776080 1"|"7779135"|"778839 5"|"7797439"|"7817985" |"7818444"|"7925781"|" 7974200"|"8036265"|"8 370514"|"8402156"|"85 21836"|"8612624"|"868 3066"|"8686066"|"8711 701"|"8818127"|"88687 72"|"8880721"|"934449 6"|"9407564"|"9462074").PN.					
L12	82	L11 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 05:06 PM
L13	0	client WITH request WITH bitstream WITH (bandwidth capability) AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 10:52 PM
L14	21	client WITH request WITH bitstream WITH (bandwidth capability)	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 10:52 PM
L15	10	("11470138" "10659513" "9998516" "9571551" "9071668" "8612624" "8402156" "7818444" "8868772").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 11:04 PM
L16	2	("20050055425" "7369610").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 01:28 PM
L17	3	("20050055425" "7369610" "20020087717").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 01:42 PM
L18	1	("6389473").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:48 PM
L19	1099	client WITH select$3 WITH bit$2rate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L20	455	client WITH select$3 WITH bit$2rate SAME stream	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L21	2	client WITH select$3 WITH bit$2rate SAME stream AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L22	1	L21 AND ((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.)	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM
L23	114	client WITH select$3 WITH bit$2rate WITH content WITH server	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM
L24	725	client WITH select$3 WITH bit$2rate AND adaptive near3	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM

		stream$3					
L25	2	client WITH select$3 WITH bit$2rate AND adaptive near3 stream$3 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:01 PM
L26	71	adaptive ADJ streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L27	0	adaptive ADJ streaming AND select$3 WITH bit$2rate AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L28	1	adaptive ADJ streaming AND select$3 WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L29	0	("56683104").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 AM
L30	0	client WITH select$3 WITH bit$2rate near3 streamlet	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:24 AM
L31	1	client WITH select$3 WITH bit$2rate WITH streamlet	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:24 AM
L32	35	adaptive near3 bitrate WITH selection WITH client	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 02:14 PM
L33	8	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 02:19 PM
L34	2	("6490627" "20030152036").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:48 PM
L35	52	client WITH request$3 WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:56 PM
L36	0	client WITH request$3 WITH streamlet AND bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L37	8	client WITH request$3 WITH streamlet AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L38	81	client WITH request$3 WITH streamlet AND bit$2rate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L39	18	client WITH request$3 WITH segments AND bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:58 PM
L40	63	segment WITH stream	(US-PGPUB; USPAT;	OR	ON	ON	2023/03/08

		WITH (chunk sement) WITH bit$2rate	USOCR; EPO)				10:05 PM
L41	0	segment WITH stream WITH (chunk sement) WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:07 PM
L42	6	"2003009581"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 11:08 PM
L43	8	"2003009581"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); EPO)	OR	ON	ON	2023/03/08 11:08 PM
L44	17	"2003009581"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; DERWENT)	OR	ON	ON	2023/03/08 11:09 PM
L45	2	("20040172478").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; DERWENT)	OR	ON	ON	2023/03/08 11:22 PM
L46	48	http ADJ get near3 request near4 client AND stream$3 AND @rlad<"20040930"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 12:32 AM

L47	51	multi$2pass near2 encod$3 WITH stream	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:16 PM
L48	0	multi$2pass near2 encod$3 WITH stream AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:16 PM
L49	6497	multi$2pass AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L50	64	multi$2pass near2 encod$3 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L52	0	multi$2pass near2 encod$3 AND streamlet AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L53	0	adaptive near3 bitrate WITH selection WITH client AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 04:42 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	8	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:19 PM
N2	0	client WITH select$3 near3 streamlet WITH bitrate AND @rlad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N3	0	client WITH select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N4	1	client WITH select$3 WITH streamlet SAME bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N5	253	request$3 near3 streamlet	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N6	101	request$3 near3 streamlet WITH client	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N7	10	request$3 near3 streamlet WITH client AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N8	0	request$3 near3 streamlet WITH client AND bit$2rate AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM
N9	0	request$3 near3 streamlet AND bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM

		AND @ad<"20040930"					
N10	3	request$3 near3 (streamlet chunk) AND bit$2rate AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM
N11	53	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND N6	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:47 PM
N12	53	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND request$3 near3 streamlet WITH client	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:52 PM

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(Not for submission under 37 CFR 1.99)

Application Number	18/069450
Filing Date	
First Named Inventor	DAVID F. BRUECK
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18/069450
	Filing Date	
	First Named Inventor	DAVID F. BRUECK
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	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	

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	03/09/2023

*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	
	Examiner Name	
	Attorney Docket Number	9401-00279

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)	2022-12-21
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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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.

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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.

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Attorney Docket Number	9401-00279

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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	11470138		2022-10-11	Brueck et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18/069450
	Filing Date	
	First Named Inventor	David F. Brueck
	Art Unit	
	Examiner Name	
	Attorney Docket Number	9401-00279

	1	INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND RECOMMENDED DETERMINATION ON REMEDY AND BOND US Int'l Trade Commission Investigation No. 337-TA-1265 (September 9, 2022)

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Examiner Signature	/CHIRAG R PATEL/	Date Considered	03/09/2023

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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.

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	Attorney Docket Number	9401-00279

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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)	2022-12-21
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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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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First Named Inventor	David F. Brueck
Art Unit	
Examiner Name	
Attorney Docket Number	9401-00279

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	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. no date	☒
	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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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)	2022-12-21
Name/Print	Brett A. Carlson	Registration Number	39928

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279

CONFIRMATION NO. 8508

70560
KW LAW LLP (Dish Technologies L.L.C.)
6122 N 7th St Suite D
Phoenix, AZ 85014

PUBLICATION NOTICE

OC000000137822105

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

Publication No.US-2023-0128962-A1
Publication Date:04/27/2023

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.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 18/069,450	Filing Date 12/21/2022	☐ 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 $480 =	
☐ 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	06/15/2023	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 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".	/TAMMY D MCBETH/
*** 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.**

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

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	18069450
Filing Date	21-Dec-2022
First Named Inventor	DAVID BRUECK
Attorney Docket Number	9401-00279
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 L.L.C	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 Carlson/
Name	Brett 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:	18069450
Filing Date:	21-Dec-2022
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:	9401-00279

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.: 18069450

Filing Date: 21-Dec-2022

Applicant/Patent under Reexamination: BRUECK

Electronic Terminal Disclaimer filed on June 15, 2023

☒ 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:	48159465
Application Number:	18069450
International Application Number:	
Confirmation Number:	8508
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:	9401-00279
Receipt Date:	15-JUN-2023
Filing Date:	21-DEC-2022
Time Stamp:	14:36:50
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	E20236EE36485067
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	41255 5e32ed0bfa2981fc32a1d7577df9954fd7797a56	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37973 5260f379bb0e9edc85921579f518d2d5644de786	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	79228		

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.:	18/069,450	Confirmation No.:	8508
Examiner:	Chirag R. Patel	Art Unit:	2454
Filed:	December 21, 2022	First Named Inventor:	David F. Brueck
Docket No.:	9401-00279 (P2007-02-01.2.11)	Customer No.:	70560
Title:	**APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING**		

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 PATENT CENTER***

Commissioner:

We hereby respond to the Office Action mailed on March 16, 2023 in the above-referenced application. Please amend the application as set forth below and consider the remarks that follow.

Amendments to the Claims begin on the following page (page 2).

Remarks begin on page 8 of this paper.

AMENDMENTS TO THE CLAIMS

Please amend the claims without prejudice or disclaimer to read as follows:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Canceled)

11. (Original) An end user station for adaptive-rate content streaming of digital content comprising:

a client module configured to be connected to a network having at least one server and further configured to request digital content over the network via at least one transmission control protocol (TCP) connection, wherein at least two different copies of the digital content are each encoded at different bit rates and stored on the at least one server, wherein each copy of the digital content is divided into a plurality of streamlets,

each of the plurality of streamlets of a corresponding copy comprising a different portion of the digital content during presentation, wherein corresponding streamlets across the at least two different copies comprise the same corresponding portions of the digital content during presentation, and wherein the client module streams the digital content by:

requesting a first streamlet from the at least one server;

automatically requesting from the at least one server subsequent portions of the digital content by requesting for each subsequent portion one of the streamlets from the different copies of the digital content dependent upon successive determinations by the client module to change a currently requested bit rate to a higher or lower bit rate, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive digital content at a rate sufficient for presenting the digital content as the digital content is received;

making the successive determinations to change the digital content bit rate based on the factor using the streamlets of one of the different copies of the digital content having the highest bit rate determined receivable for presentation so that the client module selects a higher bit rate one of the different copies when the factor is greater than a first threshold and selects a lower bit rate one of the different copies when the factor is less than a second threshold; and

arranging the streamlets requested from the at least one server in order of ascending presentation time for output to a presentation device.

12. (Original) The end user station of claim 11, wherein at least some streamlets are requested from the at least one server via a hypertext transfer protocol (HTTP) GET request.

13. (Original) The end user station of claim 11, wherein the at least one server comprises at least two servers and wherein at least one streamlet is requested from a first of the at least one server and at least one other streamlet is requested from a second server of the at least one server other than the first server.

14. (Original) The end user station of claim 11, wherein the client module repeatedly generates the factor based on a moving time window.

15. (Original) The end user station of claim 11, wherein the client module generates the factor based on a current read ahead margin.

16. (Original) The end user station of claim 11, wherein a first streamlet of each copy of the digital content has the same first duration and corresponds to a same first temporal portion of the digital content, wherein a second streamlet of each copy of the digital content have the same second duration and correspond to a same second temporal portion of the digital content.

17. (Original) The end user station of claim 16, wherein the first and second duration of the first streamlets of each copy are different from the durations of the second streamlets of each copy.

18. (Original) The end user station of claim 16, wherein each of the first streamlets has a first duration that is a range of 0.1 to 5 seconds.

19. (Original) The end user station of claim 11, wherein the client module is further configured to transmit at least one virtual timeline request to retrieve a virtual timeline corresponding to the digital content and to receive the virtual timeline from the at least one server; and arrange the streamlets requested from the at least one server using the virtual timeline.

20. (Original) The end user station of claim 11, wherein the client module is further configured to output the streamlets requested from the at least one server to the presentation device in the order of ascending presentation time.

21. (Original) The end user station of claim 11, further comprising the presentation device to display the streamlets in the order of ascending presentation time.

22. (Original) A method executable by a client device to output rate-adaptive streams received via at least one transmission control protocol (TCP) connection with at least one server over a network, the method comprising:

receiving, by the client device, digital content from the at least one server via the at least one TCP connection over the network, wherein multiple different copies of the digital content encoded at different bit rates are stored as individually-requestable portions on the at least one server, wherein each of the individually-requestable portions of a corresponding copy of the digital content is a different portion of the digital content during presentation, wherein the individually-requestable portions across the different copies yield the same portions of the digital content upon presentation, and wherein the receiving comprises:

requesting by the client device a plurality of sequential individually-requestable portions of one of the copies from the at least one server;

automatically requesting by the client device from the at least one server subsequent portions of the digital content by requesting for each such portion one of the individually-requestable portions from one of the copies dependent upon successive determinations by the client device to change a requested bit rate to a higher or lower bit rate one of the different copies, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive the digital content at a rate sufficient for presenting the digital content as the digital content is received, individually-requestable wherein the factor relates to a performance of the network; and

making the successive determinations whether to change the requested bit rate based on the factor to achieve continuous presentation of the digital content using the individually-requestable portions of the highest bit rate one of the copies determined receivable at that time at a rate sufficient for presenting the digital content as the individually-requestable portions of the digital content are received, wherein the making of the successive determinations to change the requested bit rate comprises:

requesting a subsequent individually-requestable portion from a higher bit rate one of the different copies than a currently requested one of the different copies when the at least one factor is greater than a first threshold; and

requesting a subsequent individually-requestable portion from a lower bit rate one of the different copies than the currently requested one of the different copies when the at least one factor is less than a second threshold; and

arranging the individually-requestable portions requested from the at least one server in order of ascending presentation time for output to a presentation device.

23. (Original) The method of claim 22, wherein the automatically requesting comprises requesting at least some individually-requestable portions via a hypertext transfer protocol (HTTP) GET request.

24. (Original) The method of claim 22, wherein the at least one server comprises at least two servers and wherein the client device requests at least one streamlet from a first server of the at least two servers and at least one other streamlet from a second server of the at least two servers other than the first server.

25. (Original) The method of claim 22, wherein the digital content is stored on the at least one server in a plurality of streamlets, each of the plurality of streamlets corresponding to a different temporal portion of said digital content and wherein each of the individually-requestable portions is requestable by the client device without regard to whether the client device has previously requested other individually-requestable portions of the digital content.

26. (Original) The method of claim 22, wherein the at least one TCP connection comprises a plurality of different TCP connections, and wherein the requesting of the plurality of sequential individually-requestable portions includes requesting sub-parts of the individually-requestable portions over different ones of the plurality of different TCP connections, and wherein the arranging includes reassembling the individually-requestable portions from the requested sub-parts.

27. (Original) The method of claim 22, wherein the making the successive determinations to change the requested bit rate comprises: determining if the higher bit

rate one of the different copies can be received at a rate sufficient for presenting the digital content as the digital content is received.

28. (Original) The method of claim 22, wherein the factor is indicative of a delay or a loss in one or more of the at least one TCP connections.

29. (Original) The method of claim 22, wherein the at least one server comprises a cache server of a network infrastructure operator.

30. (Original) The method of claim 22, further comprising:
outputting the received content to the presentation device.

REMARKS

We hereby respond to the latest Office Action under Rule 111. Claims 1-10 have been canceled without prejudice or disclaimer. No new matter has been added, and support for all of the claimed features can be found in the originally-filed application.

Allowable Subject Matter

We appreciate the Examiner's indication that original claims 11-30 are allowable over the art of record. These claims remain in their original form, so they are believed to remain in condition for allowance.

Double Patenting

The Office Action rejects original claims 11 and 22 as an alleged double patent of the issued parent to this application, US Patent No. 8,868,772, noting that the rejection could be overcome with a terminal disclaimer. An electronic terminal disclaimer is being filed under separate cover, so the rejection is believed to be moot. If there are any issues with the disclaimer or its associated fee, or if additional disclaimers are requested, the Examiner is invited to contact the undersigned by telephone at 602.344.9885.

Prior Art

Original claims 1-10 were rejected under Section 103. Although we do not agree with the rejections, we have canceled the rejected claims in this Track One application to bring the remaining claims 11-30 to speedy allowance. We expressly reserve the right to challenge the rejections at a later date (e.g., in a continuing application).

At present, however, the rejections are believed to be moot, and we respectfully request reconsideration of our amended application.

Conclusion

Should the Examiner have any suggestions that would advance prosecution at any time during prosecution, we would welcome a telephone call to (602) 344 9885 or an email to brett@kwlaw.co. *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. 60-2406 for any fees that may be due.

Respectfully submitted,

KW Law, LLP

Dated: June 15, 2023

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

KW Law, LLP
Customer No. 70560
brett@kwlaw.co

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	18069450
Filing Date	2022-12-21
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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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
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	1	1202487	EP	B1	2006-05-04	Nagai et al.		

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]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	1	Commission Opinion in the Matter of Certain Fitness Devices, Streaming Components Thereof, and Systems Containing Same [Public Version] dated March 23, 2023 (96 pages).	
	2		
	3		
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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	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

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)	2023-06-15
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.

Electronic Patent Application Fee Transmittal

Application Number:	18069450
Filing Date:	21-Dec-2022
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:	9401-00279

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:	48161658
Application Number:	18069450
International Application Number:	
Confirmation Number:	8508
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:	9401-00279
Receipt Date:	15-JUN-2023
Filing Date:	21-DEC-2022
Time Stamp:	17:41:37
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	E20236EH42228511
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		9401-00279_ROA.pdf	57545 1f59369d548adfd3715777ed34bbd59ad3891626	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Request for Reconsideration-After Non-Final Rejection	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	9

Warnings:

Information:

2	Information Disclosure Statement (IDS) Form (SB08)	9401-00279_IDS-15_16.pdf	612219 fcfac5eca34973d47d1f923687e70c3fe421fa53	no	4

Warnings:

Information:

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.

3	Fee Worksheet (SB06)	fee-info.pdf	38103 1533c6e1293c5b4672c6197e5fffe5475a315f75	no	2

Warnings:

Information:

Total Files Size (in bytes):	707867

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

70560 7590 07/14/2023

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: 07/14/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

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	10/16/2023

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 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted 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.

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 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. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

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

70560 7590 07/14/2023
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.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

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	10/16/2023

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)

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

❑ Electronic Payment via Patent Center or 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

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.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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.

❑ Applicant changing to regular undiscounted fee 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. _____

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.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

70560 7590 07/14/2023

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: 07/14/2023

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. 18/069,450	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 response on June 15, 2023.
   ☐ 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 11-30 . 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 6/15/23.
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 11-30 are allowed.

The following is an examiner's statement of reasons for allowance: Applicants filed a terminal disclaimer to overcome the obvious double patent rejections over U.S. Patent No. 8,868,772. The following is a statement of reasons for the indication of allowable subject matter: A thorough review of the prior art teaches portions of the claim language with respect to client-side monitoring of the ability to receive the streamlet at the current bitrate, the client adjusting the higher and lower bitrates based upon the determination and the parsing and encoding of the stream into a plurality of streamlets, it fails to disclose or render obvious,

"automatically requesting from the at least one server subsequent portions of the digital content by requesting for each subsequent portion one of the streamlets from the different copies of the digital content dependent upon successive determinations by the client module to change a currently requested bit rate to a higher or lower bit rate, the automatically requesting including repeatedly generating a factor indicative of a current ability to receive digital content at a rate sufficient for presenting the digital content as the digital content is received; making the successive determinations to change the digital content bit rate based on the factor using the streamlets of one of the different copies of the digital content having the highest bit rate determined receivable for presentation so that the client module selects a higher bit rate one of the different copies when the factor is greater than a first threshold and selects a lower bit rate one of the different copies when the factor is less than a second threshold"

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
	18/069,450	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	03/09/2023	06/29/2023							
	1	✓	-							
	2	✓	-							
	3	✓	-							
	4	✓	-							
	5	✓	-							
	6	✓	-							
	7	✓	-							
	8	✓	-							
	9	✓	-							
	10	✓	-							
1	11	✓	=							
2	12	O	=							
3	13	O	=							
4	14	O	=							
5	15	O	=							
6	16	O	=							
7	17	O	=							
8	18	O	=							
9	19	O	=							
10	20	O	=							
11	21	O	=							
12	22	✓	=							
13	23	O	=							
14	24	O	=							
15	25	O	=							
16	26	O	=							
17	27	O	=							
18	28	O	=							
19	29	O	=							
20	30	O	=							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/069,450	BRUECK et al.
	Examiner	Art Unit
	CHIRAG R PATEL	2454

CPC - Searched*		
Symbol	Date	Examiner
H04L47/30, H04L65/80, H04L47/263, H04L47/10	03/09/2023	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
PE2E Search	03/08/2023	C.P.
Google Patents - Scholar	03/08/2023	C.P.
IP.COM	03/08/2023	C.P.
Inventor - Double Patent Search	03/08/2023	C.P.

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04L	H04L47/30, H04L65/80, H04L47/263, H04L47/10	06/29/2023	C.P.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/069,450	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)	20	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	29 June 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20230629

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/069,450	BRUECK et al.
	Examiner	**Art Unit**
	CHIRAG R PATEL	2454

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04L	/	65	/	70

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	29 June 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20230629

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	18/069,450	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	9	19	18	28								
	2	1	11	10	20	19	29								
	3	2	12	11	21	20	30								
	4	3	13	12	22										
	5	4	14	13	23										
	6	5	15	14	24										
	7	6	16	15	25										
	8	7	17	16	26										
	9	8	18	17	27										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	29 June 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20230629

Bibliographic Data

Application No: 18/069,450

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.
12/21/2022	709	2454	
RULE			

APPLICANTS

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INVENTORS

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

R. DREW MAJOR, OREM, UT, UNITED STATES

CONTINUING DATA

This application is a CON of 17962231 10/07/2022 PAT 11677798

17962231 is a CON of 16876579 05/18/2020 PAT 11470138

16876579 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**

01/17/2023

STATE OR COUNTRY

UNITED STATES

ADDRESS

FILING FEE RECEIVED

$7,160

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	31	client-side SAME adaptive ADJ bit$2rate near2 streaming	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:03 PM
L2	1145	client SAME adaptive ADJ bit$2rate near2 streaming	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:03 PM
L3	0	client SAME adaptive ADJ bit$2rate near2 streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L4	0	adaptive ADJ bit$2rate near2 streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L5	12	adaptive ADJ bit$2rate AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:15 PM
L6	73	BRUECK ADJ DAVID.in.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:20 PM
L7	2524	adaptive ADJ streaming WITH client	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:26 PM
L8	4	adaptive ADJ streaming WITH client AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:26 PM
L9	36	adaptive ADJ streaming WITH client-side	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:28 PM
L10	147	dash SAME client-side	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 03:32 PM
L11	259	("10469554"|"10469555"|"10757156"|"10951680"|"11470138"|"20010013128"|"20010047423"|"20020002708"|"20020029274"|"20020044528"|"20020073167"|"20020091840"|"20020097750"|"20020131496"|"20020144276"|"20020152317"|"20020152318"|"20020156912"|"20020161898"|"20020161908"|"20020161911"|"20020169926"|"20020170062"|"20020174434"|"20020176418"|"20020178330"|"20020188745"|"20030005455"|"20030009578"|"20030014684"|"20030018966"|"20030021166"|"20030021282"|"20030055995"|"20030061305"|"20030065803"|"20	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 04:00 PM

		030067872"|"20030067 875"|"20030072376"|"2 0030081582"|"2003009 3790"|"20030107994"|" 20030135631"|"200301 35863"|"20030140159"| "20030151753"|"20030 152036"|"20030154239 "|"20030195977"|"2003 0204519"|"2003020460 2"|"20030233464"|"200 30236904"|"200302369 06"|"20040003101"|"20 040010613"|"20040030 547"|"20040030599"|"2 0040030797"|"2004003 1054"|"20040049780"|" 20040054551"|"200400 71209"|"20040083283"| "20040093420"|"20040 103444"|"20040117427 "|"20040136327"|"2004 0143672"|"2004016805 2"|"20040170392"|"200 40179032"|"200401996 55"|"20040202109"|"20 040220926"|"20040221 088"|"20040260701"|"2 0040260827"|"2004026 7956"|"20050015509"|" 20050033855"|"200500 55425"|"20050066063"| "20050076136"|"20050 084166"|"20050108414 "|"20050120107"|"2005 0123058"|"2005017761 8"|"20050185578"|"200 50188051"|"200502040 46"|"20050207569"|"20 050251832"|"20050262 257"|"20060010003"|"2 0060059223"|"2006007 5446"|"20060080718"|" 20060130118"|"200601 33809"|"20060165166"| "20060168290"|"20060 206246"|"20060236219 "|"20060277564"|"2006 1068295"|"2007002470 5"|"20070030833"|"200 70067480"|"200700793 25"|"20070094405"|"20 070204310"|"20070280 255"|"20080022343"|"2 0080028428"|"2008003 7527"|"20080046939"|" 20080056373"|"200800 86570"|"20080104647"|					

		"20080120330"|"20080120342"|"20080133766"|"20080162713"|"20080184688"|"2008019574 4"|"20080205291"|"20080219151"|"20080222235"|"20080263180"|"20080281803"|"20090043906"|"20090055471"|"20090055547"|"20090210549"|"20100098103"|"20100262711"|"20110307545"|"20150058496"|"4535355"|"5168356"|"5267334"|"5404446"|"5414455"|"5424455"|"5544318"|"5687095"|"5732183"|"57685627"|"5841432"|"5867230"|"5933603"|"5941951"|"5953506"|"5966015"|"5966025"|"5996025"|"6003030"|"6091775"|"6091777"|"6112239"|"6122660"|"6154744"|"6172672"|"6181867"|"6185736"|"6195680"|"6292383"|"6292834"|"6366614"|"6374289"|"6389473"|"6449719"|"6486803"|"6490627"|"6498897"|"6510553"|"6574591"|"6604118"|"6618752"|"6625643"|"6637031"|"6665726"|"6708213"|"6721723"|"6731600"|"6757796"|"6760772"|"6766407"|"6795863"|"6845107"|"6850965"|"6859839"|"6874015"|"6968387"|"6976090"|"7047307"|"7054365"|"7054774"|"7054911"|"7075986"|"7093001"|"7096271"|"7099954"|"7116894"|"7174385"|"7194549"|"7240100"|"7260640"|"7274740"|"7295520"|"7310678"|"7325073"|"7328243"|"7330908"|"7334044"|"7349358"|"7349976"|"7369610"|"7376747"|"7386627"|"7391717"|"7408984"|"7412531"|"7477688"|"7523181"|"7536469"|"7546355"|"7558869"|"7577750"|"7593333"|"7599307"|"7609652"|"7653735"|"7707					

		303"|"7719985"|"776080 1"|"7779135"|"778839 5"|"7797439"|"7817985" |"7818444"|"7925781"|" 7974200"|"8036265"|"8 370514"|"8402156"|"85 21836"|"8612624"|"868 3066"|"8686066"|"8711 701"|"8818127"|"88687 72"|"8880721"|"934449 6"|"9407564"|"9462074").PN.					
L12	82	L11 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 05:06 PM
L13	0	client WITH request WITH bitstream WITH (bandwidth capability) AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 10:52 PM
L14	21	client WITH request WITH bitstream WITH (bandwidth capability)	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 10:52 PM
L15	10	("11470138" "10659513" "9998516" "9571551" "9071668" "8612624" "8402156" "7818444" "8868772").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/06 11:04 PM
L16	2	("20050055425" "7369610").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 01:28 PM
L17	3	("20050055425" "7369610" "20020087717").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 01:42 PM
L18	1	("6389473").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:48 PM
L19	1099	client WITH select$3 WITH bit$2rate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L20	455	client WITH select$3 WITH bit$2rate SAME stream	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L21	2	client WITH select$3 WITH bit$2rate SAME stream AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 07:58 PM
L22	1	L21 AND ((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.)	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM
L23	114	client WITH select$3 WITH bit$2rate WITH content WITH server	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM
L24	725	client WITH select$3 WITH bit$2rate AND adaptive near3	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:00 PM

		stream$3					
L25	2	client WITH select$3 WITH bit$2rate AND adaptive near3 stream$3 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:01 PM
L26	71	adaptive ADJ streaming AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L27	0	adaptive ADJ streaming AND select$3 WITH bit$2rate AND @ad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L28	1	adaptive ADJ streaming AND select$3 WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/07 08:02 PM
L29	0	("56683104").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 AM
L30	0	client WITH select$3 WITH bit$2rate near3 streamlet	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:24 AM
L31	1	client WITH select$3 WITH bit$2rate WITH streamlet	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:24 AM
L32	35	adaptive near3 bitrate WITH selection WITH client	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 02:14 PM
L33	8	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 02:19 PM
L34	2	("6490627" "20030152036").pn.	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:48 PM
L35	52	client WITH request$3 WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:56 PM
L36	0	client WITH request$3 WITH streamlet AND bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L37	8	client WITH request$3 WITH streamlet AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L38	81	client WITH request$3 WITH streamlet AND bit$2rate	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:57 PM
L39	18	client WITH request$3 WITH segments AND bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 09:58 PM
L40	63	segment WITH stream	(US-PGPUB; USPAT;	OR	ON	ON	2023/03/08

		WITH (chunk sement) WITH bit$2rate	USOCR; EPO)				10:05 PM
L41	0	segment WITH stream WITH (chunk sement) WITH bit$2rate AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 10:07 PM
L42	6	"2003009581"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/08 11:08 PM
L43	8	"2003009581"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); EPO)	OR	ON	ON	2023/03/08 11:08 PM
L44	17	"2003009581"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; DERWENT)	OR	ON	ON	2023/03/08 11:09 PM
L45	2	("20040172478").pn.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; DERWENT)	OR	ON	ON	2023/03/08 11:22 PM
L46	48	http ADJ get near3 request near4 client AND stream$3 AND @rlad<"20040930"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 12:32 AM

L47	51	multi$2pass near2 encod$3 WITH stream	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:16 PM
L48	0	multi$2pass near2 encod$3 WITH stream AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:16 PM
L49	6497	multi$2pass AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L50	64	multi$2pass near2 encod$3 AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L52	0	multi$2pass near2 encod$3 AND streamlet AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 02:17 PM
L53	0	adaptive near3 bitrate WITH selection WITH client AND @rlad<"20040430"	(US-PGPUB; USPAT; USOCR; EPO)	OR	ON	ON	2023/03/09 04:42 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	8	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:19 PM
N2	0	client WITH select$3 near3 streamlet WITH bitrate AND @rlad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N3	0	client WITH select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N4	1	client WITH select$3 WITH streamlet SAME bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:23 PM
N5	253	request$3 near3 streamlet	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N6	101	request$3 near3 streamlet WITH client	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N7	10	request$3 near3 streamlet WITH client AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:24 PM
N8	0	request$3 near3 streamlet WITH client AND bit$2rate AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM
N9	0	request$3 near3 streamlet AND bit$2rate	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM

		AND @ad<"20040930"					
N10	3	request$3 near3 (streamlet chunk) AND bit$2rate AND @ad<"20040930"	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:25 PM
N11	53	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND N6	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:47 PM
N12	53	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND request$3 near3 streamlet WITH client	(US-PGPUB; USPAT)	OR	ON	ON	2023/03/08 02:52 PM
N13	8	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet WITH bitrate	(US-PGPUB; USPAT)	OR	ON	ON	2023/06/29 09:44 AM
N14	0	((H04L47/30 OR H04L65/80 OR H04L47/263 OR H04L47/10).cpc.) AND select$3 near3 streamlet SAME bitrate near2 copies	(US-PGPUB; USPAT)	OR	ON	ON	2023/06/29 09:44 AM

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	18069450
Filing Date	2022-12-21
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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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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]
/C.R.P/	1	1202487	EP	B1	2006-05-04	Nagai et al.		

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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	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

/C.R.P/	1	Commission Opinion in the Matter of Certain Fitness Devices, Streaming Components Thereof, and Systems Containing Same [Public Version] dated March 23, 2023 (96 pages).	
	2		
	3		
	4		
	5		
	6		

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	06/29/2023

*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	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

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)	2023-06-15
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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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

70560 7590 07/31/2023
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
07/31/2023	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@docketrak.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 18069450
Applicant : Brueck
Filing Date : 12/21/2022
Date Mailed : 07/31/2023

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

A copy of this notice MUST be returned with the reply. Please address response to "Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450".

/June Hope/
Publication Branch
Office of Data Management
(571) 272-4200

Application No. 18069450

IDENTIFICATION OF APPLICATION DEFICIENCIES IN APPLICATION FILED ON OR AFTER SEPTEMBER 16, 2012

[X] Applicant must provide legible text for the following item(s).

- [X] Specification filed 12/21/2022, page(s) 26 (equation).
- [ ] Claims filed , claim(s) .
- [ ] Other: .

[ ] Applicant must provide missing information on the following page(s) of the specification by amending the specification to add the missing text. No new matter may be added.
Page/line no(s).

[ ] The specification refers to one or more applications by attorney docket number and does not show the U.S. application number(s). Applicant must supply the U.S. application number in place of each attorney docket number.
Page/line no(s).

[ ] Applicant must provide an Abstract of the Disclosure.

[ ] The Application Data Sheet (ADS dated) does not supply the inventor's city and/or does not supply the inventor's U.S. state and/or does not supply the inventor's country. Applicant must submit a signed, in accordance with 37 CFR 1.76(e) and 1.33(b), application data sheet that corrects this deficiency. To be in compliance with 37 CFR 1.76, the corrected application data sheet must identify the information being changed by using underlining for additions and strikethroughs or brackets for deletions.

[ ] Other:

The response to this notice should contain only amended papers, as the waiver of 37 CFR 1.312 is limited to corrections of documents specifically requested in the notice.

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	18069450
Filing Date	21-Dec-2022
First Named Inventor	DAVID BRUECK
Attorney Docket Number	9401-00279
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 L.L.C.	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)

10225304

9407564

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 Carlson/
Name	Brett 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:	18069450
Filing Date:	21-Dec-2022
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:	9401-00279

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.: 18069450

Filing Date: 21-Dec-2022

Applicant/Patent under Reexamination: BRUECK

Electronic Terminal Disclaimer filed on August 22, 2023

☒ 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:	48473829
Application Number:	18069450
International Application Number:	
Confirmation Number:	8508
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:	9401-00279
Receipt Date:	22-AUG-2023
Filing Date:	21-DEC-2022
Time Stamp:	14:28:04
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	E20238LE28026957
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	41237 deb3a1f56d99e4599fd7173e6f25e6fc23d5c107	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37975 31b7c426fe472f80c869b54c4cae18f1175c4398	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	79212		

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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

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

70560 7590 08/28/2023

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
08/28/2023	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

Examiner-Initiated Interview Summary	**Application No.** 18/069,450	**Applicant(s)** BRUECK et al.		
	Examiner CHIRAG R PATEL	**Art Unit** 2454	**AIA (First Inventor to File) Status** No	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
CHIRAG R PATEL	Primary Examiner	Telephonic
Brett Carlson	Attorney	

Date of Interview: 21 August 2023

Issues Discussed:

Non-statutory Double Patenting

Examiner contacted applicants to inform upon further review by the office, an obvious double patent was found with respect to application claim 22 of the instant application over claim 9 of US Pat 10,225,304 and claim 8 of U.S. Patent No. 9407564, both in view of Carmel et al. (US 6,389,473) per Col 2 lines 1-26, which teaches the concepts that each slice is a respective slice index, independently requested by the client, and maintains proper synchronization upon playback. Applicants representative filed an E-Terminal disclaimer. Case is already allowed status and will proceed to issue.

/CHIRAG R PATEL/ Primary Examiner, Art Unit 2454	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/069,450	**10/12/2023 01:49:53 PM ET**	**9401-00279**

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 #	8508	FILED BY	Blake Scheffey
PATENT CENTER #	62982974	FILING DATE	12/21/2022
CUSTOMER #	70560	FIRST NAMED INVENTOR	DAVID F. BRUECK
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Brett Carlson

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
9401-00279_IFT.pdf	1	Issue Fee Payment (PTO-85B)	149 KB
9401-00279_FeeAddress.pdf	2	Maintenance Fee Address Change	242 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
9401-00279_IFT.pdf	DE2043A34524A755242CA71C4EA38E75C8F00FBA64E63A153 7409CE7D0B56B499FD446E3D7920BD1DF447996EA86CF88FD 7FB768F4D8FBC57BCA8631B6A0C2B6

9401-00279_FeeAddress.pdf D694D1014EEA7C5F6F9FFB0F7929EE064FAA6CDB5F6E99EB
A732914A51625357D45AD7EE3C3FFD897C787DFDDA58E9A4
BE39D8DE2566BF563C3E1C733EAA98C6

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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 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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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/069,450	**10/12/2023 01:49:53 PM ET**	**9401-00279**

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 #	8508	FILED BY	Blake Scheffey
PATENT CENTER #	62982974	AUTHORIZED BY	Brett Carlson
CUSTOMER #	70560	FILING DATE	12/21/2022
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	DAVID F. BRUECK

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 6960	**E20230BD50466139**	**Blake Scheffey**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1501	UTILITY ISSUE FEE	1200.00	1	1200.00
			TOTAL AMOUNT:	**$1,200.00**

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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: MFEE.C.AD
Document Description: Maintenance Fee Address Change

PTO/SB/47 (11-21)
Approved for use through 11/30/2024. OMB 0651-0016
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 displays a valid OMB control number.

"FEE ADDRESS" INDICATION FORM

Address to:
Mail Stop Maintenance Fee
Director of the United States
Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

-OR-

Fax to: 571-273-6500

INSTRUCTIONS: The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application.
When to check the first box below: If you have a Customer Number to represent the fee address.
When to check the second box below: If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see section 403 of the Manual of Patent Examining Procedure (MPEP).

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☑ Customer Number 000197

OR

☐ The attached Request for Customer Number (PTO/SB/125) form.

PATENT NUMBER (if known)	APPLICATION NUMBER
	18/069,450

Completed by (check one):

☐ Applicant/Inventor

/Brett A. Carlson/
Signature

☑ Attorney or agent of record 39,928 (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

October 12, 2023
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

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 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. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

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

70560 7590 07/14/2023
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.
18/069,450	12/21/2022	DAVID F. BRUECK	9401-00279	8508

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	10/16/2023

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)

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

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

☒ The Director is hereby authorized to charge [redacted], 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

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.

☐ Applicant asserting small entity status. See 37 CFR 1.27

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.

☐ Applicant changing to regular undiscounted fee 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 Carlson/ Date October 12, 2023

Typed or printed name Brett Carlson Registration No. 39928

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.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	18/069,450	Filing Date	2022-12-21	Docket Number (if applicable)	9401-00279	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
Petition to Withdraw from Issue

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)	2023-10-19
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.

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	18069450
Filing Date	2022-12-21
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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					

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					

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] 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]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	1	Claim Chart Against U.S. Pat. No. 9,407,564 ("'564 patent") "Microsoft Windows Media Technologies" as described by Birney, "Intelligent Streaming" (May 2003) ("Birney")	☐
	2	IPR2024-00043 filed on U.S. Patent 11,677,798	☐
	3	IPR2024-00044 filed on U.S. Patent 11,470,138	☐
	4	IPR2024-00045 filed on U.S. Patent 10,469,554	☐
	5	IPR2024-00046 filed on U.S. Patent 10,951,680	☐
	6	IPR2024-00047 filed on U.S. Patent 9,407,564	☐
	7	IPR2024-00048 filed on U.S. Patent 8,868,772	☐
	8	Declaration of Dr. Henry Houh including Curriculum Vitae ("Houh") in IPR2024-00043	☐
	9	Declaration of Dr. Henry Houh including Curriculum Vitae ("Houh") in IPR2024-00044	☐
	10	Declaration of Dr. Henry Houh including Curriculum Vitae ("Houh") in IPR2024-00045	☐
	11	Declaration of Dr. Henry Houh including Curriculum Vitae ("Houh") in IPR2024-00046	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	12	Declaration of Dr. Henry Houh including Curriculum Vitae (“Houh”) in IPR2024-00047	☐
	13	Declaration of Dr. Henry Houh including Curriculum Vitae (“Houh”) in IPR2024-00048	☐
	14	337-TA-1265 ITC September 11, 2023 Enforcement Complaint	☐
	15	Internet Archive Affidavit, Nathaniel E Frank-White for URLs ("SMIL")	☐
	16	"Synchronized Multimedia Integration Language (SMIL 2.0) (“SMIL2.0”)"	☐
	17	U.S. Provisional Application No. 60/041,770 (Ogdon)	☐
	18	"Exhibit 4 - DECLARATION OF DR. HENRY HOUH, PH.D. IN SUPPORT OF AYLOPREMIUM LTD AND AYLO BILLING LIMITED’S RESPONSE TOPLAINTIFFS’ MOTION FOR PRELIMINARY INJUNCTION (DC Utah, Case No. 2:23-cv-552-BSJ)"	☐
	19	Houh Exhibit A - CV of Henry H. Houh	☐
	20	Houh Exhibit B - List of Materials Considered	☐
	21	Houh Exhibit C - U.S. Patent No. 10,469,554	☐
	22	Houh Exhibit D - U.S. Patent No. 11,470,138	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	23	Houh Exhibit E - U.S. Patent No. 11,677,798	☐
	24	Houh Exhibit F - U.S. Patent No. 8,868,772	☐
	25	Houh Exhibit G - U.S. Patent No. 9,407,564	☐
	26	Houh Exhibit H - U.S. Patent No. 10,951,680	☐
	27	Houh Exhibit I - Claim Chart of U.S. Patent No. 10,469,554 and Ogdon	☐
	28	Houh Exhibit J - Claim Chart of U.S. Patent No. 10,469,554 and Shteyn	☐
	29	Houh Exhibit K - Claim Chart of U.S. Patent No. 11,470,138 and Ogdon	☐
	30	Houh Exhibit L - Claim Chart of U.S. Patent No. 11,470,138 and Shteyn	☐
	31	Houh Exhibit M - Claim Chart of U.S. Patent No. 11,677,798 and Ogdon	☐
	32	Houh Exhibit O - Claim Chart of U.S. Patent No. 8,868,772 and Ogdon	☐
	33	Houh Exhibit P - Claim Chart of U.S. Patent No. 8,868,772 and Shteyn	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	34	Houh Exhibit Q - Claim Chart of U.S. Patent No. 9,407,564 and Ogdon	☐
	35	Houh Exhibit R- Claim Chart of U.S. Patent No. 9,407,564 and Shteyn	☐
	36	Houh Exhibit S - Claim Chart of U.S. Patent No. 10,951,680 and Ogdon	☐
	37	Houh Exhibit T - Claim Chart of U.S. Patent No. 10,951,680 and Shteyn	☐
	38	Wu, Dapeng et al., Streaming Video over the Internet: Approaches and Directions, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 11, NO. 3, MARCH 2001.	☐
	39	RealNetworks Production Guide with RealOne Player (2002)	☐
	40	RealSystem G2 Production Guide (1998)	☐
	41	Darwin Streaming Server (1999)	☐
	42	Houh Exhibit N - Claim Chart of U.S. Patent No. 11,677,798 and SHTEYN	☐
	43		☐
	44		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	18069450
	Filing Date	2022-12-21
	First Named Inventor	David F. Brueck
	Art Unit	2454
	Examiner Name	Chirag R. Patel
	Attorney Docket Number	9401-00279

	45		☐
	46		☐
	47		☐

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	18069450
Filing Date	2022-12-21
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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 Carlson/	Date (YYYY-MM-DD)	2023-10-19
Name/Print	Brett Carlson	Registration Number	39928

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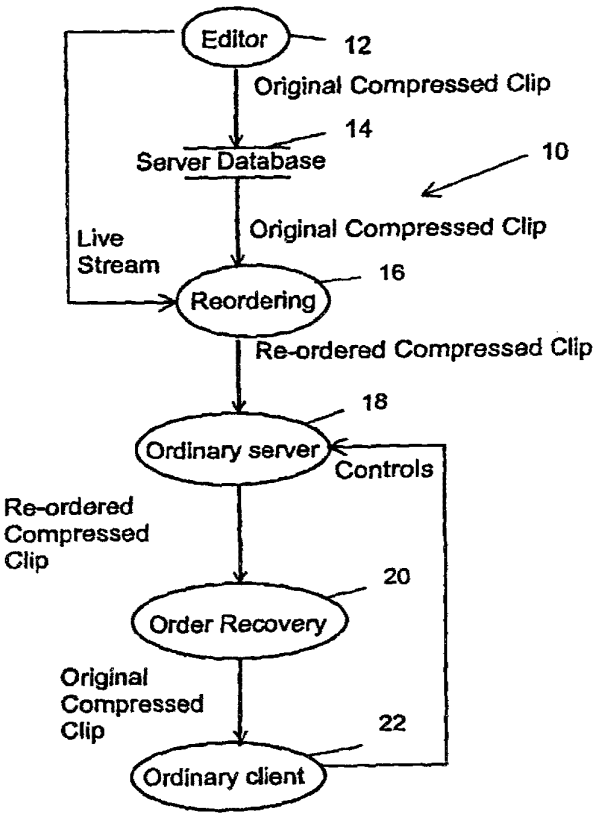
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(57) Abstract

A data transmission system (10) is provided for transmitting a data signal between a server (12, 14, 16, 18) and a communications terminal (20, 22) over a transmission link having a variable bandwidth. The data signal is a scalable compressed multimedia clip comprising a sequence of images. Each image has a base layer and a number of enhancement layers. To cope with variability in the bandwidth, the sequence is re–ordered so that the base layers have greater safety times than the enhancement layers. This allows all of the base layers to arrive in time to be played at the expense of the enhancement layers.



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DATA TRANSMISSION

This invention relates to data transmission and is particularly, but not exclusively, related to transmission of data representative of picture sequences, such as video. It is particularly suited to transmission over links susceptible to errors and loss of data.

During the past few years, the amount of multimedia content available through the Internet has increased considerably. Since data delivery rates to mobile terminals are becoming high enough to enable such terminals to be able to retrieve multimedia content, it is becoming desirable to enable mobile terminals to retrieve video and other multimedia content from the Internet. An example of a high-speed data delivery system is the upcoming GSM phase 2+.

The term multimedia as used herein applies to both sound and pictures, to sound only and to pictures only. Sound may include speech and music.

Network traffic through the Internet is based on a transport protocol called the Internet Protocol (IP). IP is concerned with transporting data packets from one location to another. It facilitates the routing of packets through intermediate gateways, that is, it allows data to be sent to machines that are not directly connected in the same physical network. The unit of data transported by the IP layer is called an IP datagram. The delivery service offered by IP is connectionless, that is IP datagrams are routed around the Internet independently of each other. Since no resources are permanently committed within the gateways to any particular connection, the gateways may occasionally have to discard datagrams because of lack of buffer space or other resources. Thus, the delivery service offered by IP is a best effort service rather than a guaranteed service.

Internet multimedia is typically streamed over the User Datagram Protocol (UDP), the Transmission Control Protocol (TCP) or the Hypertext Transfer Protocol (HTTP).

UDP is a connectionless lightweight transport protocol. It offers very little above the service offered by IP. Its most important function is to deliver datagrams between specific transport endpoints. Consequently, the transmitting application has to take care of how to packetize data to datagrams. Headers used in UDP contain a checksum that allows the UDP layer at the receiving end to check the validity of the data. Otherwise, degradation of IP datagrams will in turn affect UDP datagrams. UDP does not check that the datagrams have been received, does not retransmit missing datagrams, nor does it guarantee that the datagrams are received in the same order as they were transmitted.

UDP introduces a relatively stable throughput having a small delay since there are no retransmissions. Therefore it is used in retrieval applications to deal with the effect of network congestion and to reduce delay (and jitter) at the receiving end. However, the client must be able to recover from packet losses and possibly conceal lost content. Even with reconstruction and concealment, the quality of a reconstructed clip suffers somewhat. On the other hand, playback of the clip is likely to happen in real-time without annoying pauses. Firewalls, whether in a company or elsewhere, may forbid the usage of UDP because it is connectionless.

TCP is a connection-orientated transport protocol and the application using it can transmit or receive a series of bytes with no apparent boundaries as in UDP. The TCP layer divides the byte stream into packets, sends the packets over an IP network and ensures that the packets are error-free and received in their correct order. The basic idea of how TCP works is as follows. Each time TCP sends a packet of data, it starts a timer. When the receiving end gets the packet, it immediately sends an acknowledgement back to the sender. When the sender receives the acknowledgement, it knows all is well, and cancels the timer. However, if the IP layer loses the outgoing segment or the return acknowledgement, the timer at the sending end will expire. At this point, the sender will retransmit the segment. Now, if the sender waited for an acknowledgement for each packet before sending the next one, the overall

transmission time would be relatively long and dependent on the round-trip delay between the sender and the receiver. To overcome this problem, TCP uses a sliding window protocol that allows several unacknowledged packets to be present in the network. In this protocol, an acknowledgement packet contains a field filled with the number of bytes the client is willing to accept (beyond the ones that are currently acknowledged). This window size field indicates the amount of buffer space available at the client for storage of incoming data. The sender may transmit data within the limit indicated by the latest received window size field. The sliding window protocol means that TCP effectively has a slow start mechanism. At the beginning of a connection, the very first packet has to be acknowledged before the sender can send the next one. Typically, the client then increases the window size exponentially. However, if there is congestion in the network, the window size is decreased (in order to avoid congestion and to avoid receive buffer overflow). The details how the window size is changed depend on the particular TCP implementation in use.

A multimedia content creation and retrieval system is shown in Figure 1. The system has one or more media sources, for example a camera and a microphone. Alternatively, multimedia content can also be synthetically created without a natural media source, for example animated computer graphics and digitally generated music. In order to compose a multimedia clip consisting of different media types, such as video, audio, text, images, graphics and animation, raw data captured from the sources are edited by an editor. Typically the storage space taken up by raw (uncompressed) multimedia data is huge. It can be megabytes for a video sequence which can include a mixture of different media, for example animation. In order to provide an attractive multimedia retrieval service over low bit rate channels, for example 28.8 kbps and 56 kbps, multimedia clips are compressed in the editing phase. This typically occurs off-line. The clips are then handed to a multimedia server. Typically, a number of clients can access the server over one or more networks. The server is able to respond to the requests presented by the clients. The main task of the server is to transmit a desired multimedia clip to the client which the client decompresses and plays. During

playback, the client utilizes one or more output devices, such as a screen and a loudspeaker. In some circumstances, clients are able to start playback while data are still being downloaded.

It is convenient to deliver a clip by using a single channel which provides a similar quality of service for the entire clip. Alternatively different channels can be used to deliver different parts of a clip, for example sound on one channel and pictures on another. Different channels may provide different qualities of service. In this context, quality of service includes bit rate, loss or bit error rate and transmission delay variation.

In order to ensure multimedia content of a sufficient quality is delivered, it is provided over a reliable network connection, such as TCP, which ensures that received data are error-free and in the correct order. Lost or corrupted protocol data units are retransmitted. Consequently, the channel throughput can vary significantly. This can even cause pauses in the playback of a multimedia stream whilst lost or corrupted data are retransmitted. Pauses in multimedia playback are annoying.

Sometimes retransmission of lost data is not handled by the transport protocol but rather by some higher-level protocol. Such a protocol can select the most vital lost parts of a multimedia stream and request the retransmission of those. The most vital parts can be used for prediction of other parts of the stream, for example.

In order to understand the invention better, descriptions of the elements of the retrieval system, namely the editor, the server and the client, are set out below.

A typical sequence of operations carried out by the multimedia clip editor is shown in Figure 2. Raw data are captured from one or more data sources. Capturing is done using hardware, device drivers dedicated to the hardware and a capturing application which controls the device drivers to use the hardware. Capturing hardware may consist of a video camera connected to a PC video grabber card,

for example. The output of the capturing phase is usually either uncompressed data or slightly compressed data with irrelevant quality degradations when compared to uncompressed data. For example, the output of a video grabber card could be in an uncompressed YUV 4:2:0 format or in a motion-JPEG format. The YUV colour model and the possible sub-sampling schemes are defined in Recommendation ITU-R BT.601-5 "Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-Screen 16:9 Aspect Ratios". Relevant digital picture formats such as CIF, QCIF and SQCIF are defined in Recommendation ITU-T H.261 "Video Codec for Audiovisual Services at p x 64 kbits" (section 3.1 "Source Formats").

During editing separate media tracks are tied together in a single timeline. It is also possible to edit the media tracks in various ways, for example to reduce the video frame rate. Each media track may be compressed. For example, the uncompressed YUV 4:2:0 video track could be compressed using ITU-T recommendation H.263 for low bit rate video coding. If the compressed media tracks are multiplexed, they are interleaved so that they form a single bitstream. This clip is then handed to the multimedia server. Multiplexing is not essential to provide a bitstream. For example, different media components such as sounds and images may be identified with packet header information in the transport layer. Different UDP port numbers can be used for different media components.

A typical sequence of operations carried out by the multimedia server is shown in Figure 3. Typically multimedia servers have two modes of operation; they deliver either pre-stored multimedia clips or a live (real-time) multimedia stream. In the first mode, clips are stored in a server database, which is then accessed on-demand by the server. In the second mode, multimedia clips are handed to the server as a continuous media stream that is immediately transmitted to clients. Clients control the operation of the server by an appropriate control protocol being at least able to select a desired media clip. In addition, servers may support more advanced controls. For example, clients may be able to stop the transmission of a clip, to pause and resume transmission of a clip, and to control the media flow in

case of a varying throughput of the transmission channel in which case the server must dynamically adjust the bitstream to fit into the available bandwidth.

A typical sequence of operations carried out by the multimedia retrieval client is shown in Figure 4. The client gets a compressed and multiplexed media clip from a multimedia server. The client demultiplexes the clip in order to obtain separate media tracks. These media tracks are then decompressed to provide reconstructed media tracks which are played out with output devices. In addition to these operations, a controller unit is provided to interface with end-users, that is to control playback according to end-user input and to handle client-server control traffic. It should be noted that the demultiplexing-decompression-playback chain can be done on a first part of the clip while still downloading a subsequent part of the clip. This is commonly referred to as streaming. An alternative to streaming is to download the whole clip to the client and then demultiplex it, decompress it and play it.

A typical approach to the problem of varying throughput of a channel is to buffer media data in the client before starting the playback and/or to adjust the transmitted bit rate in real-time according to channel throughput statistics.

One way of tackling the problem of pauses is by using dynamic bit rate adjustment in the multimedia server. However, the server may not react to network congestion sufficiently quickly to avoid pausing in the client. In addition, the server cannot control the retransmission mechanism of TCP (or other underlying protocols, such as IP).

Even if dynamic bit rate adjustment is used, the client has to do some initial buffering in any case to avoid delivery delays caused by re-transmission. If a constant channel bit rate is assumed, one can calculate the point in time at which a data unit is supposed to have been completely received. In addition, one can calculate the point in time by which a data unit is supposed to have been played. The time difference between these two points in time is referred to as the safety

time. Another way of defining the safety time is to state that it is the maximum time between two consecutively received data units which does not cause pausing in the playback.

When calculating the safety times for a clip, each data unit has to be considered separately. The calculations assume that no throughput drops occur before the data unit that is currently being processed. If the maximum throughput of the channel is equal to the average bit rate of the multimedia clip, the client cannot recover from a drop in the amount of received bits after throughput has dropped. The only way to guarantee some protection against throughput drops is to buffer some data before starting playback. If the channel stops providing data, the client can still play the stream while there are data in a buffer. Thus, the average safety time is approximately equal to the initial buffering time. Since the bit rate of the clip may vary, the safety time also may vary and the minimum safety time is thus equal to or less than the initial buffering delay.

HTTP, the Hypertext Transfer Protocol, is the basis of the World Wide Web (WWW). It is a simple protocol. A client establishes a TCP connection to a server, issues a request, and reads back the server's response. The server denotes the end of its response by closing the connection. The arrangement of protocol layers is typically HTTP on TCP which is on IP.

The most common HTTP request is called GET. The GET request is associated with a universal resource identifier (URI) which uniquely specifies the requested item. The server responds to the GET request by returning the file corresponding to the specified URI. The file returned by the server normally contains pointers (hypertext links) to other files that can reside on other servers. A user can therefore easily follow the links from file to file.

Servers used for Internet multimedia retrieval are either dedicated multimedia servers or normal WWW servers.

Dedicated multimedia servers are typically capable of transmission over HTTP, TCP and UDP protocols. They may be able to readjust the contents of media clips dynamically to meet the available network bandwidth and to avoid network congestion. They may also support fast forward and fast rewind operations as well as live multimedia streaming. They can provide a number of streams simultaneously.

Multimedia servers based on normal WWW servers are also referred to as server-less or HTTP multimedia solutions. The multimedia clips are streamed over HTTP. Since this type of server has no control over the contents of the stream, no flow (bandwidth) control can be applied, and it cannot respond to network congestion. Therefore, sudden pauses in the playback can occur. Consequently there must be a relatively long initial buffering delay in the client before starting the playback to avoid such sudden pauses. Fast-forwarding a multimedia stream from a standard WWW server is not possible. Live multimedia streaming must be implemented using special tricks, such as Java programming.

When a streamed multimedia clip is received, a suitable independent media player application or a browser plug-in can be used to play it. Such multimedia players differ largely from browser to browser. Newer browsers may have some integrated plug-ins for the most popular streaming video players.

There are a number of different data transmission methods available for transmitting data between mobile terminals and their networks. One of the best known methods is GSM (Global System for Mobile communications).

The current GSM data service called Circuit Switched Data (CSD) offers a 9.6 kbps circuit-switched channel. It is intended for GSM to provide a 14.4 kbps data channel having forward error correction (FEC) and status information. High Speed Circuit Switched Data (HSCSD) provides multiple 9.6 kbps or 14.4 kbps time slots for a single user at the same time. There are symmetric and asymmetric connections. In a symmetric connection, the air interface resources are allocated

symmetrically, and provide the same data transmission rate in both directions. In an asymmetric connection, different data rates are supported for up-link and for down-link. However, asymmetric air interface connections are applicable only in non-transparent mode (see below).

Circuit-switched GSM data systems, CSD and HSCSD, offer two basic connection types, namely transparent (T) and non-transparent (NT). These are distinguished by the way they correct transmission errors. In a transparent connection, error correction is done solely by a forward error correction mechanism provided by the radio interface transmission scheme. The connection is considered as a synchronous circuit. The available throughput is constant, and the transmission delay is fixed. The transmitted data are likely to contain bit inversion errors. In a non-transparent connection, the GSM circuit connection is regarded as a packet (or frame) data flow although the end-to-end service is circuit-switched. Each frame includes redundancy bits to enable a receiver to detect remaining errors. There are two sources of error, packet drops and corruption due to interference in the radio frequency path. The latter can be recovered by redundancy checking. The Radio Link Protocol (RLP) is used to provide retransmission in case of remaining errors in frame. If a frame is found to be correct, the receiver acknowledges this fact. If it is found not to be correct, a negative acknowledgement is sent and the indicated frame is retransmitted. Consequently, a non-transparent connection is error-free but throughput and transmission delay vary.

Other network types exist, for example GPRS (General Packet Radio System). In GPRS the transmissions are truly packet based.

A video sequence consists of a series of still pictures. Video compression methods are based on reducing redundant and perceptually irrelevant parts of video sequences. The redundancy in video sequences can be categorised into spatial, temporal and spectral redundancy. Spatial redundancy means the correlation between neighbouring pixels. Temporal redundancy means that the same objects

appear in consecutive pictures. Reducing the temporal redundancy reduces the amount of data required to represent a particular image sequence and thus compresses the data. This can be achieved by generating motion compensation data, which describe the motion between the current and a previous (reference) picture. In effect, the current picture is predicted from the previous one. Spectral redundancy means the correlation between the different colour components of the same picture.

Simply reducing the redundancy of the sequence does not usually compress it enough. Therefore, some video encoders try to reduce the quality of those parts of a video sequence which are subjectively the least important. In addition, the redundancy of the encoded bitstream is reduced by means of efficient lossless coding of compression parameters and coefficients. The main technique is to use variable length codes.

Video compression methods typically differentiate between pictures that can use temporal redundancy reduction and those that cannot. Compressed pictures, which do not use temporal redundancy reduction methods, are usually called INTRA or I-frames whereas temporally predicted pictures are called INTER or P-frames. In the INTER frame case, the predicted (motion-compensated) picture is rarely precise enough, and therefore a spatially compressed prediction error picture is also associated with each INTER frame.

Temporal scalability provides a mechanism for enhancing perceptual quality by increasing the picture display rate. This is achieved by taking a pair of consecutive reference pictures and bi-directionally predicting a B-picture from either one or both of them. The B-picture can then be played in sequence between the two anchor pictures. This is illustrated in Figure 5. Bi-directional temporal prediction yields a more accurately predicted picture than uni-directional prediction. Thus, for the same quantization level, B-pictures yield increased compression as compared to forwardly predicted P-pictures. B-pictures are not used as reference pictures, that is other pictures are never predicted from them. Since they can be discarded

without impacting the picture quality of future pictures, they provide temporal scalability. It should be noted that while B-pictures provide better compression performance than P-pictures, they are more complex to construct and require more memory. Furthermore they introduce additional delays because bi-directional interpolation requires both reference pictures to have been received and additional calculations are required. In addition, B-pictures require more side information in the bitstream.

The term scalability refers to the capability of a compressed sequence to be decoded at different data rates. In other words, a scalable multimedia clip can be edited relatively easily while it is compressed so that it can be streamed over channels with different bandwidths and still be decoded and played back in real-time.

Scalable multimedia is typically ordered so that there are hierarchical layers of data. A base layer contains a basic representation of the multimedia clip whereas enhancement layers contain refinement data on top of underlying layers. Consequently, the enhancement layers improve the quality of the clip.

Scalability is a desirable property for heterogeneous and error prone environments. This property is desirable in order to counter limitations such as constraints on bit rate, display resolution, network throughput, and decoder complexity.

Scalability can be used to improve error resilience in a transport system where layered coding is combined with transport prioritisation. The term transport prioritisation here refers to various mechanisms to provide different qualities of service in transport, including unequal error protection, to provide different channels having different error/loss rates. Depending on their nature, data are assigned differently, for example, the base layer may be delivered through a channel with high degree of error protection, and the enhancement layers may be transmitted through more error-prone channels.

Generally, scalable multimedia coding suffers from a worse compression efficiency than non-scalable coding. In other words, a multimedia clip coded as a scalable multimedia clip with all enhancement layers requires greater bandwidth than if it had been coded as a non-scalable single-layer clip with equal quality. However, exceptions to this general rule exist, for example the temporally scalable B-frames in video compression.

In the following, scalability is discussed with reference to the ITU-T H.263 video compression standard. H.263 is an ITU-T recommendation for video coding in low bit rate communication which generally means data rates below 64 kbps. The recommendation specifies the bitstream syntax and the decoding of the bitstream. Currently, there are two versions of H.263. Version 1 consists of the core algorithm and four optional coding modes. H.263 version 2 is an extension of version 1 providing twelve new negotiable coding modes.

Pictures are coded as luminance and two colour difference (chrominance) components (Y, C_B and C_R). The chrominance pictures are sampled with a half of the pixels along the both co-ordinate axes when compared to the luminance picture.

The scalability mode (Annex O) of H.263 specifies syntax to support temporal, signal-to noise ratio (SNR), and spatial scalability capabilities.

Spatial scalability and SNR scalability are closely related, the only difference being the increased spatial resolution provided by spatial scalability. An example of SNR scalable pictures is shown in Figure 6. SNR scalability implies the creation of multi-rate bit streams. It allows for the recovery of coding errors, or differences between an original picture and its reconstruction. This is achieved by using a finer quantizer to encode the difference picture in an enhancement layer. This additional information increases the SNR of the overall reproduced picture.

Spatial scalability allows for the creation of multi-resolution bit streams to meet varying display requirements and/or constraints. A spatially scalable structure is illustrated in Figure 7. It is essentially the same as in SNR scalability except that a spatial enhancement layer attempts to recover the coding loss between an up-sampled version of the reconstructed reference layer picture and a higher resolution version of the original picture. For example, if the reference layer has a quarter common intermediate format (QCIF) resolution, and the enhancement layer has a common intermediate format (CIF) resolution, the reference layer picture must be scaled accordingly such that the enhancement layer picture can be predicted from it. The QCIF standard allows the resolution to be increased by a factor of two in the vertical direction only, horizontal direction only, or both the vertical and horizontal directions for a single enhancement layer. There can be multiple enhancement layers, each increasing the picture resolution over that of the previous layer. The interpolation filters used to up-sample the reference layer picture are explicitly defined in the H.263 standard. Aside from the up-sampling process from the reference to the enhancement layer, the processing and syntax of a spatially scaled picture are identical to those of an SNR scaled picture.

In either SNR or spatial scalability, the enhancement layer pictures are referred to as EI- or EP-pictures. If the enhancement layer picture is upwardly predicted from a picture in the reference layer, then the enhancement layer picture is referred to as an Enhancement-I (EI) picture. In this type of scalability, the reference layer means the layer "below" the current enhancement layer. In some cases, when reference layer pictures are poorly predicted, over-coding of static parts of the picture can occur in the enhancement layer, causing an unnecessarily excessive bit rate. To avoid this problem, forward prediction is permitted in the enhancement layer. A picture that can be predicted in the forward direction from a previous enhancement layer picture or, alternatively, upwardly predicted from the reference layer picture is referred to as an Enhancement-P (EP) picture. Note that computing the average of the upwardly and forwardly predicted pictures can provide bi-directional prediction for EP-pictures. For both EI- and EP-pictures, upward prediction from the reference layer picture implies that no motion vectors are

required. In the case of forward prediction for EP-pictures, motion vectors are required.

In multi-point and broadcast multimedia applications, constraints on network throughput may not be foreseen at the time of encoding. Thus, a scalable bitstream should be used. Figure 8 shows an IP multicasting arrangement where each router can strip the bitstream according to its capabilities. It shows a server S providing a bitstream to a number of clients C. The bitstreams are routed to the clients by routers R. In this example, the server is providing a clip which can be scaled to at least three bit rates, 120 kbit/s, 60 kbit/s and 28 kbit/s.

If the client and server are connected via a normal uni-cast connection, the server may try to adjust the bit rate of the transmitted multimedia clip according to the temporary channel throughput. One solution is to use a layered bit stream and to adapt to bandwidth changes by varying the number of transmitted enhancement layers.

According to a first aspect of the invention there is provided a method of transmitting a data signal having a sequence of data units in a predetermined order over a transmission link between a data source and a data sink comprising the step of sending the data units in an order determined by their relative importance rather than their predetermined order.

According to a second aspect of the invention there is provided a data transmission system for transmitting a data signal having a sequence of data units in a predetermined order over a transmission link between a data source and a data sink the data units being sent in an order determined by their relative importance rather than their predetermined order.

According to a third aspect of the invention there is provided a server for transmitting a data signal having a sequence of data units in a predetermined

order over a transmission link the data units being sent in an order determined by their relative importance rather than their predetermined order.

Preferably the server comprises re-ordering means. Preferably the server comprises an editor for providing a scalable data signal.

According to a fourth aspect of the invention there is provided a computer program product stored on a computer usable medium comprising computer readable program means for causing transmission of a data signal having a sequence of data units in a predetermined order over a transmission link the data units being sent in an order determined by their relative importance rather than their predetermined order.

Preferably the computer program product comprises a server. In this sense it is meant that the when the computer program is loaded into hardware it causes the hardware to operate as a server device. Preferably the computer program product comprises an editor for providing a scalable data signal. Preferably the computer program product comprises re-ordering means for re-ordering the data units.

According to a fifth aspect of the invention there is provided a data signal having a sequence of data units for transmission over a transmission link between a data source and a data sink the data units being in an order determined by their relative importance rather than their predetermined order.

Preferably where the data units or layers of the data units are ordered into a sequence other than their original sequence, the invention also includes means or a step for returning the data units or layers of the data units into their original sequence.

The transmission link may simply be a bottleneck where congestion is occurring and the invention is used to overcome the bottleneck.

An advantage of the invention is that it can provide larger safety times than prior art arrangements with the same initial buffering. In addition, it provides some degree of protection against decreased transmission throughput. Therefore it helps in reducing the occurrence of pauses without sacrificing compression efficiency.

The invention also helps in transmitting over a unreliable network connection using transmission protocols which do not automatically retransmit but only retransmit those missing parts chosen by a higher level function, for example in response to feedback. In this case, it provides more time for retransmission of the vital parts of a data signal than prior art arrangements. Thus, vital parts of a stream are more likely to be transmitted successfully and the ultimate end user of the data signal is likely to perceive a better output quality.

Preferably the bandwidth of the transmission link available to the data signal is variable. This may be because the amount of data traffic using the link is variable, for example due to the need to re-transmit lost or corrupted data.

The invention provides a way of altering a data signal so that it can be transmitted over a transmission link having a bandwidth which would otherwise not be sufficient for it or for allowing certain of the bandwidth of its transmission link to be made available for other data, for example control information.

Preferably the effect of the invention is to increase the safety times of some data units relative to, or even at the expense of, the safety times of other data units.

Preferably the data signal is arranged in a hierarchy having a base layer and at least one enhancement layer. The term base layer means a most fundamental layer. The base layer may represent the least refined version of the data signal. In each unit, the (or each) enhancement layer, when combined with the base layer, refines the base layer to make it more like the data unit. Each enhancement layer

may add more refinement to the base layer. Preferably the safety time of the base layer is increased relative to the safety times of the enhancement layers.

Preferably the data signal is scalable. The base layer and the or each enhancement layer may have a scaled relationship with respect to each other. The signal may be scalable in the temporal, the spatial, the spectral or the SNR domains.

Preferably by virtue of re-ordering the sequence the layers have safety times which depend on their position in the hierarchy. For example the base layer of a particular data unit may have a greater safety time than enhancement layers. Advantageously, the finer the level of refinement represented by a layer, the shorter its safety time.

Preferably the source is a server. Alternatively it is an editor.

Preferably the sink is a client. It may be a destination of the data signal such as a mobile terminal, for example a mobile telephone.

Preferably the data units are frames. In one embodiment the data units represent a sequence of pictures. Conveniently it is a video sequence. Most preferably, it comprises multimedia data.

It should be understood that the terms "layer" and "layers" are being used figuratively and refer to blocks of data which can be applied to each other rather than to a strictly positional relationship.

The invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a multimedia content creation and retrieval system;

Figure 2 shows operations of a multimedia clip editor;

Figure 3 shows operations of a multimedia server;

Figure 4 shows operations of a multimedia retrieval client;
Figure 5 shows an illustration of B picture prediction;
Figure 6 shows an illustration of SNR scalability;
Figure 7 shows an illustration of spatial scalability;
Figure 8 shows scalable multimedia being used in an IP multicast system;
Figure 9 shows mobile multimedia retrieval system according to the invention;
Figure 10 shows operations of an editor according to the invention;
Figure 11 shows operations of a client according to the invention;
Figure 12 shows safety times of a re-ordered sequence and an original sequence;
Figure 13 shows receiving and playback of a re-ordered sequence;
Figure 14 also shows receiving and playback of a re-ordered sequence; and
Figure 15 shows another multimedia content creation and retrieval system.

Figures 1 to 8 have been discussed above.

A mobile multimedia retrieval system 10 according to the invention is shown in Figure 9. Although only a single client 22 is shown it will be appreciated that there can be, and in preferred embodiments will be, a number of such clients. It will also be appreciated that at least part of the transmission link connecting a server 18 and the client 22 will be wireless.

The system 10 comprises an editor 12 which produces a compressed clip, a server database 14 for storing the compressed clip, re-ordering means 16 for re-ordering the sequence of the compressed clip, a server 18 for sending the re-ordered compressed clip and a client comprising order recovery means 20 to recover the original sequence of the compressed clip. The client 22 controls the operation of the server, for example by specifying which data are sent and how they are sent. Clearly, the re-ordering means 16 and the order recovery means 20 need to be compatible so that the latter can recover the original order. The re-ordering means 16 could be located to operate on data before they reach the server database 14 rather than the embodiment shown in Figure 9. Certain types of data, such as a live stream, may by-pass the database 14 and be sent by the

editor 12 directly to the re-ordering means 16. Although they are shown separately in Figure 9, the editor 12, the server database 14, the re-ordering means 16 and the server 18 can all be configured into a single unit or entity which can also be referred to as a server.

Figure 10 shows operation of an editor according to the invention. Raw data captured in the form of one or more uncompressed streams are edited to produce one or more uncompressed tracks. These tracks are compressed in a compression step to produce compressed tracks. The compressed tracks are multiplexed together to produce a compressed multimedia clip. The multimedia clips are coded scalably. The resulting bitstream consists of basic units, such as frames in video compression. These basic units are not all of equal importance; some are primary basic units which are vital to decode the bitstream and some are secondary basic units which improve the quality of the bitstream. Elimination of the secondary basic units causes only a quality loss in the decoded multimedia clip. In effect, the primary basic units are a base layer of the bitstream and the secondary units are enhancement layers.

Instead of organising the basic units into the original transmission order, that is the sequence in which they are produced by editing and compression of raw data, the invented method re-orders their sequence by prioritising the primary basic units so that they pre-empt the secondary basic units in the transmission order. Reordering can take place before or after the multiplexing process depending on the nature of the system and the data. In Figure 10 it is shown as taking place after multiplexing.

A re-ordering algorithm is used to re-order the sequence. In a preferred embodiment, the algorithm conducts stream analysis to identify primary and secondary basic units and to collect bit rate statistics. These may include the number of bits per frame. The bitstream is then re-ordered with iterative re-ordering steps to minimise the initial buffering time needed for full-quality playback with full channel throughput and reduced-quality playback with a reduced channel throughput. An example of such a re-ordering algorithm is given below. It should

be noted that the expected reduced channel throughput has to be estimated in advance since it is one of the input parameters of the algorithm. The estimation can be based on the statistics obtained from the channel behaviour, for example.

Re-ordering of the basic units means that the primary basic units are likely to be received earlier than indicated in their playback time even though some decrease in the channel throughput occurs. However, secondary basic units are vulnerable to transmission delay variations since the method schedules them to be received just before their indicated playback time. In this way the client is still likely to be able to play the primary basic units without pausing the playback, even if the channel throughput decreases considerably. The secondary basic units, on the other hand, may arrive later than their scheduled playback time and will not be used in playback.

Figure 11 shows operation of a client according to the invention. The bitstream is received by the client, re-ordered to produce the original compressed clip, demultiplexed to produce the compressed tracks and then decompressed to reconstruct the tracks. The basic unit order recovery step in the client can be applied either before or after demultiplexing (depending in when it occurs in the content editor). In Figure 11 it is shown as occurring before demultiplexing, to correspond to the order described in Figure 10. In this way re-ordering and order recovery are both applied to the multiplexed bitstream. Order recovery organises the basic units back into their natural sequence for decompression and discards all late-arriving secondary basic units.

On receipt of a basic unit by the client, it is time-stamped with a time by which it should be played. This time-stamp is compared with the current playback time. If the time-stamp is greater than the current playback time the basic unit is not decompressed and it is discarded. If the time-stamp is less than the current playback time the basic unit is decompressed and the two times are compared after decompression. If the time stamp is less than the current playback time the basic unit is played. Otherwise, it is discarded.

In the particular case in which re-ordering is performed after multiplexing, the multiplexing/demultiplexing format used needs to allow re-ordering of the basic units and recovery of the original order.

Figure 15 shows another view of a multimedia content creation and retrieval system according to the invention. The system 50 comprises an editor 52, a server 54 and a client 56.

The editor comprises a compressor 58 for compressing a raw data stream typically being in the form of a sequence of images into a form suitable for transmission, a multiplexer 60 for multiplexing the compressed raw data stream with other compressed data streams together to produce a compressed bitstream and a layer generation means 62 for producing primary basic frames which are vital to decode the bitstream and secondary basic frames which improve the quality of the bitstream.

The server 54 comprises re-ordering means 64 for arranging the frames in an order which depends on their importance in helping to reconstruct the raw data stream at the client 56 rather than their natural sequential order.

The server 54 and the client 56 each comprise transmitting/receiving means 66 and 70 respectively for data transmission over a transmission link 68 between the server 54 and the client 56.

The client 56 comprises order recovery means 72 for putting the frames back into their natural sequential order, a demultiplexer 74 for demultiplexing the bitstream and a decompressor 76 for decompressing the compressed data streams to reproduce the raw data stream. The client comprises playing/output means 78 for playing or otherwise outputting the raw data stream. The client also comprises a controller 80 which applies a control signal to the server 54 to control the re-ordering means in response to receipt of frames in the client 56.

Example

An embodiment of the invention was tested using an H.263 compliant encoder and a frame re-ordering tool. The encoder was capable of producing B-frames. The re-ordering tool comprised a re-ordering algorithm and could be adjusted to produce frame ordering for different decreased channel data rates.

A standard ITU-T test sequence of video frames called Glasgow was used. The sequence had a QCIF resolution, that is a luminance picture size of 176 x 144 pixels and a chrominance picture size of 88 x 72 pixels.

The first 297 frames of the Glasgow sequence were compressed to produce a temporally scalable bitstream comprising INTRA (I) frames, INTER (P) frames and bi-directionally predicted (B) frames. The I and P frames are referred to as primary frames and the B frames are referred to as secondary frames. The frame rate of the original (default) sequence was 12.5 frames per second (fps) and so the compressed sequence corresponded to 23.68 seconds. Each frame was compressed. The first frame was an INTRA frame, and the second one was an INTER frame. After that, there were alternate INTER frames and B-frames. A constant quantizer was used to produce a bitstream having an average bit rate of 41073 bps consisting of an average bit rate for the primary frames of 28984 bps and an average bit rate for the secondary frames of 12089 bps.

For the sake of simplicity, the example does not include multiplexing of the bitstream with another bitstream.

Re-ordering of the frame sequence was optimised separately for bit rates corresponding to sums of the primary frame bit rate (A) and (i) 25%; (ii) 50%; and (iii) 75 % of the secondary frame bit rate (B). It should be noted that 100% of the secondary bit rate (B) corresponds to the average bit rate required in order to obtain full quality playback. The summed bit rates were 32007, 35029 and 38051 bps respectively. For convenience, in the following description, these bit rates are

referred to as 25% (A+0.25B), 50% (A+0.5B) and 75% (A+0.75B), and the corresponding re-ordered sequences are referred to as 25-ordered, 50-ordered and 75-ordered. It was expected that the full rate of the channel would be the average bit rate of the sequence.

The reordering algorithm used two values:
FQFR (full quality full rate), which is the minimum initial buffering time to ensure full-quality playback assuming a full rate channel; and
RQRR (reduced quality reduced rate) which is the minimum initial buffering time to ensure reduced-quality playback in which the primary frames are played and some or all secondary frames may not be played (assuming a reduced secondary bit rate of 25%, 50% or 75%).

In calculating FQFR and RQRR for a particular channel, the algorithm assumes that it has a constant bit rate. Using the bit rate statistics the likely number of bits per frame is calculated. The time instant at which a particular frame is to be played is known from the time stamp. A time is determined by which a frame will be ready for display as a picture (allowing, of course, for the time needed to receive the bits for a frame and to prepare them) and this time is compared with the time stamp of the frame. If the frame will be received after it is to be displayed, the buffering time is increased, if it is received in time then the next frame can be dealt with. Once the algorithm has compared the likely times of receipt of all of the frames against their playback times and adjusted to buffering time accordingly so that they should all be received in time, the minimum buffering time has been calculated.

The algorithm was applied to a sequence having its original order. In this case, FQFR is smaller than RQRR because in order to obtain full quality playback, you have to wait longer in starting playback if you have a reduced rate channel. The algorithm seeks to minimise the initial buffering time needed for full-quality playback with full channel throughput and at the same time for reduced-quality playback with a reduced channel throughput. In other words, the algorithm seeks to find a value where FQFR and RQRR are approximately equal. It should be

noted that the algorithm is not optimal, that is the algorithm does not necessarily re-order the sequence so that the minimum initial buffering delay is found. The algorithm consists of the following steps:

1. Calculate FQFR and RQRR.

2. If FQFR is greater than or equal to RQRR, stop re-ordering. The minimum initial buffering delay is the greater of FQFR or RQRR. Otherwise, continue with the next step.

3. Shift all primary frames towards the beginning of the sequence by one frame step. For example, if the initial sequence is:

I0, P1, P2, B3, P4, B5, P6, B7, P8, B9, P10, ...,

shifting changes the sequence to:

I0, P1, P2, P4, B3, P6, B5, P8, B7, P10, B9, ...

where I0 is the first frame. It can be seen that where a secondary frame is earlier in sequence than an adjacent primary frame, the positions of the primary and secondary frames are exchanged.

4. Continue from step 1.

The buffering time needed to ensure pause-less playback in the reduced bit rate channel is greater for the original sequence than for the re-ordered sequence. It is desirable to have a short initial buffering time. The re-ordering process makes a trade-off between the minimum buffering time needed for a full-rate channel and the minimum buffering time needed for expected reduced-rate channels. Without re-ordering, less initial buffering time would have been needed to provide full-quality playback in the full-rate channel. However, without re-ordering, more initial buffering time would have been required to provide reduced-quality playback in the reduced-rate channel.

In the example, safety times were also investigated. Initial buffering time was set to be the minimum for reduced quality playback of the re-ordered sequence at 25% secondary bit rate. Figure 12 shows how safety time varies with playback of the 25-ordered sequence and the original order sequence. It shows that throughout playback, the 25-ordered sequence (represented by the upper line) has a longer safety time than the original order sequence.

Results were also obtained for the 50% and 75% secondary bit rates. The average safety times (in seconds) for all primary frames in a sequence are shown in the following table for all three reduced bit rates. The safety times are characterised by minimum safety time and average safety time.

		25%	50%	75%
Minimum	Re-ordered	4.79	2.51	1.06
	Default	3.46	1.63	0.64
	Difference	1.33	0.88	0.42
Average	Re-ordered	5.90	3.51	2.12
	Default	4.66	2.83	1.84
	Difference	1.24	0.67	0.28

It can be seen that both the minimum and average safety times of the re-ordered sequences are longer than those of the original sequence.

In contrast, set out below is a table showing the required buffering delays in seconds for full-quality playback at different average bit rates. This is to minimise pauses in playback.

	25%	50%	75%
Re-ordered	10.04	6.03	3.53
Default	7.02	4.64	3.02

It can be seen that the re-ordered sequence needs a longer buffering delay for full-quality playback because the secondary frames are transmitted out of their natural order and time is required to put all the frames back into their natural order. However, this is not important because the invention sets out to provide reduced quality playback with minimal initial buffering delay. To illustrate this, the following

table shows the buffering delays required to ensure pause-less reduced quality playback:

	25%	50%	75%
Re-ordered	5.28	3.49	2.47
Default	6.91	4.46	2.84

These results show that where the bit rate of the transmission channel is reduced, the invented method requires a shorter buffering delay before playback can be started.

The effect of the invention is illustrated in Figure 13 which shows playback of the 25-ordered sequence at 25% bit rate (that is A+0.25B as discussed above). Playback times, that is the times at which the frames are intended or supposed to be played to a viewer, are represented as a straight line. To be played in sequence, without requiring pauses, each frame must be received before its playback time. Any symbol located below the playback time line represents a frame which is received before its scheduled playback time and any symbol located above the playback time line represents a frame which is received after its scheduled playback time. In the example of Figure 13, the primary frames were all received in time to be played and the secondary frames were all received too late. Therefore the secondary frames were all discarded without being played.

It should be understood that if the sequence had not been re-ordered, there is a likelihood that some of the primary frames would have arrived after their playback times and so would have required playback to be paused (since a primary frame cannot be discarded without also discarding all of the frames predicted from it).

Figure 14 shows how the 25-ordered sequence is received and played when the channel throughput is not reduced. It can be seen that all frames are received in time to be played. Again, the upper line represents when secondary frames are received and the lower line represents when primary frames are received.

Of course, the exact appearance of Figures 13 and 14 depends on the nature of the original sequence, as well as the bit rate and the re-ordering that is performed. Differences can be expected in other systems which re-order data in different ways.

In use, the invention can be applied on-line to prepare a bitstream for transmission at some future point. For example, assuming that there may be considerable variation in the available bandwidth of a given transmission channel, the algorithm may be applied to a bitstream and re-ordered sequences may be calculated for several alternative bandwidths, such as 25%, 50% and 75%. In transmission, if problems are encountered, for example with pausing, the re-ordered sequence currently being used may be changed to one better suited to a lower available bandwidth. Equally, if transmission is proceeding better than expected, a sequence better suited for a higher bandwidth may be used. The invention may check the progress of transmission and/or playback a number of times during transmission and adjust the sequence accordingly. It is advantageous if this adjustment can be programmed dynamically whilst transmission is occurring. In this way, intermittent problems can de dealt with.

The part of the invention which re-orders a bitstream is located in an editor or in a server. The part of the invention which recovers the order is located in a client.

A further improvement is provided if the proportion of bits belonging to the primary frames is reduced by replacing some of the primary frames with B-frames. This reduces the compression efficiency slightly because B-frames are predicted from reference frames (P-frames) which are further away in time and so the B-frames and P-frames are less alike. This yields a poorer predicted B-frame and so more bits must be used to code the corresponding prediction error image. Since in this arrangement there are now more bits belonging to secondary frames which can be discarded, re-ordering the frames can provide even better protection against transmission delays and pauses.

One way of looking at the invention is to say that it sacrifices the safety times of the secondary frames in order to maintain maximum safety times for the primary frames.

The invention is particularly suitable for streaming-type multimedia retrieval.

While preferred embodiments of the invention have been shown and described, it will be understood that such embodiments are described by way of example only. For example, although the invention has been described applied to a temporally scalable bitstream, it can also be applied to other types of scalability, including spatial, spectral and SNR. Numerous variations, changes and substitutions will occur to those skilled in the art without departing from the scope of the present invention. Accordingly, it is intended that the following claims cover all such variations as fall within the spirit and scope of the invention.

Claims

1. A server for transmitting a data signal having a sequence of data units in a predetermined order over a transmission link the data units being sent in an order determined by their relative importance rather than their predetermined order.

2. A server according to claim 1 in which the data units represent a base layer and at least one enhancement layer.

3. A server according to claim 2 comprising re-ordering means to change the order of the data units.

4. A server according to any preceding claim in which the data signal is scalable.

5. A server according to claim 4 in which the signal is scalable in a domain selected from a group consisting of the temporal, the spatial, the spectral and the SNR domains.

6. A server according to any preceding claim which comprises an editor for providing the data signal.

7. A server according to any preceding claim in which the data signal represents a sequence of pictures to produce a moving image.

8. A server according to claim 7 in which the data signal represents a video sequence.

9. A server according to any preceding claim in which the data signal comprises multimedia data.

10. A data transmission system for transmitting a data signal having a sequence of data units in a predetermined order over a transmission link between a data

source and a data sink the data units being sent in an order determined by their relative importance rather than their predetermined order.

11. A transmission system according to claim 10 in which the data units each comprise a base layer and at least one enhancement layer and when re-ordered the base layer of a particular data unit has a greater safety time than of the or each enhancement layer of the particular data unit.

12. A transmission system according to claim 10 or claim 11 in which the source is a server.

13. A transmission system according to any of claims 10 to 12 in which the source is an editor.

14. A transmission system according to any of claims 10 to 13 in which the sink is a client.

15. A transmission system according to any of claims 10 to 14 in which the sink is a mobile terminal.

16. A transmission system according to claims 10 to 15 in which the sink is a mobile telephone.

17. A transmission system according to claims 10 to 16 in which means are provided to check the progress of transmission and to change the order being used to one better suited to available bandwidth.

18. A method of transmitting a data signal having a sequence of data units in a predetermined order over a transmission link between a data source and a data sink comprising the step of sending the data units in an order determined by their relative importance rather than their predetermined order.

19. A method according to claim 18 in which the data units are returned to their original sequence once they have been transmitted over the transmission link.

20. A method according to claim 18 or claim 19 in which the progress of transmission is checked and the order being used is changed to one better suited to available bandwidth.

21. A computer program product stored on a computer usable medium comprising computer readable program means for causing transmission of a data signal having a sequence of data units in a predetermined order over a transmission link the data units being sent in an order determined by their relative importance rather than their predetermined order.

22. A computer program product according to claim 21 comprising a server.

23. A computer program product according to claim 21 or claim 22 comprising an editor for providing a scalable data signal.

24. A computer program product according to any of claims 22 to 23 comprising re-ordering means for providing the layers of the or each data units with different safety times.

25. A data signal having a sequence of data units for transmission over a transmission link between a data source and a data sink the data units being in an order determined by their relative importance rather than their predetermined order.

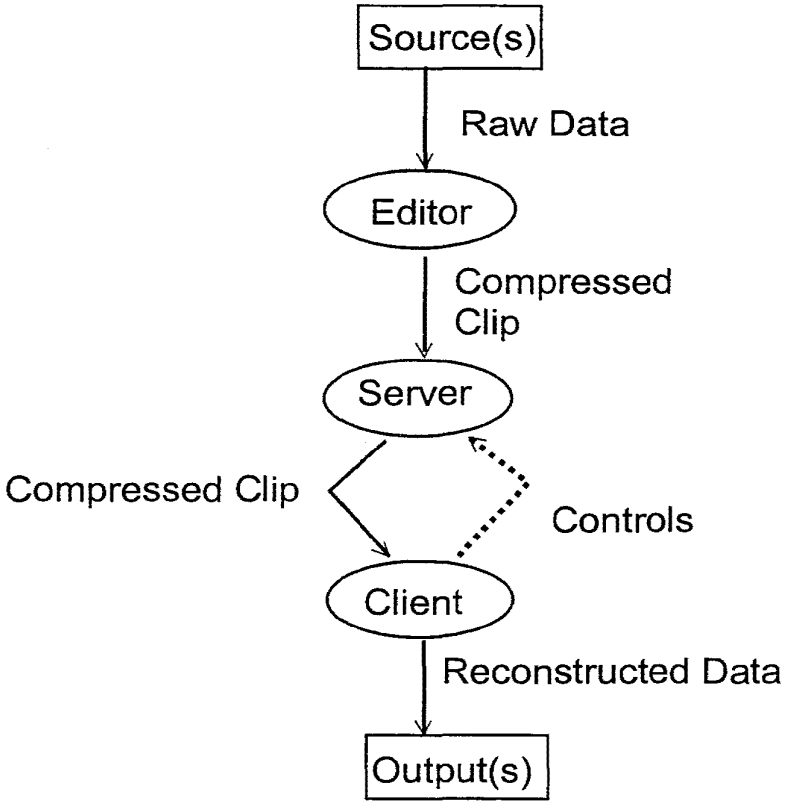

Source(s)
Raw Data
Editor
Compressed
Clip
Server
Compressed Clip
Controls
Client
Reconstructed Data
Output(s)

Fig. 1

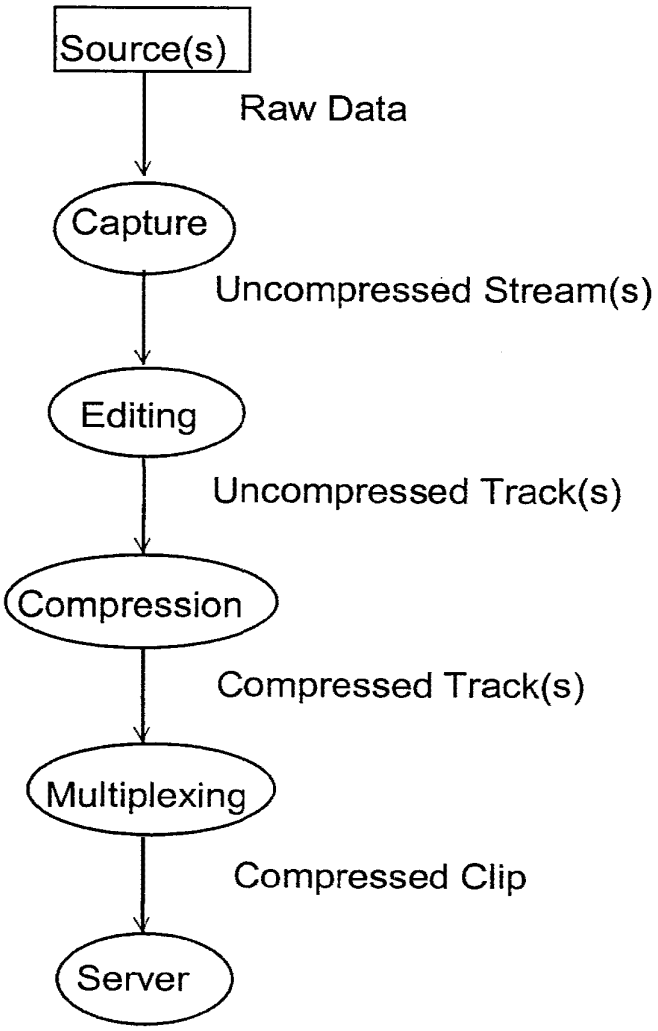

Source(s)
Raw Data
Capture
Uncompressed Stream(s)
Editing
Uncompressed Track(s)
Compression
Compressed Track(s)
Multiplexing
Compressed Clip
Server

Fig. 2

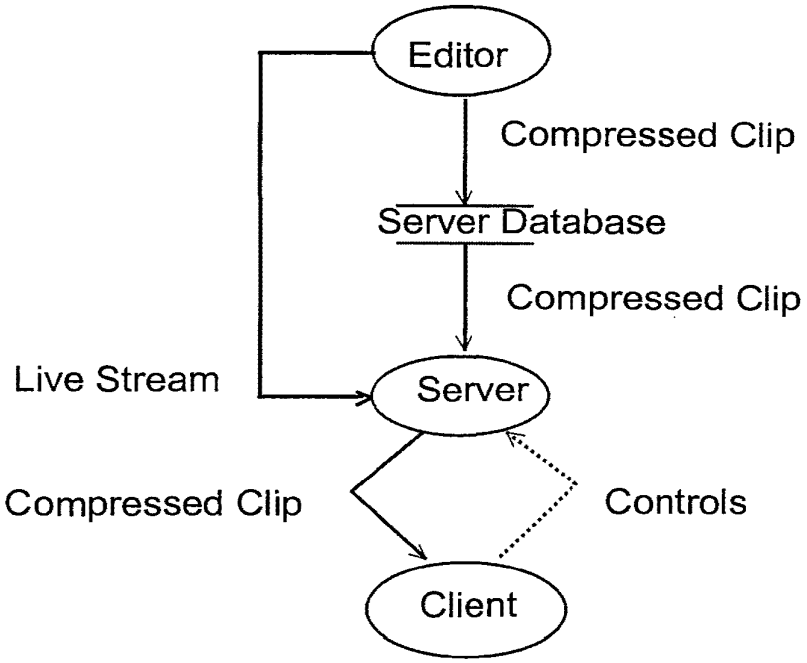

Editor
Compressed Clip
Server Database
Compressed Clip
Live Stream
Server
Compressed Clip
Controls
Client

Fig. 3

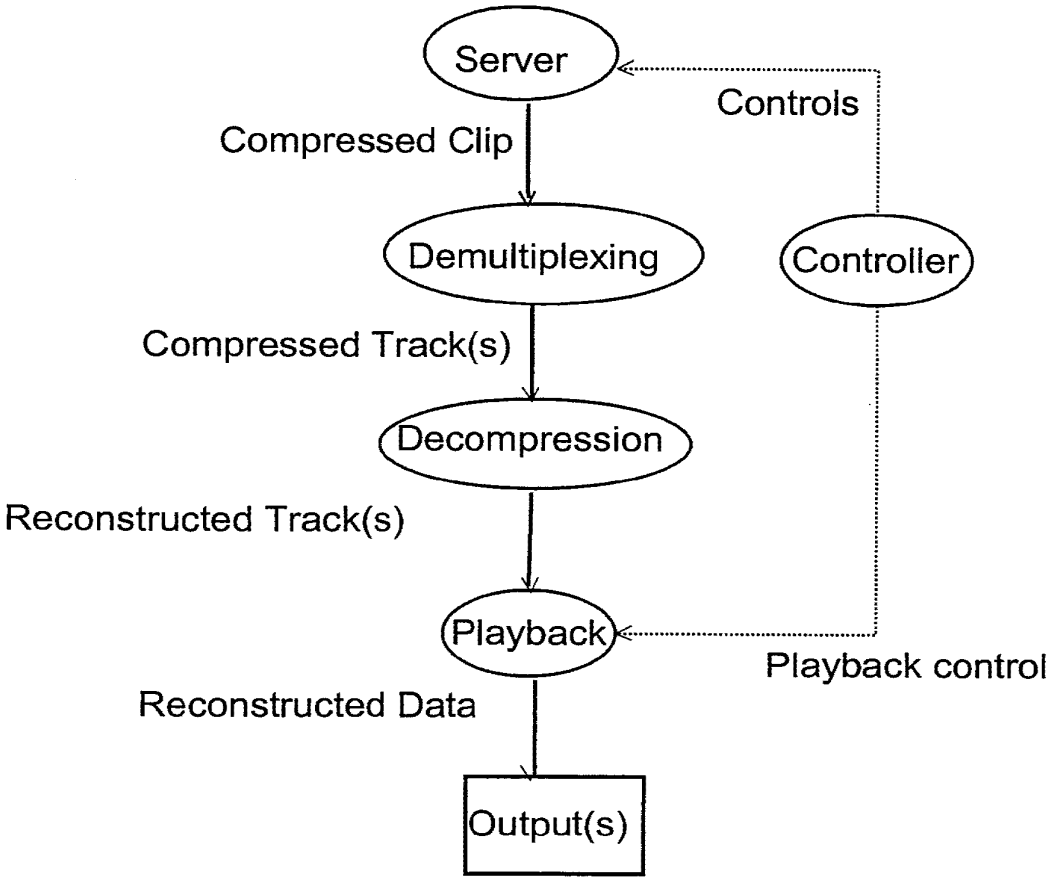

Server
Controls
Compressed Clip
Demultiplexing
Controller
Compressed Track(s)
Decompression
Reconstructed Track(s)
Playback
Playback control
Reconstructed Data
Output(s)

Fig. 4

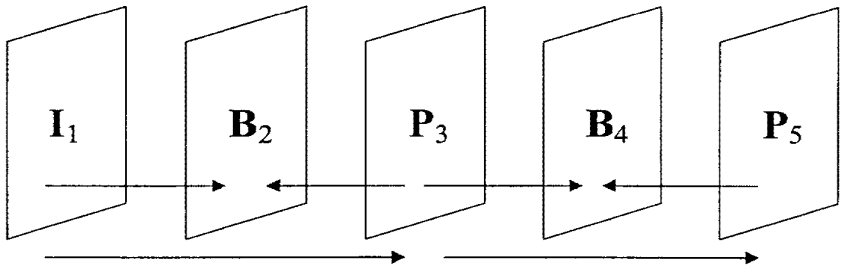


Fig. 5

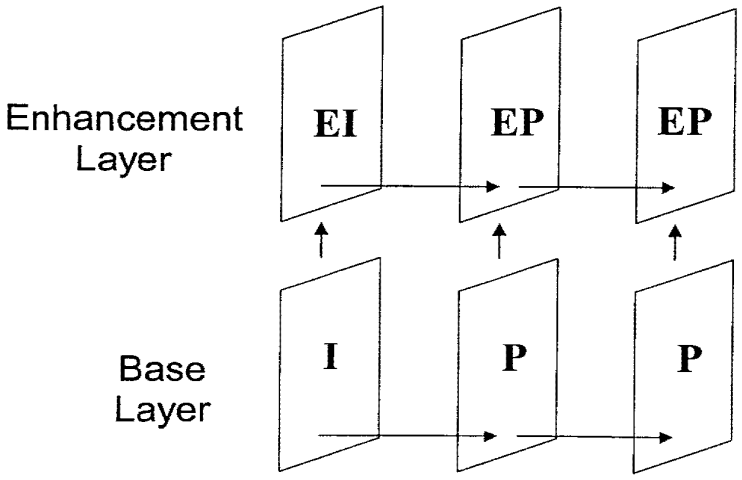


Fig. 6

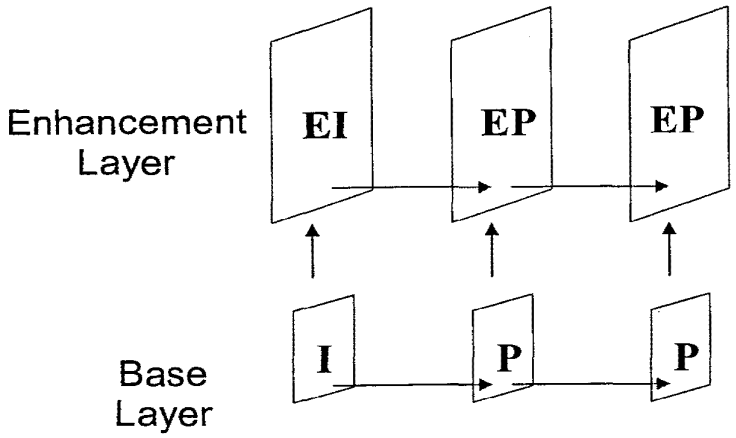

Enhancement Layer
EI
EP
EP
Base Layer
I
P
P

Fig. 7

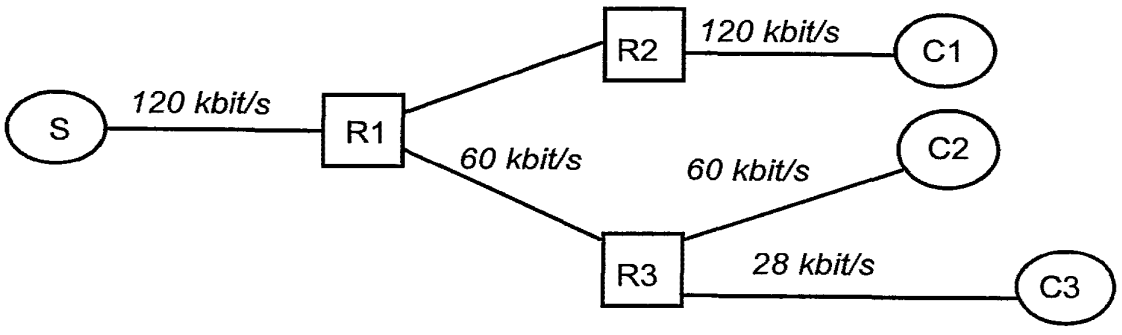

S
120 kbit/s
R1
R2
120 kbit/s
C1
60 kbit/s
60 kbit/s
C2
R3
28 kbit/s
C3

Fig. 8

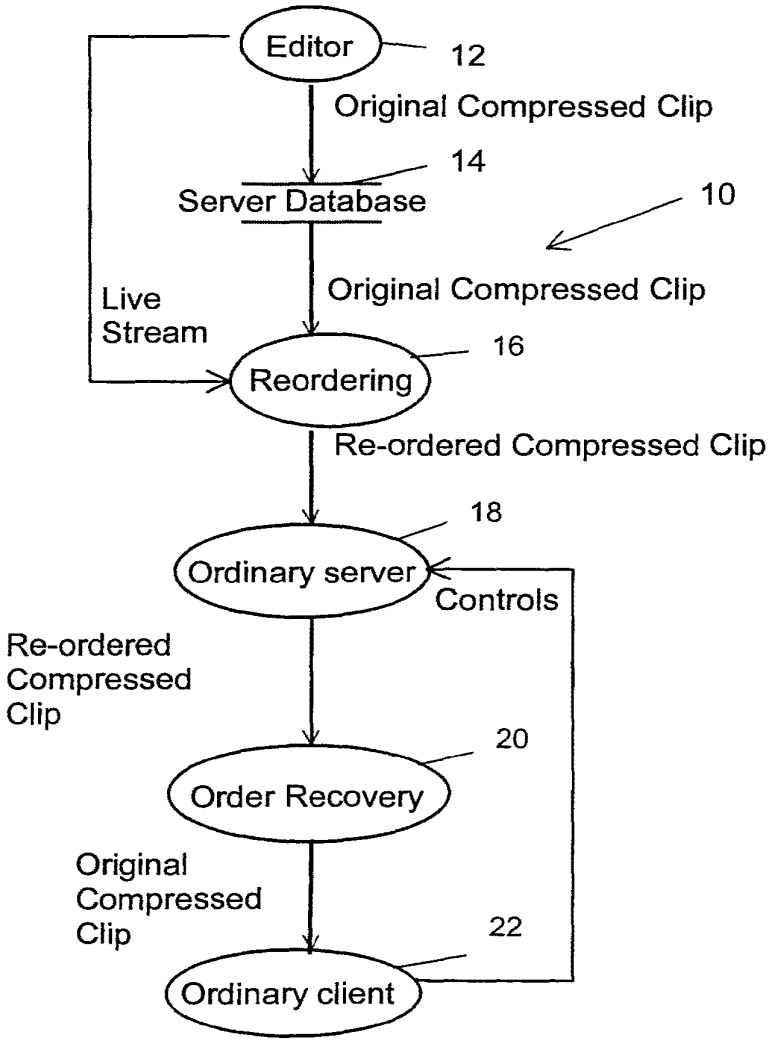

Editor
12
Original Compressed Clip
14
Server Database
10
Original Compressed Clip
Live
Stream
16
Reordering
Re-ordered Compressed Clip
18
Ordinary server
Controls
Re-ordered
Compressed
Clip
20
Order Recovery
Original
Compressed
Clip
22
Ordinary client

Fig. 9

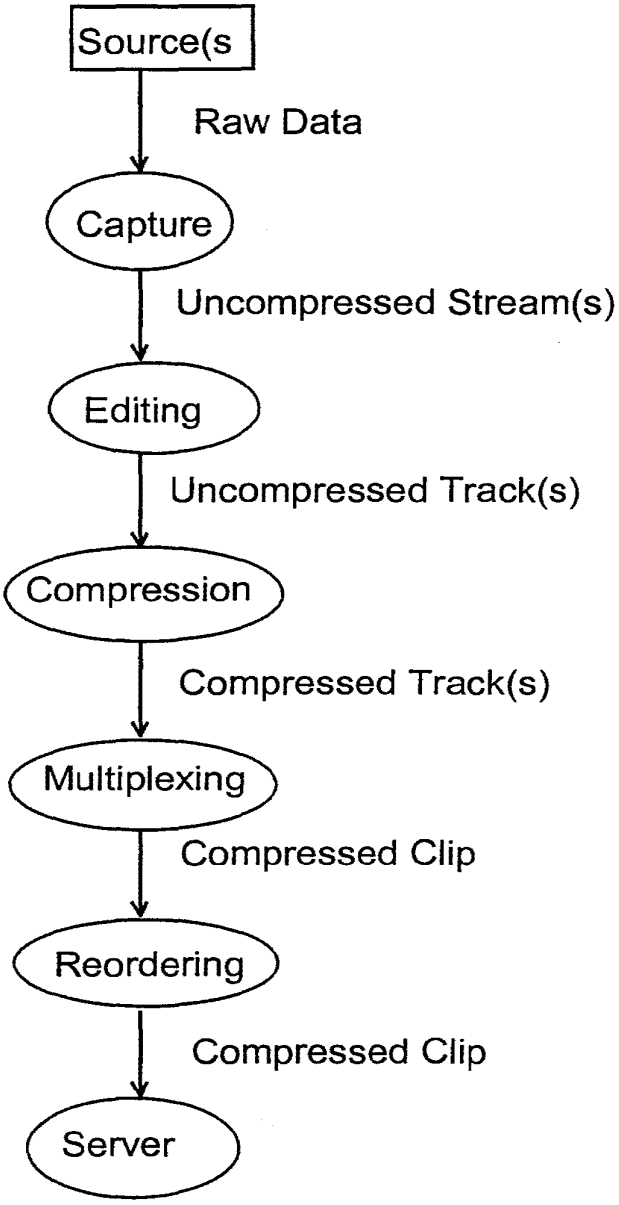

Source(s
Raw Data
Capture
Uncompressed Stream(s)
Editing
Uncompressed Track(s)
Compression
Compressed Track(s)
Multiplexing
Compressed Clip
Reordering
Compressed Clip
Server

Fig. 10

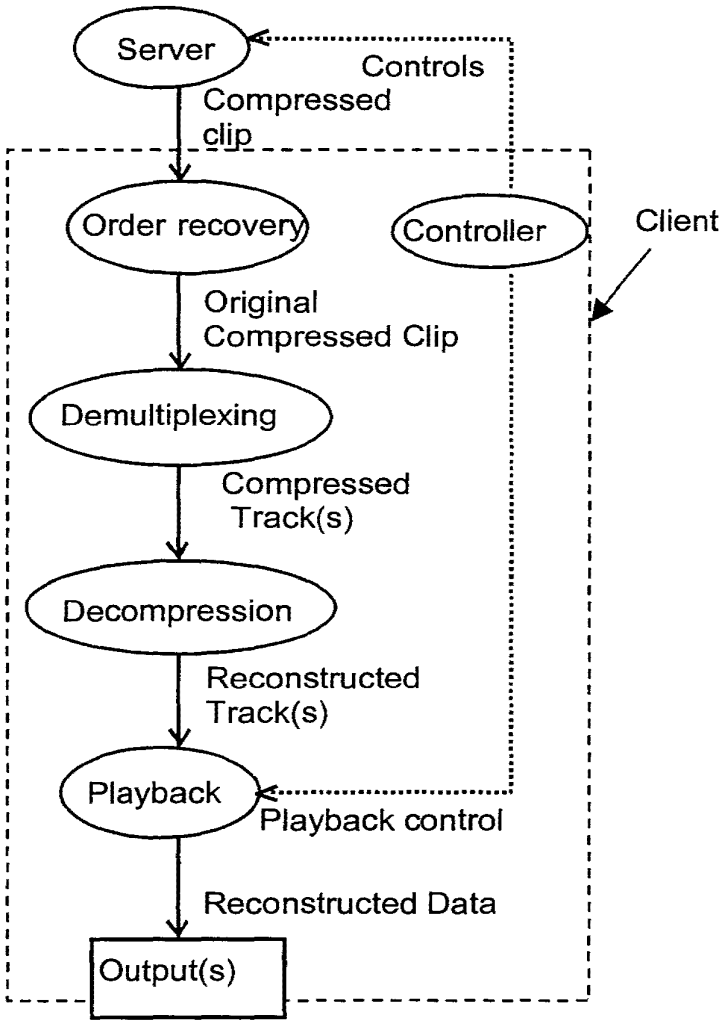

Server
Controls
Compressed clip
Order recovery
Controller
Client
Original Compressed Clip
Demultiplexing
Compressed Track(s)
Decompression
Reconstructed Track(s)
Playback
Playback control
Reconstructed Data
Output(s)

Fig. 11

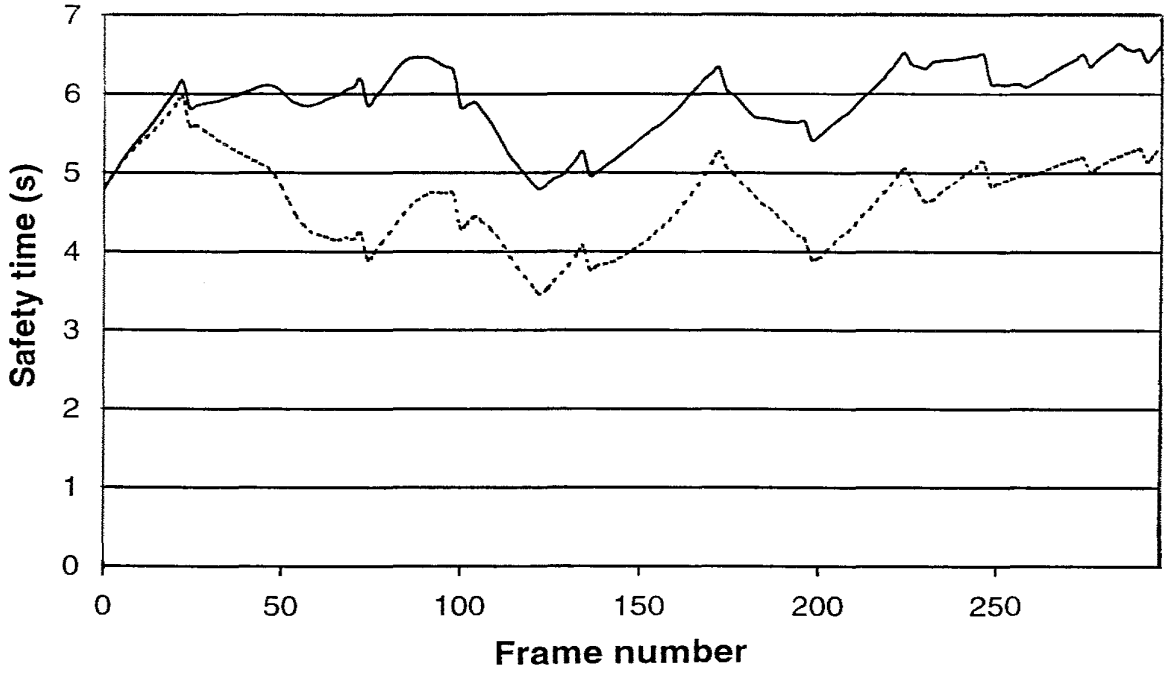


Fig. 12

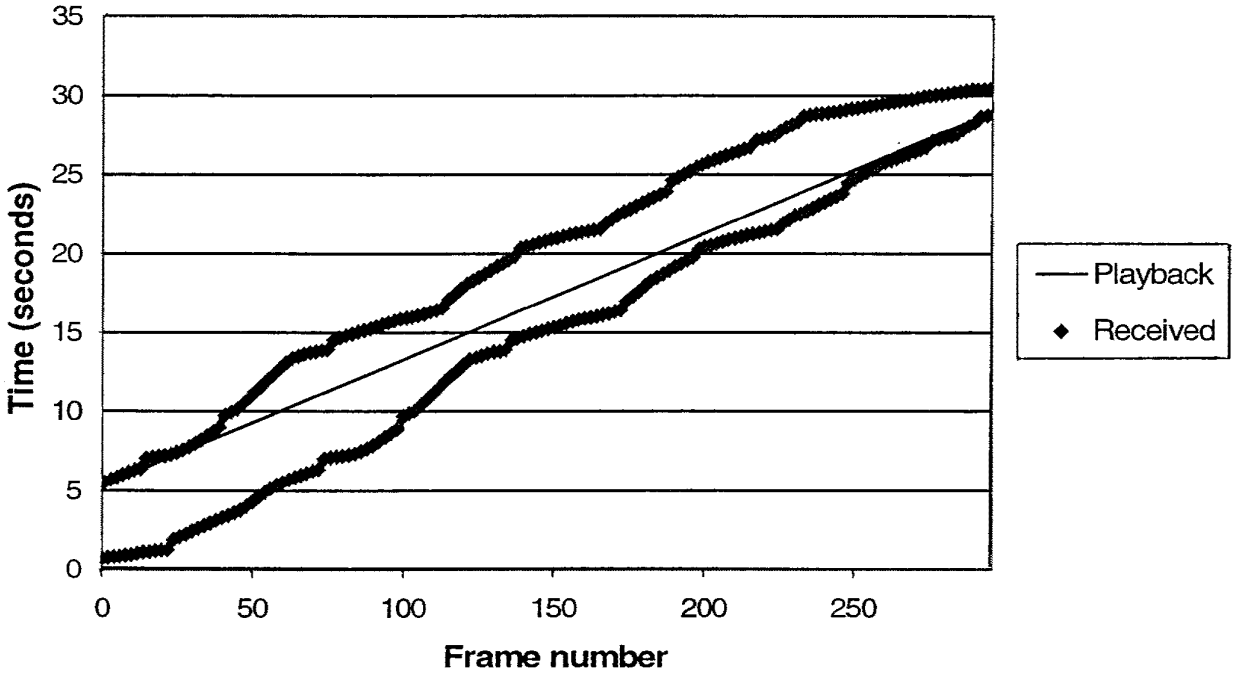

35
30
25
20
15
10
5
0
Time (seconds)
0
50
100
150
200
250
Frame number
Playback
Received

Fig. 13

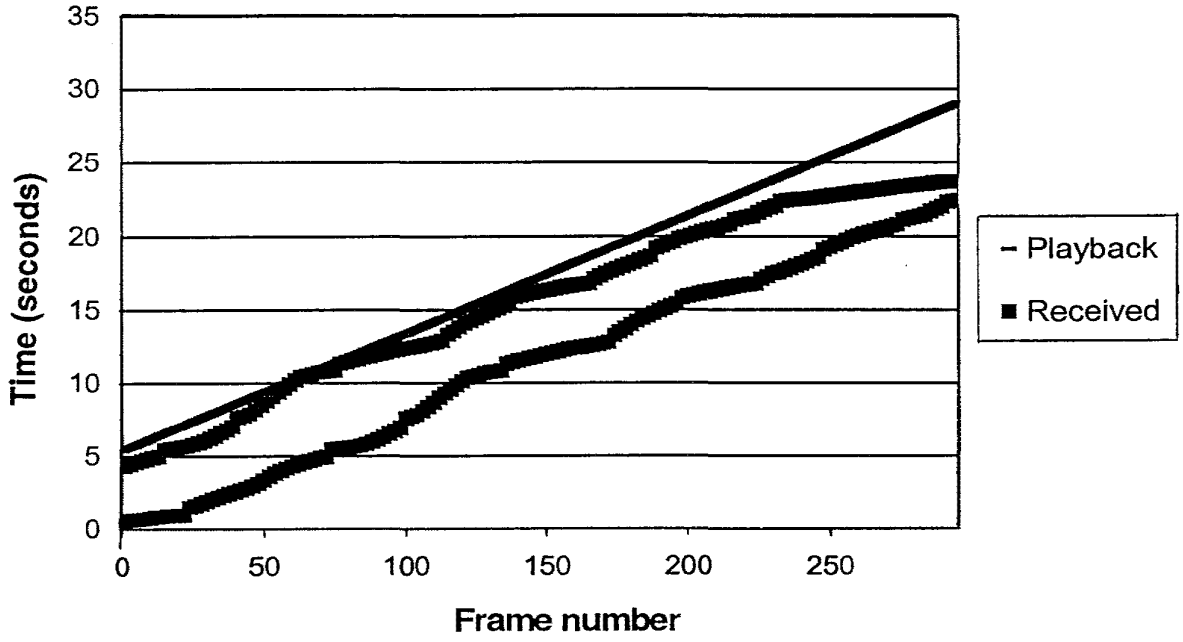

35
30
25
20
15
10
5
0
Time (seconds)
0
50
100
150
200
250
Frame number
Playback
Received

Fig. 14

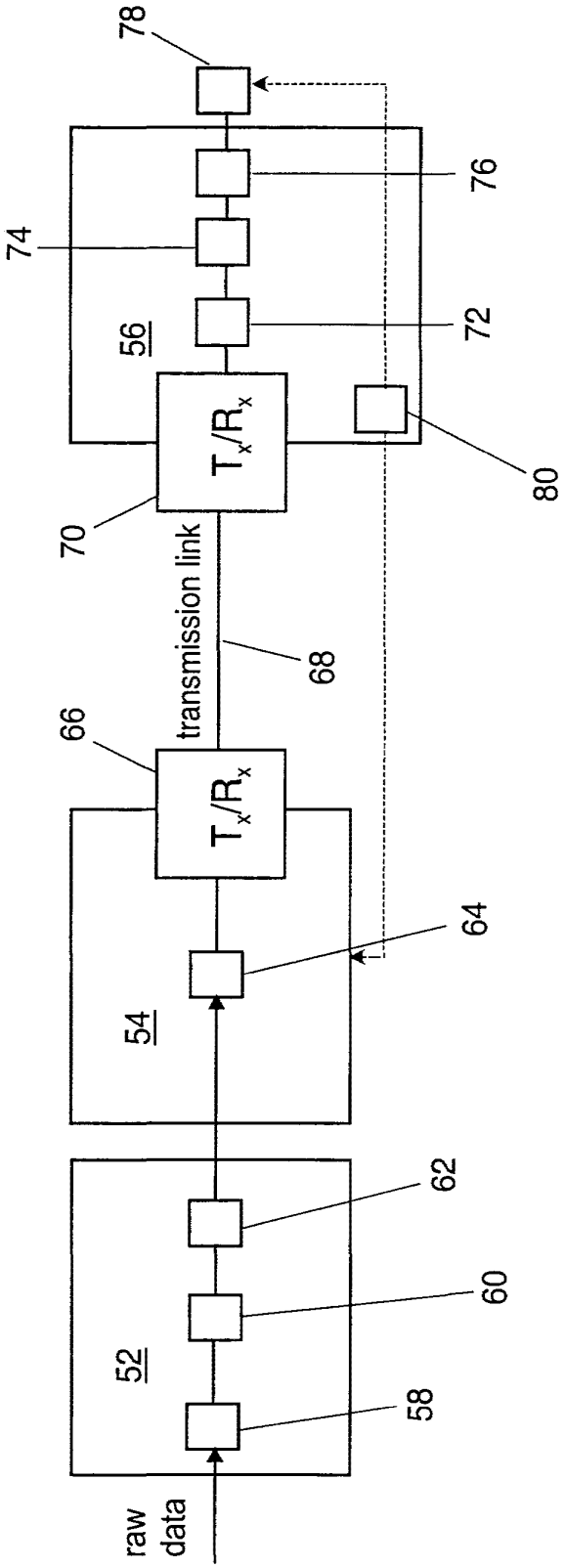

78
76
74
72
56
T_x/R_x
80
70
transmission link
68
66
T_x/R_x
64
54
62
60
52
58
raw data

Fig. 15

INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/FI 00/00363

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/00 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)
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)
WPI Data, PAJ, 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	PATENT ABSTRACTS OF JAPAN vol. 018, no. 566 (E-1622), 28 October 1994 (1994-10-28) & JP 06 205384 A (NEC CORP), 22 July 1994 (1994-07-22) abstract	1,6-10, 12-23,25
Y		2-5,11, 24

Y	US 5 564 001 A (LEWIS SCOTT W) 8 October 1996 (1996-10-08) column 2, line 58 -column 3, line 30 column 4, line 58 - line 65 column 7, line 4 - line 14 column 7, line 43 - line 47 abstract	2-5,11, 24
A		1,6-10, 12-23,25

	-/--	

[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
9 August 2000	- 9. 10. 2000

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	Jesper Bergstrand

1

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INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/FI 00/00363

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 634 871 A (AT & T CORP) 18 January 1995 (1995-01-18) the whole document -----	1-25

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

...ormation on patent family members

Inter ...nal Application No
PCT/FI 00/00363

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US 5564001 A	08-10-1996	US 5325423 A	28-06-1994
		AU 693426 B	02-07-1998
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		US 5742343 A	21-04-1998

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(54) Methods and systems for presentation of media obtained from a media stream

(57) An implementation, as described herein, facilitates fast start-up of a new media stream while mitigating and in some implementations, avoiding temporal interruption (i.e., "stutter") of the presentation of that new media stream. At least one implementation, described herein, measures a rate at which a multimedia stream is received at a downstream component configured to present the multimedia to a user; and, ascertains a duration of time to buffer the received multimedia before presentation thereof, at least in part utilizing the measured rate.

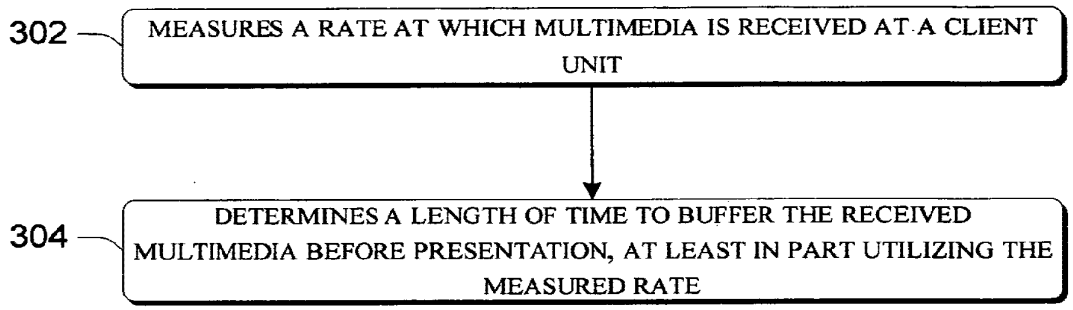


Fig. 3

EP 1 641 271 A2

Description

TECHNICAL FIELD

[0001] This invention generally relates to a data signal transmission technology.

BACKGROUND

Introduction

[0002] Digital media streaming technology can allow a user to see and/or hear digital media received from a remote location such as media sending unit. A user at a client or receiving unit may select a file for viewing. A user may alternatively select data from a real time encoder for viewing. Media or data from the selected file/encoder can be sent as a media stream to the receiving unit where it is played or otherwise presented for the user. Selecting a file can include various scenarios. For example, a user may click on a movie trailer at a web-site or change channels when watching TV through an internet provider. Since this media often includes data to create both audio and visual sensations it may be referred to as "multi-media" data or content.

[0003] Due to the amount of data required to accurately represent such multimedia, it may be compressed and encoded at an encoder before being sent to the client unit. To reproduce the original media for presentation, the media is typically decompressed and decoded before it is presented. Both the encoder and the decoder may utilize buffers to compensate for any variability in the bit rate of the content. This process is sometimes analogized to a leaky bucket model, where the encoder is encoding according to a leaky bucket and the client unit has a similarly sized bucket to avoid underflow. This comes about because the bit rate of the content may be somewhat variable, and the bucket size is basically a measure of the maximum variability of the bit rate.

Transmission of Media Streams

[0004] For practical purposes, media streams carrying audio and/or video from a media-stream encoder are typically not continuous, but are instead broken into multiple packets for transmission. In some formats such packets comprise one or more intra frames or I frames sometimes referred to as key frames. An I frame is encoded as a single image, with no reference to past or future frames.

Underflow

[0005] When a receiving unit runs out of data to decode (or present), it is called "underflow." Underflow occurs when the receiving unit is ready to decode (or present) the next frame, but the receiving unit has not yet received (or decoded) all of the data of that frame.

[0006] The practical and noticeable manifestation of an underflow is a temporal interruption (i.e., "hiccup" or "stutter") in the motion video presentation rather than the desired effect, which is a smoothly playing motion video. For example, instead of showing a motion video at a fixed frequency (e.g., 15 frames per second), a receiving unit experiencing underflow would show a frame of the video stream followed by a noticeable delay before the next or a later frame would display. This may continue for several seconds or minutes.

[0007] The conditions for an underflow are particularly ripe when a new file or encoded content is selected, i.e. changing channels. If the receiving unit immediately presents frames as soon as it receives and decodes the incoming media stream of the new channel, an underflow condition is likely to arise.

[0008] Instead, it is common for presentation of the multimedia data to be delayed for a time period sufficient to fill the client side buffer. As the multimedia data is decoded and presented, the receiving unit empties the data stored in its buffer. However, while the receiving unit is presenting decoded data, more encoded data is downloaded to re-fill the buffer. As long as the data is downloaded at least as fast as it is being played back in such a way that the buffer is never completely empty, the file should play smoothly.

[0009] The conventional techniques, described above, that are designed to prevent underflow, can produce an annoying delay between a user selection and actual presentation of the selection to the user.

SUMMARY

[0010] Various implementations described herein provide methods and systems for presenting media obtained from a media stream. At least one implementation, described herein, measures a rate (measured rate) at which a multimedia stream is received at a downstream component configured to present the multimedia to a user; and, ascertains a duration

(measured duration) of time to buffer the received multimedia before presentation thereof, at least in part utilizing the measured rate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The same numbers are used throughout the drawings to reference like elements and features.

[0012] Fig. 1 represents a schematic diagram illustrating an exemplary media-stream network topology capable of (wholly or partially) implementing at least one embodiment described herein.

[0013] Fig. 1A represents a schematic diagram illustrating an exemplary media-stream network topology capable of (wholly or partially) implementing at least one embodiment described herein.

[0014] Fig. 2 represents a flow diagram illustrating a methodological implementation described herein.

[0015] Fig. 3 represents a flow diagram illustrating a methodological implementation described herein.

DETAILED DESCRIPTION

Overview

[0016] The following systems and methods reduce buffering delay while mitigating stuttering of a multimedia presentation. Some implementations may reduce buffering delay while altogether avoiding stuttering of the presentation. A sending unit streams media from a selected file or live encoded session to a client unit (hereinafter the term "source" is utilized to refer to either a file or a session or equivalents). The term "streaming rate" is used to identify the rate at which the media is streamed from the sending unit to the client unit. Upon receipt, the client unit can immediately or subsequently present the streamed media to a client or user. A rate at which the data is utilized for the presentation is.known as the presentation rate. The average presentation rate may be approximately equal to the average streaming rate; however, at instantaneous points in time, the streaming rate and the presentation rate may be different.

[0017] Prior to streaming the media, the sending unit sends advisory data relating to the media to the client unit. The advisory data is described in more detail below and can comprise various components such an acceleration rate at which the sending unit will stream the media, an acceleration interval, various buffer values, a start-up profile, and/or a recommended or estimated buffer duration, among others. The acceleration rate is the streaming rate at which the sending unit will attempt to send data, expressed relative to the presentation rate, or it could be expressed as an absolute value in terms of bits per second or bytes per second. The sending unit may start streaming at an acceleration rate, such as two times (2x) the presentation rate, for a duration of time known as the acceleration interval. Typical acceleration rates could be in the range of 1.0x, 1.2x, 1.5x, 2.0x, and 3.0 x, though these are simply examples and any other value can occur depending on the characteristics of the sending unit and the intervening network between the sending unit and the client unit.

[0018] The client unit can buffer data in order to have sufficient data to avoid an underflow condition during the presentation. The client unit can add data to the buffer in at least two ways. First, the client unit can buffer initially before beginning presentation of the multimedia. In such an instance all of the received data is buffered. However, such buffering results in start-up delay where start-up delay is the period between, for example, a user pressing play and actually seeing or hearing the multimedia presentation. Second, the client unit can also buffer during the acceleration interval while presenting the media since the client unit may be receiving data at a greater rate than it is presenting the data. In one example of the later instance, a presentation rate may be at 1 megabit per second (Mbps). The sending unit may stream the media during the acceleration interval at 2x or 2 Mbps. The client unit can buffer this excess data for the duration of the acceleration interval while simultaneously utilizing data for the presentation.

[0019] The advisory data can, in some implementations, comprise a start-up profile(s). Generally, the start-up profile can relate to the amount of buffer required or recommended at one or more points in the presentation to avoid underflow. The sending unit can compile an estimated start-up profile before sending the media stream. In various implementations an estimated or first start-up time is calculated which satisfies the start-up profile at an estimated acceleration rate. The start-up time is a measure of the amount of buffer that the client should accumulate from when the client unit begins to receive the media stream until beginning to present the media. This amount of buffer can be measured either in units of bits, or in units of time, where units of time are simply the bit values divided by the average bit rate.

[0020] Once the client unit begins to receive the media stream the start-up time can be verified, or recalculated. Some implementations can recalculate the start-up time or buffer duration utilizing a measured acceleration rate at which the client unit is receiving the media stream. Utilizing the start-up profile, along with the actual measure of the amount of data buffered during the acceleration interval, can allow a more accurate second or measured start-up duration to be calculated. Other implementations may simply utilize the measured acceleration rate to verify the accuracy of the estimated start-up duration before beginning to present the multimedia.

[0021] In some implementations, the method can compare the measured acceleration rate to the earlier estimated

acceleration rate and act accordingly. If the comparison shows that the measured acceleration rate is slower than the estimated acceleration rate then the method can recalculate the buffer time and buffer longer. If the data is received at a rate which exceeds the estimated rate then the method may be able to shorten the buffer time. The amount of pre-start-up buffering calculated in this way may be substantially reduced compared to existing technologies. This recalculation of the startup profile can occur at any point after the client begins to receive data. For example it could occur at regular time intervals of say 100ms or it could occur at fixed fractions of the initial estimated startup time -for example at 50% of the initial calculated buffer time.

[0022] The client unit is the device closest to presentation of the file to the user, or stated another way, the client unit is the device farthest downstream. Various delays, bottlenecks and/or other intervening conditions along the media path result in the client unit being in a better position to make the start-up calculations than upstream components.

[0023] Among other advantages, allowing the client unit to determine how long to buffer data prior to start-up can reduce inaccuracies in the buffer time which might otherwise result from intervening events. For example, an upstream sending unit may calculate a buffer duration for an estimated transmission rate that it intends to stream the media to the client unit. The client unit may in fact receive the media stream at a different, e.g. higher or lower rate. As such a calculation made by the client unit can be more accurate than one made at the sending unit. The client unit can have the most accurate view of the rate at which it is receiving data and can most accurately calculate the amount of time it should buffer in order to avoid underflowing.

Exemplary Implementations

[0024] The following description sets forth one or more exemplary implementations of methods and systems for presentation of media obtained from a media stream that incorporate elements recited in the appended claims. These implementations are described with specificity in order to meet statutory written description, enablement, and best-mode requirements. However, the description itself is not intended to limit the scope of this patent.

Media-Stream Network Topology

[0025] Figs. 1 and 1A illustrate high level representations of exemplary media-stream network topology 100 in which the techniques, systems, and other aspects described herein may be implemented (partially or wholly).

[0026] The exemplary topology 100 includes one or more media-stream sending units 110 such as a server, which is communicatively coupled to a receiving or client unit 120 via a transmission means 130. Receiving unit 120 can comprise, among others, a personal computer (PC), cell-phone or set-top box. In this embodiment, receiving unit 120 further comprises a display or presentation device 140 which comprises a display screen and one or more speakers. The functionality of the sending unit can be achieved by a single component or multiple components, similarly the functionality of the client unit can be achieved by a single component or multiple components.

[0027] Sending unit 110 can store sources such as files for transmission to receiving unit 120 and/or can access the sources via network 150. In various embodiments, network 150 may be a limited access network or can comprise the internet, among other configurations. Network 150 may be coupled to an encoder 160 for encoding and compressing multimedia data or content which is accessed by sending unit 110. Alternatively, sending unit 110 can encode the media prior to streaming it over transmission means 130 to client unit 120 which can decode the media prior to presentation.

[0028] Topology 100 can allow a user engaging client unit 120 to select a source, such as a file, for presentation. Client unit 120 can request that sending unit 110 stream media from the file to the client unit. Transmission means 130 can comprise any suitable transmission means such as Ethernet, broadband, dial-up and wireless. Client unit 120 can present the media to the user via presentation device 140. Although client unit 120 and presentation device 140 are described here as distinct components, other implementations may integrate their functions into a single unit.

First Exemplary Method and Implementation

[0029] Fig. 2 represents a flow diagram of acts in accordance with one method for presentation of media obtained from a media stream.

[0030] Act 202 requests to receive a multimedia stream. Such a request can be initiated by a user as a selection on a client unit. For example, the user may click on content in a web-browser, or may switch channels while watching TV over an internet provider. The request may simply be to stream a selected source such as a file or may be more specific. For example, the request may be to stream content corresponding to 10 seconds of presentation time starting at 20 seconds into the selected file. The request can cause the file corresponding to the play request to be accessed, such as by the sending unit.

[0031] At least in part by accessing the source, advisory data associated with presentation of the source's data can be obtained. Advisory data can comprise information stored in a header of the file by a program which originally created

the file. This program examines the file to determine a maximum or recommended amount of buffer for any point in the file. The buffer data can be written into a file header where it can be accessed by the sending unit.

[0032] The sending unit may simply gather the advisory data and send it to the client unit. In other implementations the sending unit may process various components of the advisory data, such as the buffer data, prior to sending it to the client unit. In some examples, the sending unit calculates one or more estimated start-up profiles which it sends to the client unit. The start-up profile can relate to the amount of data which the client unit should acquire at various points in the presentation. For example, the start-up profile can comprise a set of values indicating the maximum amount of underflow, the time at which the underflow occurs, and the acceleration rate used to calculate the underflow. In some implementations described below, data relating to multiple acceleration rates can be contained in a single start-up profile. Other implementations may generate separate start-up profiles for individual acceleration rates.

[0033] In one implementation, the start-up profile is calculated by adding the packet sizes at each presentation time to determine presentation requirements at various times during presentation of the file. Based upon various specific acceleration rates, the method can calculate an estimate of how much data the client should have received due to accelerated streaming at each presentation time. The method can provide an estimated buffer duration prior to beginning the presentation in order to avoid underflowing the client buffers (running out of data).

[0034] The start-up profile can comprise various forms. In but one example, the start-up profile comprises a data array. Array elements can be in relation to specific acceleration rates. For example, for each acceleration rate the array comprises an underflow byte value and the time at which this underflow occurs.

[0035] In some implementations, the start-up profile relates to two buffering conditions for a given acceleration rate. The first buffering condition can relate to a recommended or estimated buffer size prior to starting presentation of the file. The second buffering condition can relate to a recommended buffer size at the end of the acceleration interval. These two conditions will be described in more detail below.

[0036] The first buffer condition can be utilized to calculate how long the client unit should buffer initially so that by each underflow time it has at least an adequate number of bytes to reduce and/or avoid stuttering. The second buffer condition relates to calculating a worst case buffer scenario to ensure that when the client unit fmishes the acceleration period that it has a sufficient amount of buffer for any point in the presentation. This worst case buffer scenario can be the header value that was written by the encoding process that indicates the recommended amount of buffer that the client should have to avoid underflowing for the worst case or most "action" portion of the content. This second calculation is based on the premise that the client unit should only rely on increasing its buffer amount during the acceleration interval. In some implementations, the sending device sends, in the advisory data, the header values relating to the recommended amount of buffer. In other implementations, the sending device, as part of the advisory data may expressly provide a recommended full buffer value for the client device to achieve by the end of the acceleration interval.

[0037] In such an implementation, the method determines an amount of buffered data sufficient for the entire presentation which the client unit should achieve prior to leaving the acceleration interval. New data is of course added to the buffer during the presentation as the client unit continues to receive streaming media, but the new data is added at a rate which is closer to the rate that data is decoded for presentation. As such the total buffer size should not be depended upon to increase significantly. This implementation of the method calculates a buffer duration before presentation to satisfy both of these two buffer values at the estimated acceleration rate that the sending unit intends to stream the media.

[0038] In still another implementation, the sending unit may perform the buffer calculation, and simply pass the client unit a single value for the amount of time that the client unit should buffer. Alternatively, the sending unit can pass an array of buffer times to the client unit, for different acceleration rates, and the client unit can simply pick the time closest its own measured acceleration rate, or interpolate a more accurate value. The skilled artisan should recognize that these are but examples of which components execute the algorithm(s). For example, in some implementations more or all of the calculations may be executed by the sending unit. In still other implementations, more or all of the calculations may be executed by the client unit.

Exemplary Sending unit Algorithm

[0039] This section describes a more detailed example of an exemplary algorithm utilized by the sending unit in one implementation. This algorithm is configured to function with various client requests. In one such example, the client requests to join an already running broadcast publishing point such as a TV program. In another such example, the client requests to play a file from an on-demand publishing point that might be referenced on a web-site.

[0040] For the broadcast publishing point example, the method finds the I frame that will be the starting point of the media it streams to the client unit. The algorithm below operates on that set of data which will be sent to the client unit, namely from that I frame onward. In the on-demand example, the calculation simply starts at the first packet in the presentation. Alternatively, the user can seek to any point in the file. In that case the method finds an I frame close to that seek point and begins sending data from that point. The calculation begins from that I frame.

[0041] In the case of real time encoded content, there is no actual file that is streamed to the client unit. However, the

sending unit may buffer some amount of the real time content, and send data from that buffer to the client unit. That buffer is logically equivalent to a file in many ways for the purposes of startup profile. That buffer could be arranged in a circular manner where as new data is added on, old data is deleted from the end. In order to provide acceleration from the sending unit to the client unit for real time encoded content, the sending unit simply sends part of this buffered amount more quickly than the actual playback rate to the client.

[0042] In this particular implementation, the sending unit generally performs a profiling process that is used to fmd peaks in client unit buffer requirements over a particular period of the media stream. This particular implementation calculates the data for each presentation time, by summing the previous packet sizes. The data for any particular presentation time is the sum of all packets with lesser presentation times. This value is a measure of the amount of data that the client unit should have, in order to avoid under-flowing.

[0043] The implementation further calculates the average bit rate of the stream by taking the number of bytes sent to the client unit up to that point, i.e. presentation time, and dividing it by the difference in send time. This value is the local actual average bit rate, and it could be different from the average bit rate value stored in the file header, over portions of the stream. This particular implementation utilizes this value rather than the average value from the file header because it may be more accurate over the portion of the file which is being examined.

[0044] The implementation calculates an amount of streamed data which will be sent to the client unit at each of the same presentation time values, using the above calculated average. The method can do this calculation for several acceleration rates.

[0045] The implementation can calculate the estimated excess amount of client buffer at each interval by subtracting the second number from the first (needed data- streamed data), for each acceleration rate. As long as this number is negative, the client will be streamed more data than it needs and it will not underflow. However if this value is positive at any point in the presentation then an underflow condition will exist at the client unit.

[0046] The method also keeps track of the largest underflow value of the client buffer and the presentation time at which the largest underflow occurs for each acceleration rate. The point in the presentation time where the client will have the greatest buffer requirements may change as the acceleration rate changes. In such circumstances the method calculates the underflow values at several acceleration rates.

[0047] This will produce one underflow value, such as an amount of data, and presentation time of that underflow value for each acceleration rate. The underflow value will often be different for each acceleration rate, because the rate at which data is delivered to the client will be different due to the differing acceleration rates. However, the presentation time value for each underflow could be the same for several acceleration rates, or it could be different. Depending on the shape of the estimated data delivery versus time curve different acceleration rates could yield underflows at different times.

[0048] This implementation then can send the client unit these calculated underflow buffer values and the times at which they occur, the acceleration rate used to calculate them and the average bit rate to that point in the presentation. In some instances the advisory data compiled above can be sent to the client unit as the start-up profile for the client unit, where the start-up profile contains an estimated buffer duration as calculated by the sending unit. For example, the sending unit may send the amount of buffer utilized for each of one or more acceleration rates, one of which may be the estimated acceleration rate at which the sending unit intends to stream the data. Based at least in part upon this buffer data, the client unit can subsequently interpolate or otherwise calculate the best value to use knowing more accurately what its acceleration rate is as will be described in more detail below. Other implementations may have even more of the calculations done by the sending unit. For example, the sending unit could monitor the amount of data that it has sent to the client unit and then send a signal to the client to exit buffering and begin presentation.

[0049] One example of such a start-up profile is provided below.

```
X-StartupProfile:
Rate=10,12,15,20,30;MaxBytes=123424,113482,103245,94030,85125;Tim
e=520,280,160,120,40;StartTime=5500;LastTime=1640;MaxDiffTime=0;
MaxDiffSndTime=0;ByteRate=135626,126514,119730,116204,106546
```

[0050] Act 204 receives advisory data relating to the multimedia stream. As described above, the advisory data can relate to the start-up profile at one or more acceleration rates which can be employed by the sending unit and supported by the intervening network or transmission means since the network itself may be the limiting factor in the achievable bit rate between the sending unit and the client unit.

[0051] Below is but one example of a header utilized by the sending unit and client unit to convey which features are supported by the respective devices. In this particular example the sending unit and client unit can support advisory data

in the form of a start-up profile(s).

Supported: com.microsoft.wm.startupprofile

[0052] Some implementations may allow the client unit to have some interactive ability or algorithmic ability to control the sending unit based upon the advisory data. For example, the client unit may choose an acceleration rate, and an acceleration interval based upon the advisory data, and request the sending unit to stream the media accordingly. In another example, the sending unit may determine the acceleration rate, but the client unit may be allowed to request the acceleration interval. As will be described in more detail below, at any acceleration rate the client unit can calculate how long the sending unit should accelerate, to avoid additional start-up delay due to the full buffer value at the end of the acceleration interval. Therefore, upon receiving the advisory data, specifically the estimated acceleration rate from the sending unit, the client unit may calculate and request a corresponding acceleration interval. Alternatively, the client unit may calculate and request a corresponding acceleration interval before it has actually received the advisory data. It may pass this requested acceleration interval to the sending unit during the initial request to receive the media stream.

[0053] In other implementations, the sending unit makes decisions regarding the media stream without deference to the client unit. In one such implementation, the sending unit simply informs the client, in the advisory data, of the estimated acceleration rate and the acceleration interval and streams the media. Note that in some network topologies the acceleration interval is accurately controllable by the sending unit whereas the acceleration rate depends on the characteristics of the intervening network as well as the rate at which the sending unit is sending.

[0054] If the advisory data contains an estimated acceleration rate and resultant estimated buffer duration the method can proceed to act 206. Alternatively or additionally, the client unit may determine an estimated acceleration rate and/or associated estimated buffer duration before proceeding to act 206. For example, the client unit may estimate the acceleration rate of the future stream utilizing packet pair or run time packet pair. In another example the client determines the estimated rate via a URL modifier such as "?wmbitrate=xxx".

[0055] One example for calculating the estimated buffer duration can be seen in the following scenario. In this instance the acceleration interval is 1.0 seconds, the average presentation rate is 1.0 Mbps and the worst case buffer demand is 2.5 megabits of data. The estimated acceleration rate is 3 Mbps. As such 2.0 megabits of data can be buffered during the acceleration interval if playback occurs as soon as streaming commences leaving a person to believe that 0.5 megabits should be buffered prior to presentation. However, since there must be some buffering prior to playback, the client will not experience acceleration for a full 1 second after playback starts because part of that acceleration time will be spent in buffering before playback starts. In this particular case if the client buffers for ½ second it will acquire 3 / 2 = 1.5 Mbits of data. Then it plays for ½ second during which time the sending unit is still accelerating at 3 Mbps, but 1 Mbps is consumed by playback, therefore 2 Mbps is available to be buffered. Since this goes on for ½ second then ½ × 2 = 1 Mbit of data is buffered during playback. This results in 1.5 + 1 = 2.5 megabits of data in the buffer at the end of the acceleration interval, which is sufficient to avoid stuttering. The 2.5 megabits that should be buffered is divided into two pieces: the 1.5 Mbits buffered before the presentation starts and the 1.0 Mbits buffered after the presentation starts.

[0056] Act 206 begins to receive and buffer the multimedia stream. The media stream can be received by the client unit from the sending unit. Buffering can be started based upon the estimated buffer duration described above.

[0057] Act 208 ascertains a measured rate at which the multimedia stream is being received. The client unit may measure the rate itself or may ascertain the receiving rate from a third party component. The skilled artisan should recognize suitable methodology for measuring the rate at which the media stream is being received at the client unit.

[0058] Act 210 calculates a duration to buffer the media stream based, at least in part, on the measured rate. Hereinafter this duration will be referred to as the measured buffer duration or measured duration to distinguish it from the estimated buffer duration described above and is not intended to imply that the duration is itself measured but rather that the measured buffer duration is calculated utilizing the measured acceleration rate. The measured buffer duration can be more accurate than the estimated duration, based on the worst case buffer requirements of the entire multimedia content file, and can allow the method to reduce the likelihood of stutter while reducing start-up time.

[0059] In this example, it may be that the client unit is not actually receiving the streaming media at the estimated rate. As a result, the estimated buffer duration may actually be too short or longer than necessary. As the method approaches the estimated buffer duration, the measured acceleration rate is utilized by the client unit to recalculate the startup profile calculation to see, if in fact, it has buffered long enough at the measured acceleration rate to buffer adequate data.

[0060] If the calculation reveals that the client unit has not buffered long enough, then the client unit will buffer an incremental amount. For example the client unit may choose to recheck the buffer calculation when the amount is half the difference between the estimated buffer duration and the measured buffer duration. The client may wish to put a minimum bound on this difference, such as 100ms to avoid performing the calculation repeatedly in a small time interval. When this extra buffer duration is achieved, the client again performs the startup profile calculation with the current measured acceleration. Since the acceleration may vary somewhat, it is possible that the value is now higher and

potentially the client is able to exit the buffering state at this point. One reason for choosing a new buffering time that is half the difference between the old and new, is to give the client unit the opportunity to exit buffering as quickly as possible.

Exemplary Client Algorithm

[0061] This particular implementation utilizes the data array of the start-up profile supplied by the sending unit as described above. The startup profile data also includes a measure of the total amount of presentation time profiled on the sending unit as well as the maximum difference between the audio and video send times, if the audio is sent after the video. The audio and video send times are discussed in more detail below.

[0062] In this particular instance individual elements of the array for each acceleration rate comprise an underflow byte value, the time at which this underflow occurs, the acceleration rate used in this calculation, and the average bit/byte rate of the file up to that point. The sending unit's start-up profile indicates a number of extra bytes out in the future (above the average streaming rate multiplied by acceleration) that the client should have in its buffer at a particular time to avoid under-flowing. As stated above, the client unit acquires those extra bytes two ways: by initial buffering and by acceleration during the streaming time. The client unit calculates how long it has to buffer initially so that by each underflow time T, it has at least the right number of bytes to avoid an underflow.

[0063] The data array provides underflow values which are tied to a specific acceleration. Thus, the sending unit is telling the client unit the amount of underflow that will occur for specific values of acceleration at some point T in time. It is very unlikely that the measured acceleration rate at which the client unit receives the media stream exactly matches the sending units' estimated acceleration. As such, initial buffer durations of the data array may result in the client unit buffering too much or too little data. The client recalculates the amount of buffer; using its own measured acceleration. In this particular implementation the client unit then interpolates its own value for underflow at the measured acceleration rate that it achieves.

This exemplary client calculation proceeds as follows:

[0064] The client estimates the acceleration rate or relies on an estimate from the sending unit to determine the estimated buffer duration.

[0065] Once the client unit begins to receive the media stream and ascertains the measured rate at which it is receiving the media stream it can utilize the measured rate to calculate the measured buffer duration for each of the underflow/time pairs passed to it by the sending unit, using the sending unit's average bit rate of the content.

[0066] In this implementation, the sending unit may have previously sent in the advisory data a maximum acceleration parameter which tells the client that it will not send data any faster than a particular amount. The client unit utilizes this amount as an upper bound on the acceleration parameter in the calculation. Knowing the measured acceleration rate the client unit can calculate the number of excess bytes it will have accrued (due to acceleration) by any particular time after it starts presenting.

[0067] The client unit then subtracts the calculated bytes from the underflow byte value passed down by the sending unit. If there is a positive result then the client unit should buffer long enough to accumulate that extra number of bytes. The client unit keeps track of the maximum value of the buffer bytes using each of the underflow/time value pairs from the sending unit in its calculation. The client interpolates each underflow value from the sending unit to its own measured acceleration rate, before using that value in the calculation. Rather than keeping track of buffer bytes, the client can equally well perform the calculation in the time space by dividing the byte values by the average bit rate value passed down from the sending unit. Using time rather than bytes might be more convenient for some client units that use presentation or send time (rather than acquired bytes) as the measure of how much data they have received, and when to exit buffering and start playback.

[0068] In an alternative implementation, the client unit calculates the measured buffer duration only for the underflow/time pairs passed to it that most closely matches its measured acceleration rather than performing the calculation for all underflow/time pairs. The client unit may also use some other subset of the underflow/time pairs, such as the two pairs closest to its own measured acceleration.

Additional Factors

Send Chunk Size

[0069] As noted above, streaming media commonly comprises grouped packets that are sent at intervals rather than continuously. In recognition of this process, some implementations may add an estimate of sending unit bandwidth variation, which is the interval between sends from the sending unit. For example, with some sending unit configurations, the sending unit will send data in 1 second chunks. On a link that is high speed relative to the content, sending data in

large chunks could cause the client to come out of buffering too early if no account is taken of this chunk size.

[0070] The reasoning for such occurrences is that following each large chunk send there may be a significant period (almost 1 second) where no data will arrive from the sending unit. However, in some configurations, the client calculation assumes that data is arriving linearly at the accelerated rate. If it just barely gets enough buffered data to satisfy its buffer requirements from the 1 second send, then it will likely run out of data before the next 1 second send occurs, because it is assuming that it received data linearly at the average acceleration rate.

[0071] To avoid this problem the sending unit can send an indication of its send chunk size to the client unit, and the client unit adds this amount to its buffer time. In one such example where the sending unit sends in 150ms chunks (for 1.2Mbit content). Responsively, the client can add 150-200ms to its startup calculation to avoid this chunk effect.

Audio Video separation

[0072] In some implementations the advisory data received at act 204 may contain information relating to any separation of corresponding portions of the audio and video in the media stream. In some file formats corresponding audio and video data may not be sent together. For example, if the video for presenting at time 1 second is 1000 bytes into the file and the audio for the same 1 second presentation time is 2000 bytes into the file then the client unit has to wait for the audio before presenting this portion of the file. This factor may outweigh other fast start-up buffer considerations since it would be undesirable to begin presentation until the client unit has both the corresponding audio and video. For example, if the audio is three seconds later than the video, the method may wait for that 3 second duration even if it otherwise has enough buffer to start playback and avoid stuttering. In one such implementation, the sending unit sends this information to the client unit as a header. One header for the audio video relationship and one for the startup profile buffer times for given acceleration rates.

[0073] In one such implementation, the sending unit attempts to quantify the lateness of the audio with respect to the video by looking at the difference in the presentation times of the audio and video packets in the file.

[0074] In this particular implementation, each time an audio packet is encountered, the method calculates the difference between the presentation time of the last video packet and the audio packet. When this value is positive (video presentation time is greater than the audio presentation time) it means that the audio data corresponding to this video sample is at some point further along in the file - at some point in the future and the client unit will have to wait for that audio to be able to synchronize audio and video. The method can save the maximum of the values calculated in the first step, as a worst case measure of how far behind the audio is relative to the video. The method can then send the maximum value of the audio lateness to the client unit.

[0075] This particular implementation can repeat this calculation each time it identifies an audio sample, it can then add the difference in send time to the calculated value, since this sample will be sent that amount of time later, contributing further to the lateness of the audio.

[0076] In another implementation a video sample is spread across several packets with an audio sample interspersed. The calculation can find the last video packet at a given presentation time and compare that against the audio presentation time.

[0077] Act 212 initiates presentation of the multimedia based on the measured buffer duration. The presentation can be initiated at a reduced time while mitigating and/or avoiding stutter during the presentation.

Second Exemplary Method and Implementation

[0078] Fig. 3 represents a flow diagram of acts in accordance with one method for presentation of media obtained from a media stream.

[0079] Act 302 measures a rate (measured rate) at which multimedia is received at a downstream component configured to present the multimedia. Measuring the rate at which the multimedia is being received can be achieved utilizing any suitable means. Measuring the receive rate at this relative position can reduce discrepancies, such as those caused by intervening events or conditions, which may reduce the accuracy of attempting to estimate such a rate farther upstream.

[0080] Act 304 determines a duration of time to buffer the received media before presentation, at least in part utilizing the measured rate. In but one implementation, the method begins buffering the streaming media and calculates a duration to buffer prior to starting playback based upon the measured receive rate. Utilizing the measured rate in the buffer duration calculation can result in a reduced start-up time while still avoiding stuttering of the presentation. Acts 302 and 304 may be repeated multiple times prior to beginning presentation of the media to even more precisely determine the buffer duration.

Computing Environment

[0081] The one or more embodiments, as described herein, may be implemented 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 include, but are not limited to, personal computers, server computers, thin clients, thick clients, hand-held or laptop devices, cell phones, 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.

[0082] The one or more implementations, as described herein, 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.

[0083] The one or more implementations, as described herein, may be described in the general context of processor-executable instructions, such as program modules, being executed by a processor or a computer. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types and functions. Typically, the functionality of the program modules may be combined or distributed as desired in various embodiments.

Conclusion

[0084] The above described implementations allow a unit configured to actually present media content to a user to make the final determination regarding a duration to buffer a media stream before presenting the media to the user. Such a configuration can reduce buffer duration while mitigating and/or avoiding stuttering during the presentation.

[0085] Although the inventive concepts are described in language specific to structural features and/or methodological acts, it is to be understood that the inventive concepts described in the appended claims are not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as exemplary forms of implementing the claimed inventive concepts.

Claims

1. A computer-readable medium having processor-executable instructions that, when executed by a processor, performs a method comprising:

   measuring a rate (measured rate) at which a multimedia stream is received at a downstream component configured to present the multimedia to a user; and,
   ascertaining a duration (measured duration) of time to buffer the received multimedia before presentation thereof, at least in part utilizing the measured rate.

2. A medium as recited in claim 1 further comprising prior to said measuring, receiving advisory data that provides a cumulative buffer amount for the presentation at an estimated acceleration rate.

3. A medium as recited in claim 2 further comprising, determining an estimated duration to buffer the received multimedia before presentation based, at least in part, on the estimated acceleration rate and the cumulative buffer amount.

4. A medium as recited in claim 1 further comprising prior to said measuring, receiving advisory data that provides a data array for one or more acceleration rates, and wherein for individual acceleration rates the data array contains a corresponding underflow byte value, a time in the presentation when the underflow byte value occurs, and an average data rate to a given point in the stream.

5. A medium as recited in claim 4 further comprising, determining an estimated duration to buffer the received multimedia before presentation for each of the acceleration rates of the data array.

6. A medium as recited in claim 5, wherein determining the measured duration comprises interpolating the measured rate between a higher data array acceleration rate and a lower data array acceleration rate.

7. A computing device comprising a medium as recited in claim 1.

8. A method facilitating fast start-up of a new multimedia stream associated with a source, the method comprising:

   requesting to receive a multimedia stream;

receiving advisory data relating to the multimedia stream;
beginning to receive and buffer the multimedia stream;
ascertaining a rate (measured rate) at which the multimedia stream is being received;
calculating a duration (measured duration) to buffer said multimedia stream based, at least in part, on said measured rate; and,
initiating presentation of the multimedia based on the measured duration.

9. A method as recited in claim 8, wherein said receiving comprises receiving advisory data that comprises an estimated buffer duration prior to beginning presentation of the multimedia for an estimated acceleration rate at which an upstream component intends to stream the multimedia.

10. A method as recited in claim 8, wherein said receiving comprises receiving advisory data that comprises a data array of acceleration rates, and wherein individual acceleration rates are associated with cumulative buffer amounts for the presentation, and wherein the data array further comprises an estimated acceleration rate at which an upstream component intends to stream the multimedia and an acceleration interval for which the upstream component intends to maintain the estimated acceleration rate.

11. A method as recited in claim 10, further comprising prior to the act of beginning, determining, at least in part from the advisory data, an estimated buffer duration prior to beginning to present the multimedia for the acceleration rates of the data array.

12. A method as recited in claim 8, wherein said act of receiving comprises receiving advisory data comprising a start-up profile relating to multiple acceleration rates and wherein said calculating comprises interpolating the measured rate between a first of the multiple acceleration rates having a higher value than the measured rate and a second of the multiple acceleration rates having a lower value than the measured rate and selecting the measured duration to satisfy both of the first and second acceleration rates.

13. A method as recited in claim 8, wherein said calculating comprises calculating a first measured duration and prior to reaching the first measured duration ascertaining a second subsequent measured rate and calculating a second measured duration, and wherein said initiating is based on said second measured duration.

14. A computing device configured to implement a method as recited in claim 8.

15. A computer implemented method comprising:

determining a duration to buffer a multimedia stream before beginning to present the multimedia; and,
subsequent to beginning to receive the multimedia stream, but prior to beginning to present the multimedia, verifying the duration.

16. A method as recited in claim 15, wherein the act of verifying comprises measuring a rate (measured rate) at which the multimedia is being received and comparing the measured rate to an estimated rate that the multimedia would be received.

17. A method as recited in claim 15, wherein the acts of determining and verifying are achieved by a single component.

18. A system comprising:

a sending unit configured to transmit multimedia; and,
a receiving unit configured to receive the multimedia and present the multimedia to a user, wherein the receiving unit is further configured to ascertain a measured rate at which the receiving unit is receiving the multimedia and to calculate, based at least in part on the measured rate, how long it should buffer the multimedia before starting to present the multimedia.

19. A system as recited in claim 18, wherein the sending unit comprises a server.

20. A system as recited in claim 18, wherein the sending unit is configured to access encoded multimedia and to transmit the encoded multimedia to the receiving unit.

21. A system as recited in claim 18, wherein the sending unit is configured to encode the multimedia prior to transmitting the encoded multimedia to the receiving unit.

22. A system as recited in claim 18, wherein the sending unit is configured to access the multimedia from a live encoding session.

23. A system as recited in claim 18, wherein the sending unit is configured to access the multimedia from a file.

24. A system as recited in claim 18, wherein the receiving unit comprises a personal computer.

25. A system as recited in claim 18, wherein the receiving unit comprises a set-top box.

26. A system as recited in claim 18, wherein the receiving unit comprises a cell phone.

27. A system as recited in claim 18, wherein the receiving unit is configured to decode the multimedia received from the sending unit.

28. A system as recited in claim 18, wherein the sending unit is further configured to send information regarding buffer values associated with presentation of the multimedia.

29. A system as recited in claim 18, wherein the sending unit is further configured to access header information associated with a presentation of the multimedia contained in a file and to send a summary of the information to the receiving unit.

30. A system as recited in claim 29, wherein the summary comprises at least one data array comprising at least one acceleration rate and a summarized buffer value associated with the presentation of the multimedia.

31. A system as recited in claim 29, wherein the summary comprises at least one data array comprising one or more of an acceleration rate, an associated buffer value associated with the presentation of the multimedia, or a time in the presentation associated with the buffer value.

32. A system as recited in claim 18, wherein the sending unit is further configured to send an estimated acceleration rate at which it intends to transmit the multimedia and a duration which it plans to transmit at the estimated acceleration rate.

33. A system as recited in claim 18 further comprising a transmission means coupling the sending unit and the receiving unit and wherein the transmission means may cause a transmission rate from the sending unit to be greater than the measured rate at the receiving unit.

34. A system comprising:

a downstream component configured to receive and buffer a multimedia stream and after buffering an amount of units of the multimedia to begin a presentation of the multimedia for a user; and,
an upstream component configured to access the multimedia and stream the multimedia to the downstream component, and wherein the upstream component is further configured to obtain at least one start-up profile relating to a recommended amount of buffer at one or more points in the presentation to mitigate an underflow condition.

35. A system as recited in claim 34, wherein the at least one start-up profile comprises multiple start-up profiles which relate to potential streaming rates of the multimedia stream.

36. A system as recited in claim 34, wherein the upstream component compiles the at least one start-up profile.

37. A system as recited in claim 34, wherein the upstream component calculates an estimated buffer time to buffer the amount of units, based at least in part on the at least one start-up profile.

38. A system as recited in claim 34, wherein the upstream component calculates an estimated buffer time to buffer the amount of units, based at least in part on the at least one start-up profile and wherein the upstream component passes the estimated buffer time to the downstream component which buffers according to the estimated buffer

time without further calculation or verification of the estimated buffer time.

39. A system as recited in claim 34, wherein the upstream component calculates an estimated buffer time to buffer the amount of units, based at least in part on the at least one start-up profile and wherein the upstream component passes the estimated buffer time to the downstream component which begins to buffer according to the estimated buffer time and prior to beginning the presentation the downstream component verifies the estimated buffer time.

40. A system as recited in claim 34, wherein the downstream component calculates an estimated buffer time to buffer the amount of units based at least in part on the at least one start-up profile.

41. A system as recited in claim 40, wherein the downstream component is configured to verify the estimated buffer time by calculating a second buffer time to buffer the amount of units based at least in part on a measured rate at which the downstream component is receiving the multimedia stream.

42. A system as recited in claim 41, wherein the downstream component is configured to delay beginning the presentation beyond the second buffer time due to properties of the multimedia stream.

43. A system as recited in claim 42, wherein the properties comprise one or more of send chunk size or audio/video separation.

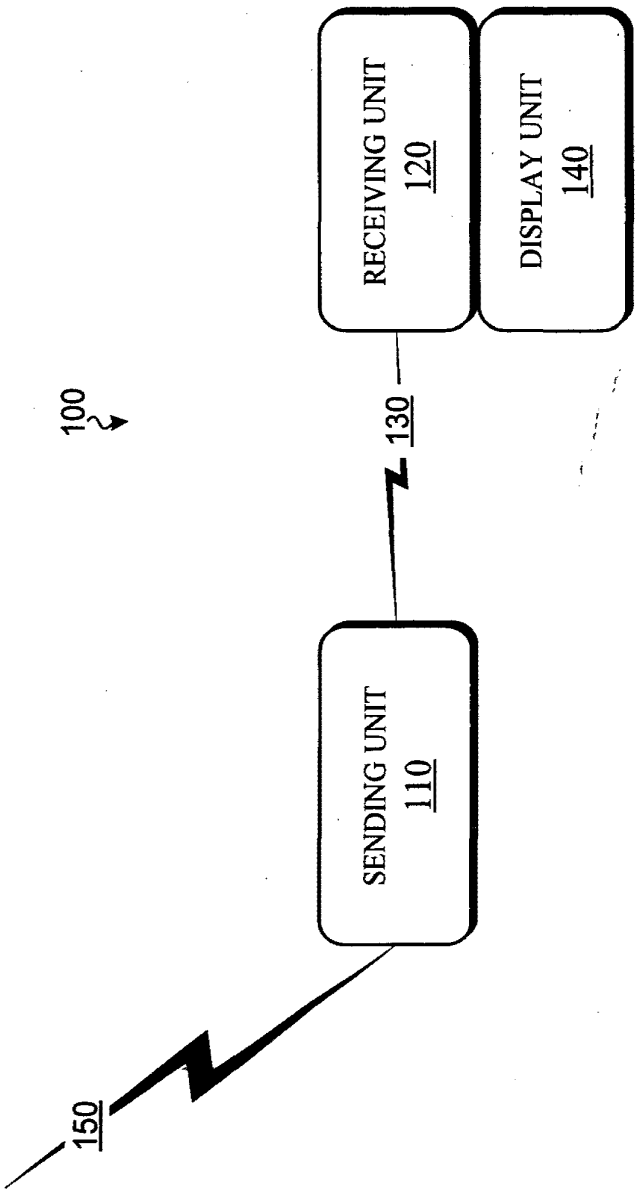

100
SENDING UNIT
110
RECEIVING UNIT
120
130
DISPLAY UNIT
140
150

Fig. 1

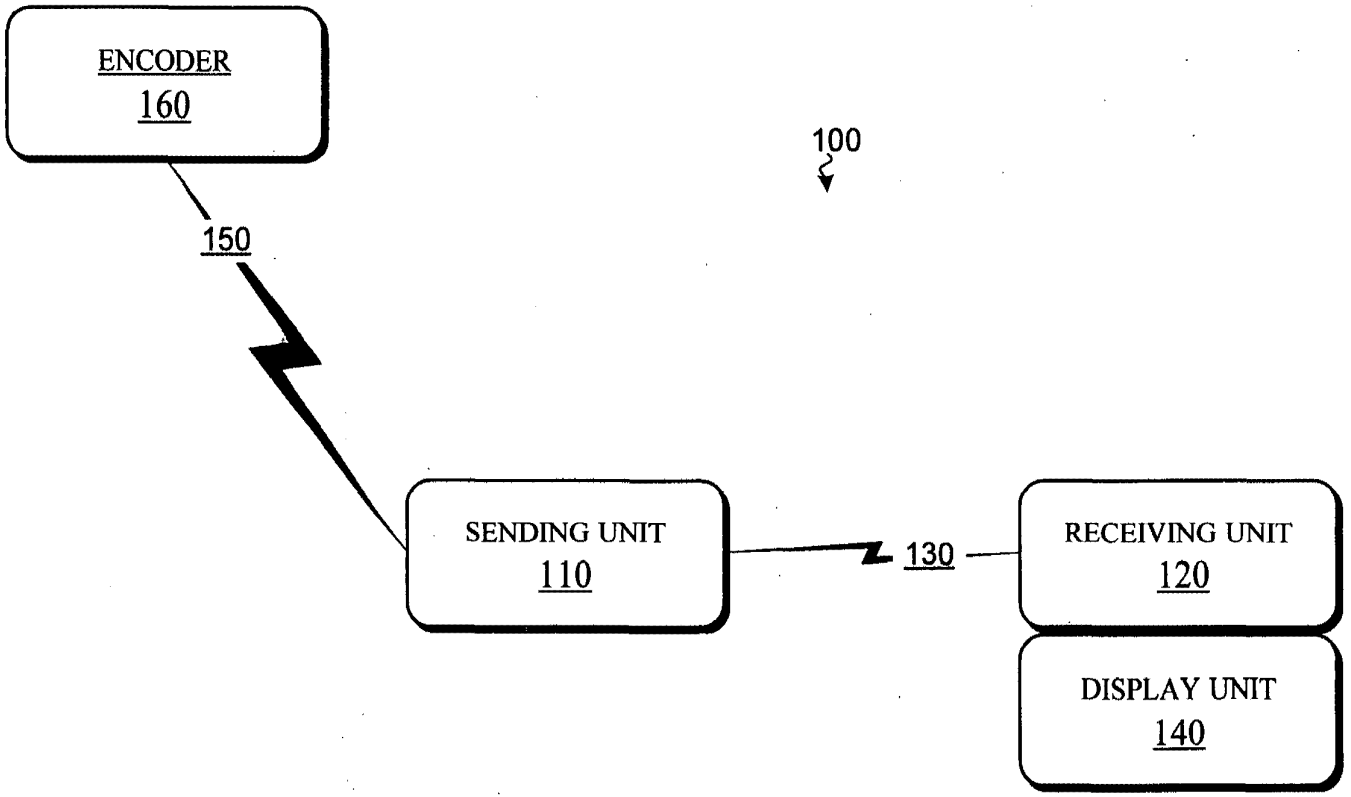

ENCODER
160
100
150
SENDING UNIT
110
130
RECEIVING UNIT
120
DISPLAY UNIT
140

Fig. 1A

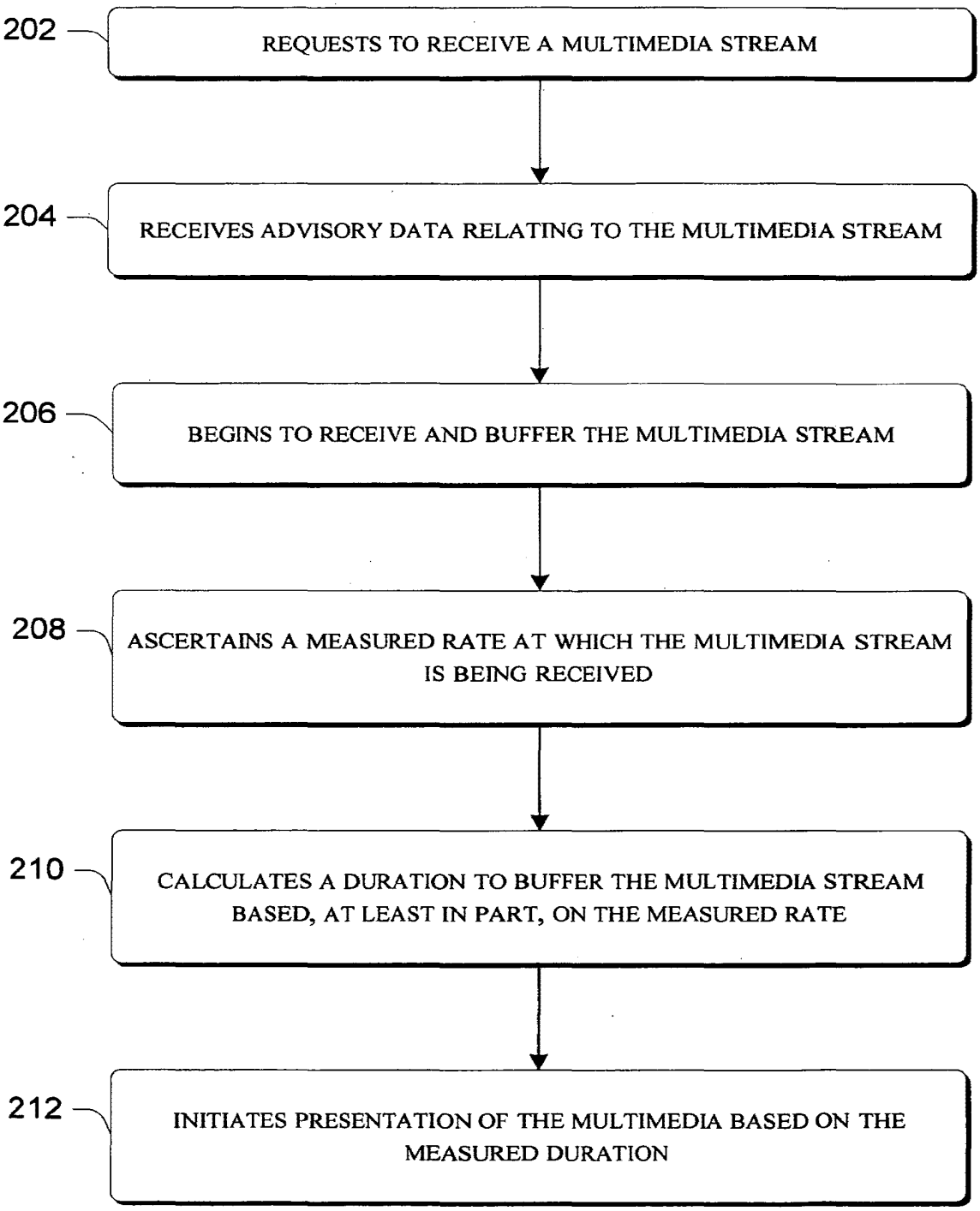

202
REQUESTS TO RECEIVE A MULTIMEDIA STREAM
204
RECEIVES ADVISORY DATA RELATING TO THE MULTIMEDIA STREAM
206
BEGINS TO RECEIVE AND BUFFER THE MULTIMEDIA STREAM
208
ASCERTAINS A MEASURED RATE AT WHICH THE MULTIMEDIA STREAM IS BEING RECEIVED
210
CALCULATES A DURATION TO BUFFER THE MULTIMEDIA STREAM BASED, AT LEAST IN PART, ON THE MEASURED RATE
212
INITIATES PRESENTATION OF THE MULTIMEDIA BASED ON THE MEASURED DURATION

Fig. 2

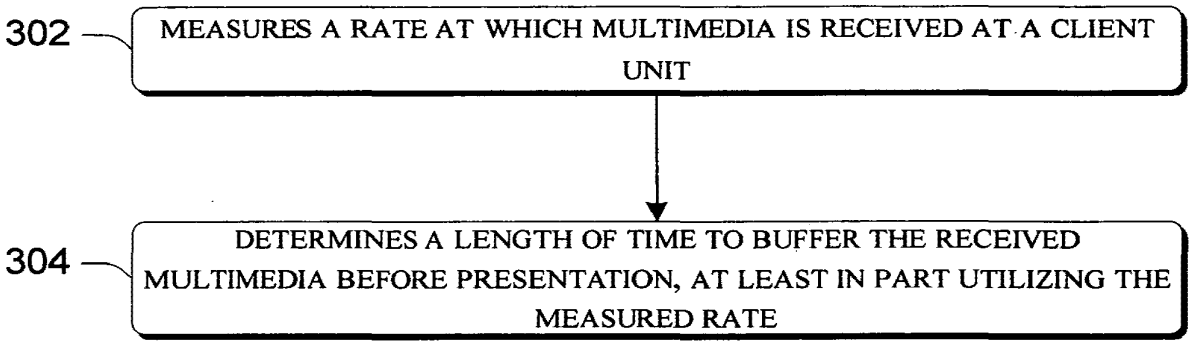

302
MEASURES A RATE AT WHICH MULTIMEDIA IS RECEIVED AT A CLIENT UNIT
304
DETERMINES A LENGTH OF TIME TO BUFFER THE RECEIVED MULTIMEDIA BEFORE PRESENTATION, AT LEAST IN PART UTILIZING THE MEASURED RATE

Fig. 3

PTO/SB/08a (01-10)
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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	18069450
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First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	18069450
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First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

CERTIFICATION STATEMENT

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

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Signature	/Brett Carlson/	Date (YYYY-MM-DD)	2023-10-19
Name/Print	Brett Carlson	Registration Number	39928

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(54) Decompression system for compressed video data for providing uninterrupted decompressed video data output

System zur Dekompression komprimierter Videodaten mit ununterbrochenem Datenstrom am Videoausgang

Système de décompression pour données vidéo comprimées sans interruption de données sur la sortie vidéo

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- **IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, vol. 2, no. 2, June 1992, NEW YORK US, pages 197-206, XP000280659 LIN ET AL: "designing a high-throughput vlc decoder part II-parallel decoding methods"**

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Description

[0001] This invention is in the field of video data and the provision of video data to users. In particular, it relates to methods and apparatus for decompresing compressed video data.

[0002] For purposes of this description, video data typically comprises the video and audio data contained in a stored video program. However, other data including but not limited to text and graphics may be included in the video data without in any way affecting the operation of the present invention or the substance of this description. All references herein to video data should therefore be considered in the broadest sense.

[0003] Video servers for providing video data to users are known. Although uncompressed video data can be stored in such servers and sent to users, the sheer amount of data in even a short video program usually requires that the video data be stored and manipulated in a compressed form. Methods and apparatus for accomplishing the compression and decompression of video data are known.

[0004] One known compression format is sponsored by the Motion Picture Expert Group and is known as MPEG. Although both an MPEG-1 and an MPEG-2 compression format are known, their differences are not relevant to the present invention.

[0005] MPEG compression is based on the fact that from one frame of video data to the next, there are comparatively few changes, even when objects or persons are in motion. It is therefore not necessary to store all of the video data contained in each frame. Rather, after a base frame has been stored, each successive frame can be recreated by storing only the video data that describes objects or persons that have either changed or moved. Periodically, a complete frame of video data must be stored to re-initialize the process. This type of data compression is called motion compensation.

[0006] MPEG compressed video data consists of three types of frames. The first, an intra coded frame (hence, an I-frame) provides all the video data needed to fully describe that particular frame. A predicted frame (hence, a P-frame) provides only information about how the P-frame differs from the last I- or P-frame. Finally, a bi-directional frame (hence, a B-frame) provides information about how the B-frame differs from both the preceding I- or P-frame and the next I-or P-frame. The decompression of the video data contained in a B-frame requires the decompression of two frames, either both I-frames, an I-frame and P-frame, or both P-frames. Decompressing a P-frame requires the video data contained in the preceding P- or I-frame. Typically, storing an I-frame requires three times as many bits as a P-frame, and storing a P-frame requires roughly three times as many bits as a B-frame. These relative storage requirements of the I-, B-, and P-frames are provided only for comparison purposes and no limitation of the present invention to the stated relative storage requirements should be implied.

[0007] Fig. 1 shows the typical transmission and display order of a series of MPEG compressed video data frames. As P-frames need the video data contained in a decoded I-frame to be decoded, and as B-frames need the video data contained in either or both a decoded I-frame and a P-frame, the transmission order of compressed MPEG frames differs from the display order of decompressed MPEG frames. Both the transmitted and displayed frames begin with an I-frame, and another I-frame occurs roughly every fifteen frames thereafter. During transmission, two B-frames are preceded by a P-frame. When displayed, after the first I-frame, two B-frames follow, and then a P-frame. As neither a B-frame or a P-frame can be decompressed without reference to an I-frame, all compressed video data streams must begin with an I-frame.

[0008] A known architecture for decoding MPEG video data streams is shown in Fig. 2. Decompression system 10 consists of compressed video data buffer 11, decoder 13, and decompressed video data buffer 17. An input bus 15 provides a stream of compressed MPEG video data to buffer 11. As bus 15 provides video data at a fixed rate, some time elapses before enough video data is stored in buffer 11 for decoder 13 to begin decompressing the video data.

[0009] A latency time exists before enough video data enters buffer 11 for decoder 13 to begin decompression. This latency time is herein called buffer filling latency time. An even longer latency time occurs due to the nature of the MPEG video data. Either an I-frame and a P-frame, two P-frames, or two I-frames must be decompressed and available before a B-frame can be decompressed. Typically two B-frames are transmitted after a P-frame. The system must receive and decompress these I- and/or P-frames before the B-frames can be decompressed. The time required for this decoding and reordering is herein called a reordering latency time.

[0010] The effect of the reordering latency time is noticeable every time a new video program begins. The reordering latency time and the buffer filling latency time together result in the system generating several blank frames between the old and new video programs while the new video program is decompressed sufficiently for display. In some known systems, as many as eight such blank frames are generated between two consecutive video programs. These blank frames are highly undesirable.

[0011] At present, no known system corrects this deficiency at acceptable cost.

[0012] The article "Designing a High-throughput VLC Decoder Part II - Parallel Decoding Methods" in IEEE Transactions on Circuits and Systems for Video Technology, vol.2, no.2, June 1992, New York, U.S. at pages 197 to 206 and in particular Fig.9 on page 203, discloses a hybrid pipelined decoder as a dynamic combination of parallel and pipelined decoders with buffers which may offer variable rate access.

[0013] According to a first aspect of the present invention, as defined in claim 1, there is provided a system for decompressing video data streams and for providing continuous video data output, the system comprising: an input switch coupled to a plurality of compressed video data input lines, the switch capable of selecting input lines and capable of controlling the video data flow rate of the selected input lines; a plurality of decompression circuits coupled to the input switch for decompressing compressed video data received from the input switch and storing decompressed video data; an output switch coupled to the decompression circuits, the output switch coupling only one of the decompression circuits to an output bus at any time; characterised in that a controller is provided which is coupled to the input switch, the decompression circuits, and the output switch, and which commands the input switch to provide a first video data stream to a first video data decompression circuit at a first rate and to provide remaining video data streams to the remaining video data decompression circuits at a second rate prior to the end of the first video data stream.

[0014] According to a second aspect of the present invention, as defined in claim 6, there is provided a method for providing continuous decompressed video data to an output from a plurality of compressed video data streams, the method comprising the steps of: receiving the plurality of compressed video data streams; selecting a first video data stream; decompressing the selected first video data stream at a first rate for the duration of the first video data stream; decompressing the remaining video data streams at a second rate prior to the end of the first video data stream; providing the decompressed first video data stream to the output; and repeating the selecting, compressing, decompressing and providing steps until all the video data streams have been provided to the output.

The system will decompress and display a first video data stream. Prior to the end of the first video data stream, the system will begin accepting as input and decompressing another video data stream. At least several frames of the MPEG compressed video data comprising the second video data stream will be decompressed and available for display as soon as the first video data stream ends. The buffer filling and reordering latency times which occur when the present invention begins to decompress its first video data stream occur off-line, so the user has no direct experience of it. As successive video data streams begin, their buffer filling and reordering latency time occur while the previous video data stream is being decompressed and displayed. The user does not experience these latencies either. In known systems, the user experiences both the buffer filling and the reordering latency times as blank frames between successive video data streams every time a new video data stream begins.

[0015] In the preferred embodiment, the input switch controls the flow rate of two video data streams on two video data input lines which comprise the inputs of the preferred embodiment. Initially, the first video data stream flows into the present invention at a first rate. When the second video data stream is later allowed to flow, it flows into the system at a second rate on the second line. In the preferred embodiment, the first rate is higher than the second rate. In other embodiments, this need not be the case. The input switch can halt the flow of either stream.

[0016] The input switch is in turn coupled to two decompression circuits, each circuit comprising a compressed video data buffer, a decoder, and a decompressed video data buffer. Incoming compressed video data is stored in the compressed video data buffer, decompressed in the decoder, and stored temporarily in the decompressed video data buffer. The decompressed video data buffer from both circuits is in turn coupled to an output switch.

[0017] Both decompression circuits and the input and output switch are coupled to a microcontroller. Under instructions from a stream scheduler, the microcontroller determines which decompression circuit will accept video data at the first rate and which will accept it the second rate. The first decompression circuit receives the first video data stream at the first rate, decompress it, and provides it to the output bus.

[0018] Prior to the end of the first video data stream, the system will instruct the input switch to begin flowing the second video data stream into the second decompression circuit at the second rate. Several frames of the second video data stream will be decompressed and stored in the decompressed video data buffer before the first video data stream ends. When the first video data streams ends, the system immediately begins to display the decompressed second video data stream and simultaneously increases the rate of video data flow into the second decompression circuit to the first rate. In this manner, successive video data streams are displayed without the user seeing any blank frames between the video data streams or experiencing the buffer filling and reordering latency times directly.

[0019] Processing at first and second rates by alternate decompression circuits continues indefinitely until all video data streams have been displayed.

[0020] The preferred embodiment will now be described in detail with reference to the figures listed and described below.

Fig. 1 shows typical MPEG compressed frame transmission and decompressed frame display sequences(Prior Art);

Fig. 2 shows a known system for decompressing video data (Prior Art);

Fig. 3 is a block diagram of the preferred embodiment of the present invention; and

Fig. 4 is an example showing the relative rates of video data transmission through the first and second decompression circuits of the present invention

during typical use.

[0021] A first preferred embodiment of the present invention is illustrated in Fig. 3. Decompression system 100 comprises input switch 105, first and second decompression circuits 120 and 130, which in turn are further comprised respectively of compressed video data buffers 121 and 131, first and second decoders 123 and 133, decompressed video data buffers 125 and 135, output switch 115 and microcontroller 110. Stream scheduler 150 is coupled to microcontroller 110. Microcontroller 110 is a commercially available Motorola 68331 microcontroller and requires no further description herein.

[0022] In each decompression circuit, the compressed video data buffer is coupled to the decoder, which is in turn coupled to the decompressed video data buffer. The decoders in the preferred embodiment are commercially available STI 3500 MPEG decoders from SGS Thomson and require no further description herein.

[0023] Input switch 105 is coupled to two compressed video data input lines, both compressed video data buffers 121 and 131, and to microcontroller 110. Output switch 115 is similarly coupled to decompressed video data buffers 125 and 135 and to microcontroller 110. Microcontroller 110 is further coupled to both decoders 123 and 133, the two compressed video data buffers 121 and 131, as well as to server controller 150. Although microcontroller 110 receives instructions from stream scheduler 150, stream scheduler 150 does not form part of the present invention.

[0024] Although shown as separate buffers in Fig. 3, the compressed and decompressed video data buffers can be realized as a single buffer, which would be accessed in a known manner. The exact configuration of the buffers can therefore be varied considerably from the illustrated embodiment without changing the present invention in a material way. In the preferred embodiment, the buffers comprise eight 256K words by 16 bits dynamic random access memories ("DRAMs") coupled to the decoder. The DRAMs are commercially available from many vendors, including Hitachi, and require no further description herein.

[0025] In operation, two separate compressed video data streams enter input switch 105. Under command of microcontroller 110, video data flows into one of the decompression circuits at a first rate and flows into the other at a second rate. For purposes of this description only, and without implying any limitation, video data will be assumed to flow initially into decompression circuit 120 at a high rate and into decompression circuit 130 at a lower rate. It should be understood that nothing herein constrains the second rate to be less than the first rate. Although the preferred first embodiment uses a first rate of 15 megabits per second and a second rate of 7.5 megabits per second, these rates were chosen to reduce overall bandwidth demands. The second rate in other embodiments could be the same or indeed higher than the first rate.

[0026] As compressed video data buffer 121 begins to fill with the video data it is receiving at a high rate, decoder 123 begins decompressing that video data. Decompressed frames of video data are stored in decompressed video data buffer 125. After the first I- and P-frames have been decompressed and stored in decompressed video data buffer 125, decompression of the B-frames that separated the I- and P-frames begins. Decompressed video data frames are removed from decompressed video data buffer 125 in the proper order under the direction of microcontroller 110 and sent through output switch 115 to an output bus.

[0027] When the first compressed video data stream is nearly finished, the process of decompression begins in decompression circuit 130. Microcontroller 110 instructs input switch 105 to begin flowing the second compressed video data stream into decompression circuit 130, albeit at the second, lower rate. If the video stream being decompressed in decompression circuit 120 is very long, it is possible that decompression circuit 130 will fill its decompressed video data buffer to capacity prior to the completion of the first video data stream, despite the microcontroller only ordering the second decompression circuit to begin operation shortly before the first video data stream is predicted to end. Microcontroller 110 will in that case instruct input switch 105 to stop the flow of video data into decompression circuit 130.

[0028] Once the video program flowing into decompression circuit 120 ends, decompression circuit 130 has several frames of video data decompressed and ready for immediate display or output. Output switch 115 would be instructed by microcontroller 110 to switch the output to decompression circuit 130 as the output from decompression circuit 120 ends, insuring a continuous generation of decompressed video data without any blank frames between video streams. Input switch 105 also begins to flow the second video data stream into decompression circuit 130 at the higher, first rate of video data flow. Input switch 105 may provide decompression circuit 120 with a low rate of video data immediately, but it is more likely that no video data will be flowed into decompression circuit 120 for at least some interval of time. This process would continue alternatively, with each decompression circuit alternatively providing the output from the system. In this manner, the buffer filling and reordering latency times are not experienced by system users and no blank frames occur between video programs.

[0029] An example of the process of alternatively providing video data to decompression circuits 120 and 130 is illustrated graphically in Fig. 4. At time T_1, decompression circuit 120 is receiving and decompressing a first video data stream at a high rate. Decompression circuit 130 is not receiving video data. At time T_2, microcontroller 110 has instructed input switch 105 to begin flowing the second video data stream into decompression circuit 130 at the second, lower rate. At time T_3, the first

video data stream being processed by decompression circuit 120 ends. Immediately, decompression circuit 130 begins receiving video data at a high rate, while simultaneously sending its stored decompressed video data frames to the output bus. At time T_4, microcontroller 110 instructs input switch 105 to begin flowing the next video data stream into first decompression circuit 120 at the second, lower rate. At time T_5, the buffers in decompression circuit 120 are full and video data flow to that circuit ceases. At time T_6, the video data stream being decompressed by decompression circuit 130 ends. Decompression circuit 120 now receives its next video data stream at the high, first rate, while providing its stored decompressed video data frames to the output bus. Video data stream input to decompression circuit 130 ends until time T_7, when microcontroller 110 again instructs input switch 105 to begin flowing the next video data stream into decompression circuit 130 at the second, lower rate. At time T_8, the video data stream being decompressed by decompression circuit 120 ends and data stream input to that circuit is also ended, while simultaneously video data stream input to decompression circuit 130 is increased to the first, high rate and the stored frames of decompressed video data in decompression circuit 130's buffer are provided as output. This sequential process continues until all video data streams provided as input have been decompressed and provided as output in a continuous output stream.

[0030] Although the present invention has been described in detail with reference to only two decompression circuits, nothing herein should be taken to limit the present invention to only two such circuits. The expansion of the system to more decompression circuits would be a straightforward process and would provide even greater system flexibility and usefulness. In a system with more than two decompression circuits, the switching process would obviously not have to occur alternatively or sequentially.

[0031] The present invention can be used in a real time display system, where different video programs must be displayed consecutively without pause. Video "clips" can be played from random start points to random end points followed by another video "clip" with random start and end points, with no delay or blank frames between the "clips". It should be noted that such random start points will require additional flexibility from the system, as decompression will have to begin early enough to decompress the video data stream up to the "random" start point, as all preceding decompressed video data streams will have to be used to decompress the video data stream up to the chosen start point and then discarded. The present invention is also useful in video data editing systems, where video data programs or portions of programs must be spliced together. Video program insertion, advertisement insertion and video editing are all environments within which the present invention would be useful.

Claims

1. A system (100) for decompressing video data streams and for providing continuous video data output, the system (100) comprising:

   an input switch (105) coupled to a plurality of compressed video data input lines, the switch (105) capable of selecting input lines and capable of controlling the video data flow rate of the selected input lines;
   a plurality of decompression circuits (120,130) coupled to the input switch (105) for decompressing compressed video data received from the input switch (105) and storing decompressed video data;
   an output switch (115) coupled to the decompression circuits (120,130), the output switch (115) coupling only one of the decompression circuits (120,130) to an output bus at any time;

   characterised in that a controller (110) is provided which is coupled to the input switch (105), the decompression circuits (120,130), and the output switch (115), and which commands the input switch (105) to provide a first video data stream to a first video data decompression circuit (120) at a first rate and to provide remaining video data streams to the remaining video data decompression circuits (130) at a second rate prior to the end of the first video data stream.

2. The system of claim 1, wherein the controller (110) commands the output switch (115) to couple the first video data decompression circuit (120) to the output bus while the first video data decompression circuit (120) receives video data input at the first rate.

3. The system (100) of claim 1 or 2 wherein the second rate has a lower, the same, or a higher bit per second rate than the first rate.

4. The system (100) of any preceding claim, wherein the decompression circuits (120,130) further comprise:

   a buffer (121,131) for storing compressed video data;
   a decoder (123,133) for decompressing video data; and
   a buffer (121 or 125, 131 or 135) for storing decompressed video data.

5. The system (100) of any preceding claim, wherein the controller (110) commands the input switch (105) to halt video data flow at the second rate if the video data decompression circuit (130) receiving video data at the second rate cannot store any more

decompressed video data.

6. A method for providing continuous decompressed video data to an output from a plurality of compressed video data streams, the method comprising the steps of:

receiving the plurality of compressed video data streams; selecting a first video data stream;
decompressing the selected first video data stream at a first rate for the duration of the first video data stream;
decompressing the remaining video data streams at a second rate prior to the end of the first video data stream;
providing the decompressed first video data stream to the output; and
repeating the selecting, compressing, decompressing and providing steps until all the video data streams have been provided to the output.

7. The method of claim 6, wherein the first rate is greater than the second rate.

8. The method of claim 6, wherein the first rate is equal to the second rate.

9. The method of claim 6, wherein the first rate is less than the second rate.

Patentansprüche

1. Ein System (100) zum Dekomprimieren von Videodatenströmen und zum Liefern einer durchgehenden Videodatenausgabe, wobei das System (100) folgende Merkmale aufweist:

einen Eingangsschalter (105), der mit einer Mehrzahl von Eingangsleitungen für komprimierte Videodateil gekoppelt ist, wobei der Schalter (105) in der Lage ist, Eingangsleitungen auszuwählen, und wobei der Schalter (105) in der Lage ist, die Videodatenflußrate der ausgewählten Eingangsleitungen zu steuern;

eine Mehrzahl von Dekompressionsschaltungen (120, 130), die mit dem Eingangsschalter (105) gekoppelt sind, zum Dekomprimieren komprimierter Videodaten, die von dem Eingangsschalter (105) empfangen wurden, und zum Speichern von dekomprimierten Videodaten;

einen Ausgangsschalter (115), der mit den Dekompressionsschaltungen (120, 130) gekoppelt ist, wobei der Ausgangsschalter (115) zu einem Zeitpunkt nur eine der Dekompressionsschaltungen (120, 130) mit einem Ausgangsbus koppelt;

dadurch gekennzeichnet, daß eine Steuerung (110) vorgesehen ist, die mit dem Eingangsschalter (105), den Dekompressionsschaltungen (120, 130) und dem Ausgangsschalter (115) gekoppelt ist, und die den Eingangsschalter (115) anweist, um einen ersten Videodatenstrom zu einer ersten Videodatendekompressionsschaltung (120) mit einer ersten Rate zu liefern, und um verbleibende Videodatenströme vor dem Ende des ersten Videodatenstroms zu den verbleibenden Videodatendekompressionsschaltungen (130) mit einer zweiten Rate zu liefern.

2. Das System gemäß Anspruch 1, bei dem die Steuerung (110) den Ausgangsschalter (115) anweist, um die erste Videodatendekompressionsschaltung (120) mit dem Ausgangsbus zu koppeln, während die erste Videodatendekompressionsschaltung (120) Videodateneingangssignale mit der ersten Rate empfängt.

3. Das System (100) gemäß Anspruch 1 oder 2, bei dem die zweite Rate eine niedrigere, die gleiche oder eine höhere Bit-pro-Sekunde-Rate als die erste Rate hat.

4. Das System (100) gemäß einem der vorhergehenden Ansprüche, bei dem die Dekompressionsschaltung (120, 130) ferner folgende Merkmale aufweist:

einen Puffer (121, 131) zum Speichern von komprimierten Videodaten;

einen Decodierer (123, 133) zum Dekomprimieren von Videodaten; und

einen Puffer (121 oder 125, 131 oder 135) zum Speichern von dekomprimierten Videodaten.

5. Das System (100) gemäß einem der vorhergehenden Ansprüche, bei dem die Steuerung (110) den Eingangsschalter (105) anweist, um den Videodatenfluß mit der zweiten Rate anzuhalten, wenn die Videodatendekompressionsschaltung (130), die die Videodaten mit der zweiten Rate empfängt, keine dekomprimierten Videodaten mehr speichern kann.

6. Ein Verfahren zum Liefern von durchgehenden dekomprimierten Videodaten zu einem Ausgang aus einer Mehrzahl von komprimierten Videodatenströmen, wobei das Verfahren folgende Schritte aufweist:

Empfangen der Mehrzahl von komprimierten Videodatenströmen;

Auswählen eines ersten Videodatenstroms;

Dekomprimieren des ausgewählten ersten Videodatenstroms mit einer ersten Rate für die Dauer des ersten Videodatenstroms;

Dekomprimieren der verbleibenden Videodatenströme mit einer zweiten Rate vor dem Ende des ersten Videodatenstroms;

Liefern des dekomprimierten ersten Videodatenstroms zu dem Ausgang; und

Wiederholen der Schritte des Auswählens, des Komprimierens, des Dekomprimierens und des Lieferns, bis alle Videodatenströme zu dem Ausgang geliefert worden sind.

7. Das Verfahren gemäß Anspruch 6, bei dem die erste Rate größer als die zweite Rate ist.

8. Das Verfahren gemäß Anspruch 6, bei dem die erste Rate gleich der zweiten Rate ist.

9. Das Verfahren gemäß Anspruch 6, bei dem die erste Rate kleiner als die zweite Rate ist.

Revendications

1. Système (100) destiné à décomprimer des séquences de données vidéo et à assurer une sortie de données vidéo en continu, ce système (100) comportant:

un commutateur (105) d'entrée relié à une pluralité de lignes d'entrée pour données vidéo comprimées, ce commutateur (105) étant apte à sélectionner des lignes d'entrée et apte à commander la vitesse d'écoulement de données vidéo sur les lignes d'entrée sélectionnées;
une pluralité de circuits (120, 130) de décompression reliés au commutateur (105) d'entrée et destinés à décomprimer les données vidéo comprimées reçues du commutateur (105) d'entrée et à mettre en mémoire des données vidéo décomprimées;
un commutateur (115) de sortie relié aux circuits (120, 130) de décompression, ce commutateur (115) de sortie connectant seulement l'un de ces circuits (120, 130) de décompression à un canal de sortie à quelque moment que ce soit;

caractérisé en ce qu'il est prévu un dispositif (110) d'ordonnancement qui est relié au commutateur (105) d'entrée, aux circuits (120, 130) de décompression, et au commutateur (115) de sortie, et qui commande au commutateur (105) d'entrée de fournir une première séquence de données vidéo à un premier circuit (120) de décompression de données vidéo à une première vitesse et de fournir les séquences restantes de données vidéo aux circuits restants (130) de décompression de données vidéo à une seconde vitesse préalablement à la fin de la première séquence de données vidéo.

2. Système selon la revendication 1, dans lequel le dispositif (110) d'ordonnancement commande au commutateur (115) de sortie de connecter le premier circuit (120) de décompression de données vidéo au canal de sortie pendant que ce premier circuit (120) de décompression de données vidéo reçoit les données vidéo qui entrent à la première vitesse.

3. Système (100) selon la revendication 1 ou la revendication 2 dans lequel la seconde vitesse assure un débit de bits par seconde plus faible, le même, ou plus élevé que celui de la première vitesse.

4. Système (100) selon l'une quelconque des revendications précédentes, dans lequel les circuits (120, 130) de décompression comportent en outre:

une mémoire tampon (121, 131) destinée à conserver en mémoire les données vidéo comprimées;
un dispositif décodeur (123, 133) destiné à décomprimer les données vidéo; et
une mémoire tampon (121 ou 125, 131 ou 135) destinée à conserver en mémoire les données vidéo décomprimées.

5. Système (100) selon l'une quelconque des revendications précédentes, dans lequel le dispositif (110) d'ordonnancement commande au commutateur (105) d'entrée d'arrêter l'écoulement des données vidéo à la seconde vitesse si le circuit (130) de décompression de données vidéo qui reçoit des données vidéo à la seconde vitesse ne peut pas conserver en mémoire davantage de données vidéo décomprimées.

6. Procédé de fourniture à une sortie de données vidéo décomprimées en continu à partir d'une pluralité de séquences de donnée vidéo comprimés, ce procédé comportant les opérations consistant à :

recevoir la pluralité de séquences de données vidéo comprimées;
sélectionner une première séquence de don-

nes vidéo;
décomprimer la première séquence sélectionnée de données vidéo à une première vitesse pendant la durée de cette première séquence de données vidéo;
décomprimer les séquences restantes de données vidéo à une seconde vitesse préalablement à la fin de la première séquence de données vidéo;
fournir à la sortie la première séquence décomprimée de données vidéo; et
répéter les opérations consistant à sélectionner, comprimer, décomprimer, et fournir jusqu'à ce que toutes les séquences de données vidéo aient été fournies à la sortie.

7. Procédé selon la revendication 6, dans lequel la première vitesse est plus grande que la seconde vitesse.

8. Procédé selon la revendication 6, dans lequel la première vitesse est égale à la seconde vitesse.

9. Procédé selon la revendication 6, dans lequel la première vitesse est inférieure à la seconde vitesse.

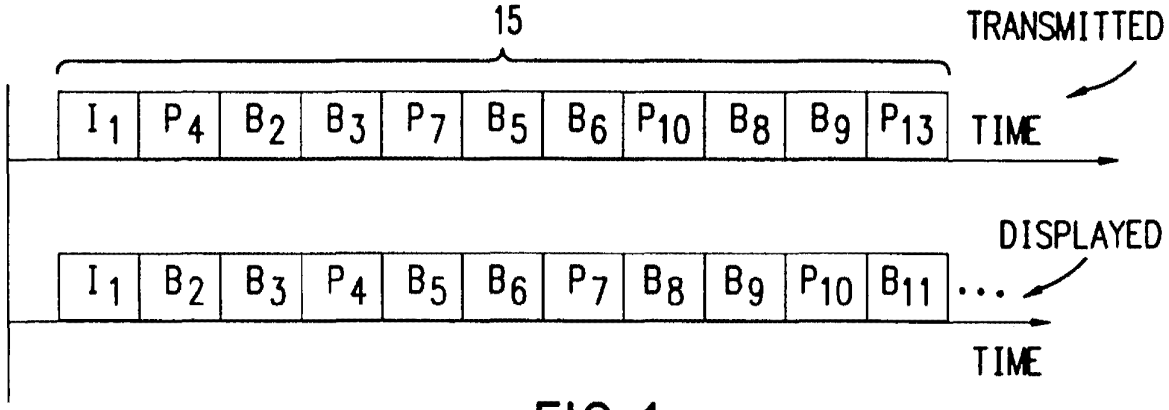


FIG.1

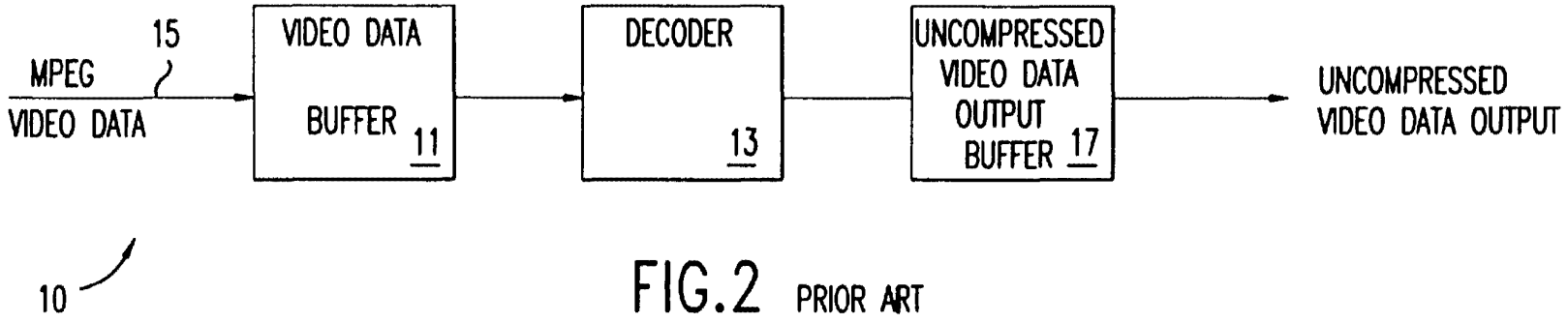


FIG.2 PRIOR ART

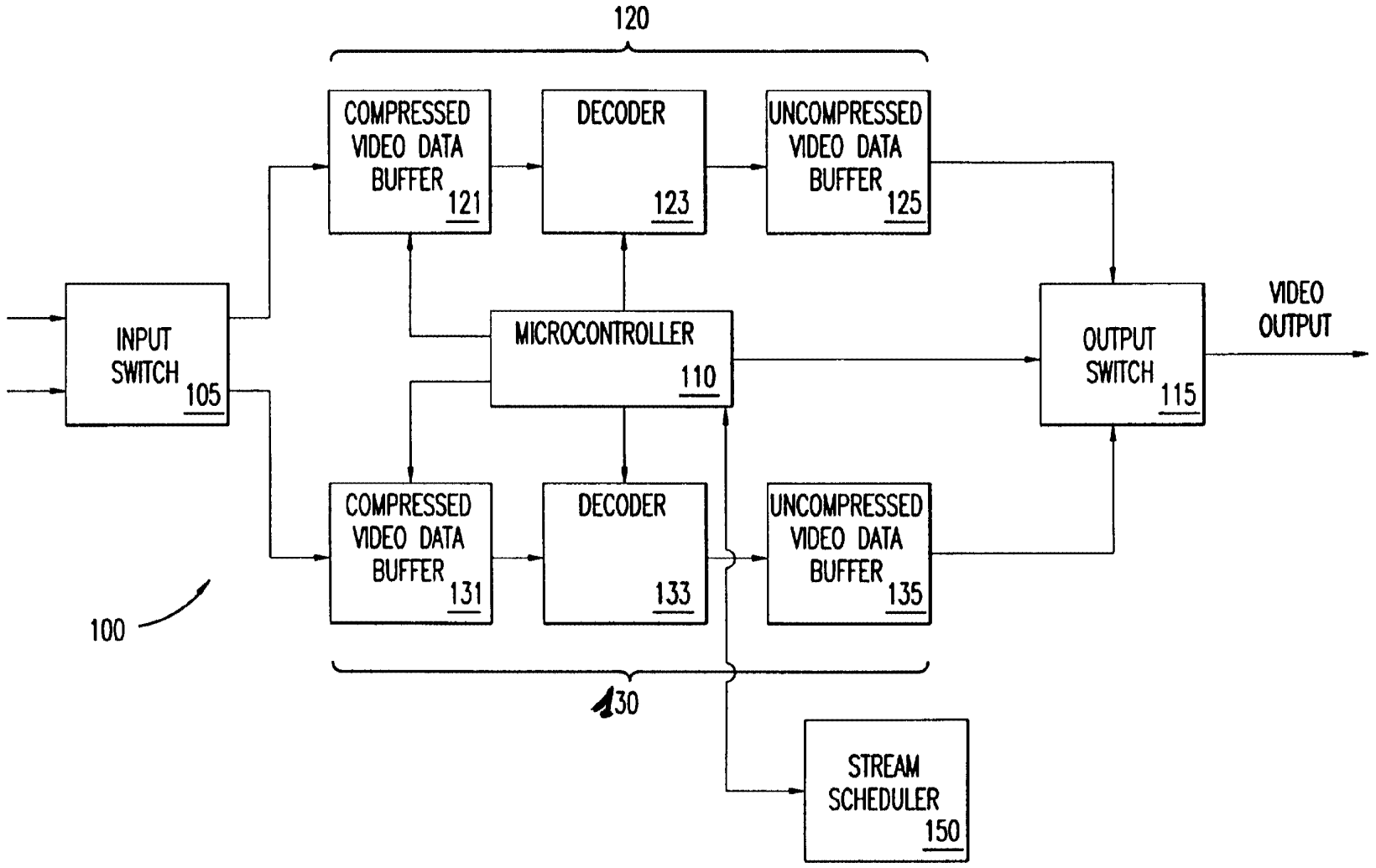

120
COMPRESSED VIDEO DATA BUFFER 121
DECODER 123
UNCOMPRESSED VIDEO DATA BUFFER 125
INPUT SWITCH 105
MICROCONTROLLER 110
OUTPUT SWITCH 115
VIDEO OUTPUT
COMPRESSED VIDEO DATA BUFFER 131
DECODER 133
UNCOMPRESSED VIDEO DATA BUFFER 135
100
130
STREAM SCHEDULER 150

FIG.3

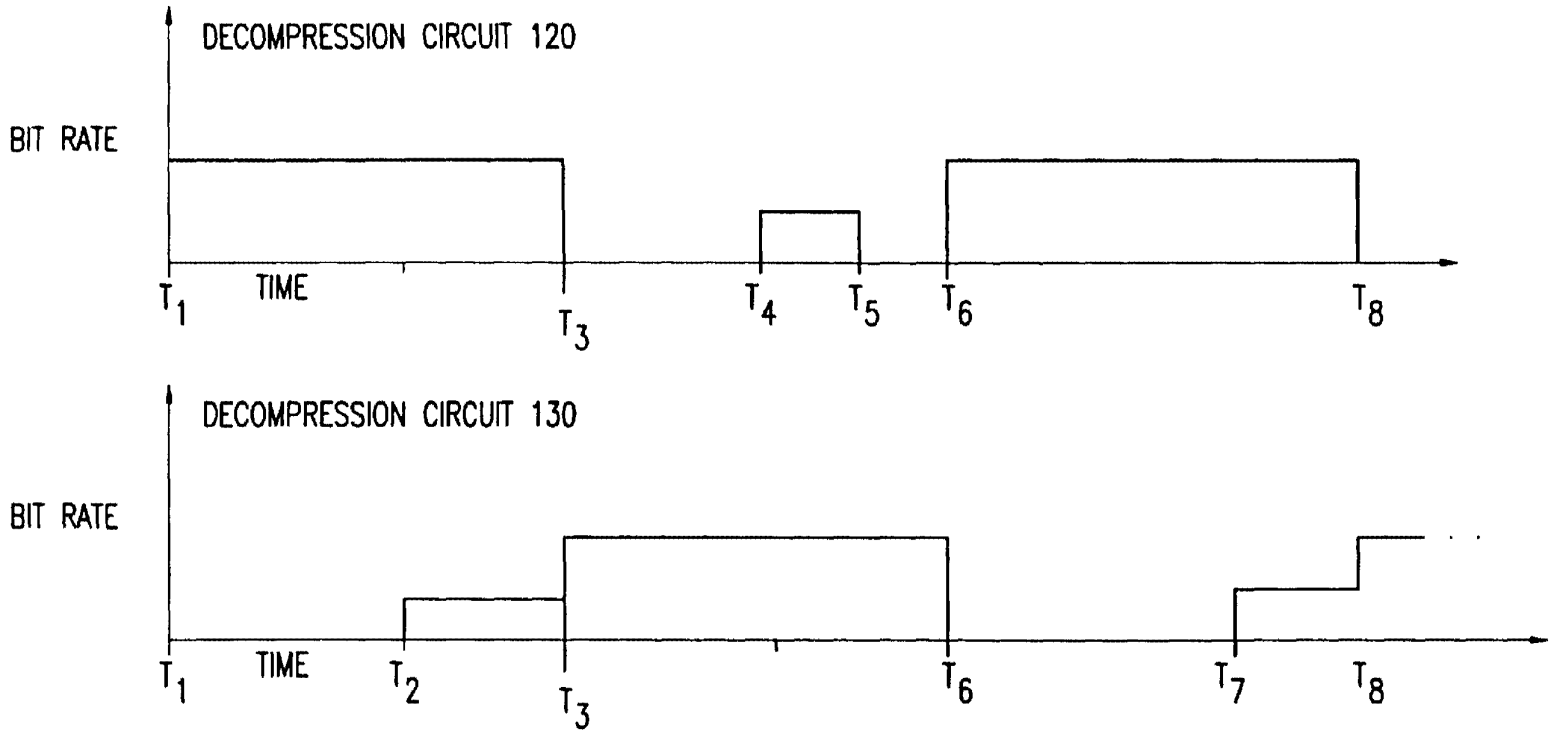

DECOMPRESSION CIRCUIT 120
BIT RATE
TIME
T_1
T_3
T_4
T_5
T_6
T_8
DECOMPRESSION CIRCUIT 130
BIT RATE
TIME
T_1
T_2
T_3
T_6
T_7
T_8

FIG.4

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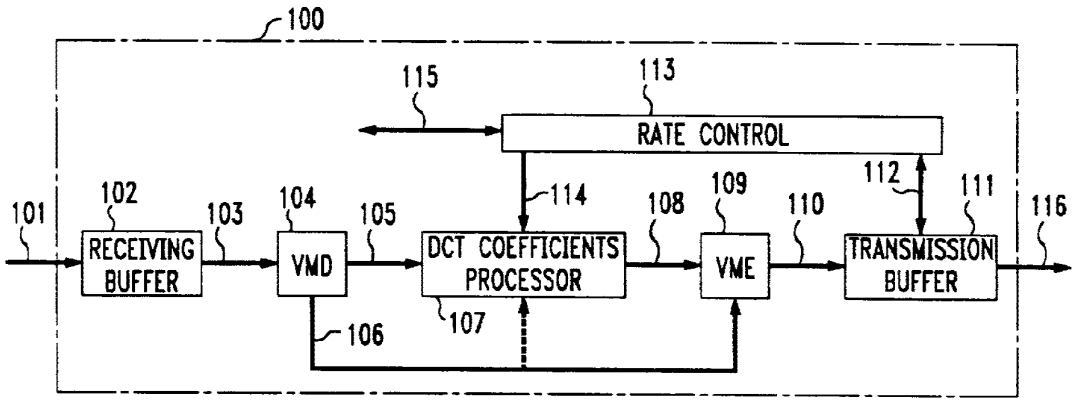
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(54) Video transmission rate matching for multimedia communication systems

(57) Digital video transmission rate matching techniques are disclosed. A bit stream rate matching apparatus includes a bit rate increasing device and a bit rate reducing device (107). The bit rate increasing device converts a video bit stream having a first transmission rate to a video bit stream having a second transmission rate characterized in that the first transmission rate is less than the second transmission rate. The bit rate reducing device (107) converts a video bit stream (101) having the second transmission rate to a video bit stream having the first transmission rate. The bit stream rate matching apparatus is useful in the context of a multimedia conference where a first endpoint device employs the first transmission rate and a second endpoint device employs the second transmission rate.

FIG. 1



EP 0 711 077 A2

Description

Background of the Invention

1. Field of the Invention

The invention relates generally to multimedia communication systems which utilize endpoint devices, and more specifically to techniques for matching the video transmission rates of a plurality of endpoint devices.

2. Descriptionof thePriorArt

Video transmission rate matching is a technique which has been used to convert the bit rate of a first video bit stream to match that of a second video bit stream. This conversion may require bit rate reduction and/or bit rate increases. Among these two conversion processes, bit rate reduction is more critical, due to the fact that this process involves the removal of bits. Since these bits represent video information, the quality of a video signal having a reduced bit rate may be degraded. The amount of degradation is related to the manner in which the bit rate reduction is achieved.

With respect to bit rate increases, no information is removed from the video bit stream. Instead, such a rate increase requires the incorporation of additional bits into the bit stream. Although it would be desirable to add bits to the bit stream for the purpose of enhancing the video signal, such enhancements are often in the pel domain. For example, if an incoming video signal has been subjected to a process of data compression, the information discarded in the compression process is not stored. The information is lost, and cannot be recovered and added to the bit stream during the process of increasing the bit rate. Therefore, bit rate increases are implemented by adding "extra" bits to the bit stream, wherein these "extra" bits are not the same bits that may have been removed during a previous data compression step. Bits are added using conventional bit- stuffing patterns to occupy the additional bandwidth of a rate-increased video signal.

Video transmission rate matching has been applied to a wide variety of applications in the field of multimedia communication, especially in environments involving multipoint communication topologies. For example, in multimedia conferencing applications, a "bridge" or "multipoint control unit" (MCU) is typically employed. This MCU is a computer-controlled device which includes a multiplicity of communication ports. The ports may be selectively interconnected in a variety of ways to provide communication among a group of endpoint devices. MCUs are often used to establish multi-party conferences among a plurality of endpoint devices, and to establish multi-party conference calls. A state-of-the-art MCU is described in ITU Document H.243, "Procedures for Establishing Communication Between Three or More Audiovisual Terminals Using Digital Channels up to 2 Mbps", March 1993, and in ITU Document H. 231, "Multipoint Control Units for Audiovisual systems Using Digital Channels up to 2 Mbps", March 1993.

Existing MCUs require all endpoint devices participating in a given multimedia conference to use the same video transmission rate. Typically, during the initial setting up of a multimedia conference, or at the time that it is desired to add an additional endpoint device to an existing conference, the MCU polls all of the endpoint devices to ascertain the video transmission rate or rates each endpoint device is equipped to implement. When the MCU polls a given endpoint device, the endpoint device transmits a capability code back to the MCU. The capability code includes information specifying the video bit rate transmission capabilities, audio bit rate transmission capabilities, etc., of a given endpoint device. These capability codes may also specify the compression algorithm or algorithms used by a given endpoint device.

Based upon the capability codes received by the MCU from the various endpoint devices, the MCU selects a minimum video bit rate to be used as the video transfer rate for the multimedia conference. The MCU sends a video rate signal to all endpoint devices which specifies use of this video transfer rate. Upon receipt of the video rate signal, the endpoint devices all operate using the same video transfer rate.

Use of the same video transfer rate for all endpoint devices participating in a given conference presents significant shortcomings. For example, in many cases, a conference participant may desire to receive high-quality video by using a relatively high video transfer rate, whereas other participants may want to use less expensive equipment offering a lower video transfer rate. State-of-the-art MCUs cannot implement a multimedia conference using a plurality of different video transfer rates. Therefore, it would be desirable to equip existing MCUs with a video transmission rate matching device. Through the use of video transmission rate matching techniques, video communication among a plurality of endpoint devices will be provided, even when the endpoint devices use different video transmission rates.

One video transmission rate matching method well-known to those skilled in the art is termed the transcoding method. Pursuant to the transcoding method, a compressed video bit stream having a first bit rate is fully decoded into a video space known as the pel domain. This fully-decoded bit stream, which may be conceptualized as a completely reconstructed video sequence, is then encoded into a video bit stream having a second bit rate.

The existing transcoding method is disadvantageous. Since decoding as well as encoding processes are required, transcoding is very time-consuming. As a practical matter, the time delay is at least twice that of the end-to-end encoding delay. Such a delay is not tolerable for applications requiring real-time communication, such as multimedia conferencing. A faster method

of performing video bit rate matching is needed.

Summary of the Invention

Digital video transmission rate matching techniques are disclosed. A bit stream rate matching apparatus includes a bit rate increasing device, a bit rate reducing device, and first and second switching devices. The first switching device switches each of a plurality of incoming video bit streams to any one of the bit rate increasing device, the bit rate reducing device, and the second switching device. Each of these incoming video bit streams originates from a particular endpoint device. The second switching device switches video bit streams from the bit rate reducing device, the bit rate increasing device, and the first switching device to each of a plurality of outgoing video bit streams. The first and second switching devices are controlled by a processor. The bit stream rate matching apparatus is useful in the context of a video communication where a first endpoint device employs the first transmission rate and a second endpoint device employs the second transmission rate.

Brief Description of the Drawings

FIG. 1 is a hardware block diagram of a video transmission rate reduction apparatus according to a preferred embodiment disclosed herein;

FIGs. 2 and 3 are data structure diagrams setting forth illustrative coding formats for representing video information;

FIG. 4 is a data structure diagram illustrating the arrangement of DCT coefficients within one of the blocks shown in FIG. 3;

FIG. 5 is a data structure diagram setting forth an illustrative example of DCT coefficient partitioning;

FIG. 6 is a software flowchart setting forth a procedure for performing video bit rate matching according to a preferred embodiment disclosed herein;

FIG. 7 is a hardware block diagram setting forth an illustrative structure for the discrete cosine transformation (DCT) processor of FIG. 1;

FIG. 8 is a hardware block diagram setting forth the system architecture of a multimedia conferencing system which includes an MCU having a video processor equipped to perform video transmission rate matching methods according to various preferred embodiments disclosed herein;

FIG. 9 is a block diagram showing an illustrative hardware configuration for the video processor of FIG. 8; and

FIG. 10 is a hardware block diagram setting forth a bit rate matching system for use with five endpoint devices.

Detailed Description

For illustrative purposes, video transmission rate matching will be described in the operational context of an H.261 environment. However, it is to be understood that the video transmission rate matching techniques described herein are generally applicable to any video compression algorithm which uses transformation and quantization processes. For example, the techniques disclosed herein may be employed in conjunction with video telephones of the type described in CCITT recommendation COST 211. However, for purposes of the present disclosure, video data to and/or from the video transmission rate matching system will be compressed in an H.261-like format.

An "H.261-like" format is any coding format which is similar to the coding format currently being established by the International Telecommunications Union (ITU-T). The format is described in the ITU-T document "Recommendation H.261, Video Codec for Audiovisual Services at px64 kbits/s", May 1992, and the ITU-T document "Description of Reference Model 8", June 9, 1989.

FIG. 1 is a hardware block diagram showing a transmission rate reduction system 100 for a video signal which has been compressed in an H.261-like format. The transmission rate reduction system 100 includes an input port 101 for accepting a compressed video signal having a first bit transmission rate and an output port 116 for providing a compressed video signal having a second bit transmission rate. A compressed video signal is defined as the binary representation of a video signal which has been compressed by a coding algorithm substantially similar to that described in the H.261 standard, and then coded according to a syntax substantially similar to that described in the H.261 standard.

A compressed video signal in the form of a digital, coded bit stream is presented to input port 101. This compressed video signal includes coded digitized video information along with a header. The header may include the types of information specified in the H.261 standard, and/or other types of information such as the source, the destination, the content, and/or the organization of the video information.

Input port 101 is connected to a receiving buffer 102, which is a conventional digital buffer. This receiving buffer 102 provides electrical isolation between the source of the compressed video signal and the various circuit elements shown in FIG. 1.

The output of the receiving buffer 102 is coupled to a video multiplex decoder (VMD) 104. VMD 104 includes the combination of a decoder and a demultiplexer. The demultiplexer is equipped to demultiplex the coded bit stream. The decoder decodes header information which has been coded into the aforementioned coded bit stream. The demultiplexer and decoder perform the function of recovering compressed video data from the coded bit stream.

The VMD 104 includes a first output port 105 and a second output port 106. The VMD 104 provides the first output port 105 with quantized DCT coefficients along

with quantization information. The nature of these DCT coefficients is described in greater detail in the H.261 standard. The second output port 106 is provided with motion vectors. First output port 105 is coupled to DCT coefficients processor 107, and second output port 106 is coupled to a video multiplex encoder (VME) 109. The operation and structure of VME 109 will be described in greater detail below. The motion vectors are sent directly from VMD 104 to VME 109 because no motion estimation is employed in the present example.

The DCT coefficients received from the first output 105 of VMD 104 are sent to DCT coefficients processor 107. The DCT coefficients processor 107 processes the DCT coefficients in such a manner that the output 108 of DCT processor 107 is a signal which requires fewer bits to encode than the number of bits which were received from the first output 105 of the VMD 104. The DCT coefficients processor 107 reduces the number of bits such that the resulting video quality is not substantially degraded as perceived by human visual processes. In other words, the video quality is degraded "gracefully". The amount of information reduced by processing coefficients at DCT coefficients processor 107 is controlled by the rate-control signal 114 sent by rate control unit 113. Various techniques for programming DCT coefficients processor 107 to degrade video quality gracefully are well known to those skilled in the art. Three such techniques for gracefully degrading video quality will be discussed in greater detail hereinafter.

The processed DCT coefficients are produced at the output 108 of DCT coefficients processor 107. These processed DCT coefficients, together with the motion vectors 106 produced at the second output of VMD 104, are sent to the video multiplexing encoder (VME) 109 to form a new video bit stream substantially conforming to the H.261 standard. The VME 109 encodes the processed DCT coefficients and motion vectors, and multiplexes them into the layered data structures shown in FIG. 3, to be described in greater detail hereinafter. The new coded bit stream, produced at the output 110 of VME 109, is sent to a transmission buffer 111.

As it is well-known that compressed video data signals may include a plurality of components, wherein each component may be represented by a different number of bits, transmission buffer 111 performs a variable-rate to constant-rate translation for the compressed video. The transmission buffer 111 includes circuitry to ascertain and to indicate the status of the transmission buffer 111, which is defined as the occupancy ratio of the memory locations within the transmission buffer 111. The occupancy ratio refers to the ratio between the number of occupied memory locations within a given buffer and the total number of memory locations within this buffer. The buffer status is produced at a first input/output 112 of the transmission buffer 111. This first output 112 is coupled to a rate control 113 circuit. This rate control 113 circuit adjusts the average data rate provided by the DCT coefficients processor 107.

Rate control 113 circuit and DCT coefficients processor 107 are coupled together via signal line 114. The rate control 113 circuit includes a first communications line 115 adapted for receiving a signal, (for example, from a control processor) which specifies a desired output bit rate for transmission buffer 111. The communications line 115 is also adapted to transmit signals to control processor 840 (FIG. 9). The desired output rate signal is processed by rate control circuit 113 in conjunction with the buffer status signal received at the first input/output 112, to generate a rate control output signal which is downloaded via signal line 114 to DCT coefficients processor 107. Based upon the desired output rate signal and the buffer status signal, the rate control 113 circuitry computes the total number of bits for each frame, as well as the bits targeted for each macro block. The targeted bits per macro block or bits per frame are used as reference to produce a proper control signal, which is applied to a second input 114 of the DCT coefficients processor 107. The function of the second input 114 is to force the DCT coefficients processor 107 to operate in such a manner that the bits produced for each macro block are as close to the targeted bits per macro block as possible. The type of signal applied to second input 114 is dependent upon the specific type of DCT coefficients processor 107 which is utilized.

DCT coefficients processor 107 is the processing unit where the DCT coefficients recovered from the VMD 104 are further processed in order to match a desired (i.e., target) output video rate. Three methods can be used to process the DCT coefficients to reduce the total number of bits. Each of these methods provides for the graceful degradation of video quality, as was discussed above. The first method is termed DCT coefficients zeroing, the second method is called the requantization of the DCT coefficients, and the third method consists of the combination of the first and second methods. In the first method, DCT coefficients are partitioned into groups based upon the relative importance of the various coefficents. Due to the fact that DCT coefficients are generally organized into two-dimensional arrays wherein the array entries which are relatively close to the upper left-hand corner of the array include relatively low-frequency components, as compared with array entries which are relatively close to the lower right-hand corner of the array, the relative importance of various DCT coefficients is known. The lower frequency components are more important and the higher frequency components are less important. Based upon the output produced by rate control 113 circuit on signal line 114, the coefficients of the least important group are set to zeroes. Here, the control signal on signal line 114 consists of a digital representation of the indices of a plurality of specific importance groups, or simply indices of the DCT coefficients within a macro block, whose coefficients will subsequently be set to zeroes. By forcing some DCT coefficients to zero, the amount of data pro-

duced by the DCT coefficients processor 107 can be properly controlled by rate control 113 circuit.

FIGs. 2 and 3 are data structure diagrams setting forth illustrative coding formats for representing video information in accordance with the H.261 standard. Referring now to FIG. 2, video information consists of a plurality of frames 201, 203, 205, 207, 209, 211, 213, 215, 217, 219, 221. Each of these frames contains a a representation of a two-dimensional video image in the form of a pixel array. Since a given frame may represent a video image at a specific moment in time, a plurality of frames may be employed to represent a moving image. Each frame represents a picture. A plurality of frames represents a coded video sequence.

Each of the frames is compressed according to any one of two types of compression algorithms, termed intra-frame coding (I) and predictive coding (P). For example, frames 201 and 211 are compressed using intra-frame coding (I), and frames 203, 205, 207, 209, 213, 215, 217, 219, and 221 are compressed using predictive coding. The sequence of frames shown in FIG. 2 establish a data structure for representing a video image in the form of an encoded video sequence having a plurality of levels arranged in a two-dimensional array, wherein each level represents the value of a pixel element. This encoded video sequence may be termed a coded video bit stream.

If intra-frame coding (I) is to be applied to a given frame, such as frame 201, the frame is termed an I-designated frame, and if predictive coding (P) is to be applied to a given frame, such as frame 205, the frame is termed a P-designated frame.

Pursuant to intra-frame coding (I) compression processes, the I-designated frame 201 is divided into a plurality of pixel blocks, wherein each block consists of an array of 8 x 8 pixels. Next, a discrete cosine transform (hereinafter, DCT), is performed on each of the pixels in the 8x8 pixel block, in accordance with procedures well-known to those skilled in the art, to generate a plurality of DCT coefficients. Thereafter, quantization is performed on the DCT coefficients, in accordance with well-known quantization procedures. These quantized DCT coefficients constitute compressed video image information for the I-encoded frame 201.

Predictive coding (P) is implemented on a P-designated frame, such as frame 205, by: 1) partitioning the P- designated frame into a plurality of macro blocks. For example, if the frame includes a plurality of pixel arrays, each having 16 x 16 pixels (FIG. 2, 251, 252, 253, 254, 257, 258), each 16 x 16 pixel array may be partitioned into 4 contiguous blocks, wherein each block is an 8 x 8 pixel array; a 16 x 16 pixel array (luminance) together with an 8 x 8 pixel block (chrominance) and an 8 x 8 pixel block (chrominance), comprises a macro block 247; 2) for each of the macro blocks (16 x 16 pixels) created in step (1), searching the most recent previously occurring frame (which could be either a P- or an I-designated frame, but in the present example is frame 203) for the macro block which contains image information that is most similar to the image information in the macro block created in step (1); 3) generating motion vectors to spatially translate the macro block found in the prior I or P frame in step (2) to the location of the similar macro block in the P frame presently being compressed; 4) generating a predicted frame from the most recent previously occurring frame using the motion vectors; 5) on a macro-block-by-macro-block basis, subtracting the predicted frame from the P-frame being compressed, to generate blocks of residues; 6) performing DCT's on the blocks of residues; 7) quantizing the coefficients of the blocks of transformed residues; and 8) concatenating the quantized residue coefficients and the motion vectors to form a compressed video signal.

In an intra-frame coded (I) picture, every macro block is intra-coded. That is, each macro block is coded without referring to any macro block in the previous I-or P-frame. In the predictive-coded (P) picture, the macro block can be either intra-coded or inter-coded.

To form the coded video bit stream for transmission, the compressed image information, as well as other information such as motion vectors, are coded using specified code words. The code words are then multiplexed into a layered data structure to form the final bit stream. In an H.261-like environment, the coded bit stream is organized into a hierarchical format, the structure of which is illustrated in FIG. 3.

Referring to FIG. 2, the sequence of frames 201, 203, 205, 207, 209, 211, 213, 215, 217, 219, 221 forms a coded video bit stream. This bit stream may be conceptualized as a serial representation of coded frames which can be processed to form a moving video image (i.e., a moving picture). A typical sequence of frames is IPPP..PIPPP, where I indicates an intra-coded frame, and P designates a predictive-coded frame. For each frame 221, the coded bit stream representing the frame includes a header 263 and coded data 265. Each header 263 includes a start code and data related to the respective frame (i.e., picture). In an H.261 system environment, much of the header information is required for synchronization purposes. For example, at the frame (picture) layer for frame 221, header 263 includes a picture start code (PCS) field 267, a picture number (TR) field 269, a picture type (PTYPE) field 271, a PEI field 273, and a PSPARE field 274. The PEI field 273 and the PSPARE field 274 are adapted to accommodate extra information which may be required for future applications.

Picture data is segmented into Groups of Blocks (GOB) 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, and 245. A GOB (for example, GOB 229) comprises one-twelfth of the coded frame (CIF) 221. Therefore, GOB 229 may be conceptualized as including one-third of one quarter of a coded picture area. The area represented by one-quarter of a coded picture is abbreviated as QCIF. Accordingly, there are 12 GOBs 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, 245 in a CIF

frame 221, and three GOBS in a QCIF frame. The arrangements of GOBs in a CIF/QCIF picture are depicted in FIGs. 2 and 3.

Each GOB 229 includes a header field 291, followed by a macro block data field 298. The header field 291 includes a GOB start code (GBSC) field 292, a group number (GN) field 293, a group type (GTYPE) field 294, a GOB quantizer (GQUANT) field 295, and spare information fields in the form of GEI field 296 and GSPARE field 297. Each GOB 229 consists of 33 macro blocks, such as "macro block 24" (reference numeral 247) and "macro block 25" (reference numeral 249). The arrangement of macro blocks within a GOB is depicted in FIG. 2.

Each macro block includes a header field 275 followed by a block data field 277. The header field 275 includes a macro block address (MBA) field 279, a block type information (MTYPE) field 281, a quantizer type (MQUANT) field 283, a motion vector (MVD) field 285, and a coded block pattern (CBP) field 287. The block data field 277 of each macro block 247 consists of 6 blocks, including four luminance blocks Y1 (reference numeral 251), Y2 (reference numeral 252), Y3 (reference numeral 253), Y4 (reference numeral 254), one chrominance block U (reference numeral 257), and one chrominance block V (reference numeral 259). An illustrative example of the contents of luminance block U (reference numeral 257) is set forth in FIG. 2. Note that this block includes an 8 x 8 pixel array wherein all pixels have a luminance value of black.

A block represents a matrix (array) of pixels, e. g., 8 x 8, over which a discrete cosine transform (DCT) is performed. The array of pixels is represented by a matrix of pixel array coefficients, including a DC coefficient and a plurality of AC coefficients. The transformed coefficients (TCOEFF) 301 (FIG. 3) consists of a DCT DC coefficient occurring first, followed by respective pixel array coefficients (AC), in the order of their relative importance. The arrangement of DC and AC coefficients in an illustrative block data field 277 (FIG. 3) is shown in FIG. 4. The block data field 277 (FIG. 3) consists of the transformed coefficients (TCOEFF) 301 and an end of block code (EOB) 303 which is appended at the end of each successively occurring block of data.

A typical partitioning of DCT coefficients is illustrated in FIG. 5. The DCT coefficients are arranged in a two-dimensional array 500 stored in block data field 277 (FIG. 3). The two-dimensional array 500 (FIG. 5) includes eight rows and eight columns. Each entry in the array corresponds to a specific entry group, such as Group 506, Group 507, or Group 508. The groups are based upon the relative importance of the entries contained therein. Each group includes entries conforming to a specific range of importance levels. These importance levels relate to the relative extent to which the elimination of a particular entry would degrade the quality of the overall video image in a given frame. In the example of FIG. 5. Group 506 is the most important group, and includes entries having a relatively high level of importance. Group 507 includes entries having an intermediate level of importance, and Group 508 includes entries having the least importance to the overall quality of the video image.

FIG. 6 is a software flowchart setting forth a procedure for performing video bit rate matching according to a preferred embodiment disclosed herein. The operations set forth in the flowchart may be implemented using the hardware previously described in connection with FIG. 1, wherein the functioning of rate control 113 circuit was disclosed. As shown in FIG. 6, the video bit rate matching procedure consists of six steps. The first step is initialization 600, followed by macro block processing 601, macro block parameter updating 602, and macro block counting 603. At block 603, a test is performed to ascertain whether or not the number of macro blocks that have already been processed are greater than a maximum number of macro blocks. If not, the program loops back to block 601. If so, the program progresses to block 604, where frame parameters are updated. Next, at block 605, frames are counted, and a test is performed to ascertain whether or not there are additional frames to consider. If so, the program loops back to block 601. If not, the program ends.

Referring to block 600, in the initialization stage, the rate control unit 113 (FIG. 1) performs the following series of operations:

1. Obtaining a value for the desired video output bit rate. This value may be received, for example, from one or more endpoint devices;
2. Specifying the maximum output frame rate based upon the desired video output bit rate;
3. Sending the maximum output frame rate to one or more endpoint devices; i.e., sender endpoint devices--which are to be used to send video information to other endpoint devices. Once the sender endpoint device receives the maximum output frame rate, this endpoint device is forced to encode video signals with the specified maximum frame rate.
4. Computing the average number of bits per frame and stores this number in a memory location designated as average_bits_per_frame. If the desired video output bit rate is R_{out} and the maximum frame rate is F_{out}, then the average_bits_per_frame= $\frac{R_{out}}{F_{out}}$.
5. Initializing the transmission buffer with an initial buffer fullness specified as B_0.
6. Specifying the targeted_bits_per_frame for the 1st frame. targeted_bits_per_frame = $K*\frac{R_{out}}{F_{out}}$ where K is a constant which is chosen based on the maximum frame rate and the initial buffer fullness B_0. Then the targeted_bits_per_mblk is targeted_

$$\text{bits\_per\_mblk} = \frac{\text{targeted\_bit\_per\_frame}}{\text{total\_number\_of\_mblk}}$$

7. According to the targeted_bits_per_mblk, specifying the particular group indices which are to be set to zero.

At the macro block processing step (FIG. 6, block 601), the DCT coefficients processor 107 (FIG. 1) performs the following steps:

1. Receiving a macro block from the VMD 104 (FIG. 1);
2. Receiving a control signal over signal line 114 from rate control 113 circuit in the control signal specifies one or more DCT coefficients to be set to zero; and
3. Setting the DCT coefficients specified by the control signal to zero.

After processing one macro block, the rate control 113 circuit receives the new buffer status from transmission buffer 111 via first input/output 112. The rate control 113 circuit uses the buffer status, defined above, to update the control signal. Since the transmission buffer 111 is used as a temporary storage facility for video information, the buffer may operate in a first state, where the buffer is in the process of receiving new video information from input buffer 110, or the buffer may operate in a second state, where the buffer has already stored incoming video information and is adapted to output this information to buffer output 116. Therefore, the status of the buffer refers to the state in which the buffer is operating at a given moment.

The steps implemented by rate control circuit 113 for updating the control signal include:

1. Obtaining the total number of bits used for the mblk, bits_per_mblk;
2. Computing the difference between the targeted_bits_per_mblk and the actual bits_per_mblk.
bits_difference += targeted_bits_per_mblk-bits_per_mblk.
3. Updating the control signal on signal line 114 based on the following:
If difference > 0 , reduce the number of indices to be set to zero.
else if difference < 0, increase the number of indices to be set to zero.
else no change.

At the end of processing each macro block, the macro block counter is checked against the total number of mblk to ascertain whether or not a frame is finished. If a frame is finished, rate control 113 circuit starts updating the frame parameters. At block 604, the rate control 113 circuit performs the following series of operations:

1. Obtaining the transmission buffer 111 status;
2. Obtaining the total number of bits used in the frame;
3 Based on the targeted memory location occupancy rate for transmission buffer 111 (i.e., buffer fullness), computing the targeted bits for the next frame and the targeted bits for each macro block;
4 Based on the targeted bits for each macro block, providing an appropriate control signal for the 1st macro block of the next frame.

After frame parameter updating, the new frame is checked. If there are no more bits, then the procedure ends. Otherwise, the procedure reverts back to processing macro blocks.

A second method of video bit rate matching is the requantization of DCT coefficients. The output signal at the first output 105 of VMD 104 includes two components: quantized DCT coefficients, and a quantization parameter. In order to determine values for the DCT coefficients, an inverse quantization operation is performed on the quantized DCT coefficients as follows. Let $\{x_i, i=0,1,2,..\ 63\}$ be the quantized DCT coefficients and $\{y_i, i=0,\ 1,...63\}$ be the reconstructed DCT coefficients, with Qp representing the quantization parameter. Then, with respect to an H.261-like environment, in the I-coding mode, the reconstructed DC coefficient y_0 is calculated using the relationship

$$y_0 = x_0 * 8,$$

and the remaining coefficients are calculated using the formula

$$y_i = [x_i * 2 + \sin(x_i)] * Qp.$$

where {i= 1, 2, ...63} in I mode and {i=0, 1, ...63} in P mode, and the sign(w) function is defined as follows:

$$\text{sign}(w) = \begin{cases} 1 & \text{if } w \geq 0 \\ -1 & \text{if } w < 0 \end{cases}$$

To control the amount of data produced by the DCT coefficients processor 107 (FIG. 1), the rate-control unit computes the proper quantization parameter Qp_{new} based on the targeted bits per macro block and sends it to the DCT coefficients processor 107 to requantize the DCT coefficients. Let $\{z_i, i=0,1,..63\}$ be the new quantized DCT coefficients, and Qp_{new} be the new quantization parameter obtained from the rate control 113 circuit. Then, the new quantized DCT coefficients are determined by

$$z_0 = (y_0+4)/8,$$

where z_0 is the DC coefficient of the I-coded macro block. The rest of the coefficients are obtained by

$$z_i = y_i(2*Qp_{new})$$

where {i=1, ...63 } for the intra-coded macro block, and {i=0,1,...,63} for inter-coded macro blocks.

With respect to the second method of matching vid-

eo signal bit rates, the sequence of operations performed by the hardware configuration of FIG. 1 is virtually identical to the process set forth in FIG. 6, with the following exceptions. Referring back to FIG. 6, at the initialization stage (block 600), the rate control 113 circuit performs the following steps:

1. Obtaining the new (desired and/or target) video output bit rate;
2. According to the new video output bit rate, specifying the maximum output frame rate;
3. Sending the maximum frame rate via communications line 115 to the sender endpoint device (defined above) to force this endpoint to encode the video with the maximum frame rate.
4. Computing the average number of bits per frame as average _bits_per _frame. Let new video bit rate be R_{out} and the maximum frame rate be F_{out}, then the average_bits_per_frame=$\frac{R_{out}}{F_{out}}$.
5. Initializing the transmission buffer with an initial buffer memory occupancy rate (fullness) of B_0.
6. Specifying the targeted_bits_per_frame for the 1st frame.

$$\text{targeted\_bits\_per\_frame} = K^* \frac{R_{out}}{F_{out}}$$

where K is a constant which is chosen based on the maximum frame rate and the initial buffer fullness B_0. Then the targeted_bits_per_mblk is

$$\text{targeted\_bits\_per\_mblk} = \frac{\textit{targeted\_bits\_per\_frame}}{\textit{total\_number\_of\_mblk}}$$

7. According to the targeted_bits_per_mblk, specify the new quantization parameter Qp_{new}.

At the macro block processing step (block 601), the DCT coefficients processor 107 performs the following steps:

1. Obtaining an mblk from the VMD 104;
2. Performing inverse quantization based on the Qp and recovering the DCT coefficients;
3. Obtaining the control signal on signal line 114 from rate control 113 circuit;
4. Using the control signal on signal line 114, requantizing the DCT coefficients.

After the processing of one macro block has been completed, the rate control 113 circuit 113 obtains the new (current) transmission buffer 111 status and updates the control signal on signal line 114. The steps implemented by rate control 113 circuit include:

1. Obtaining the total number of bits used for the macro block, bits_per_mblk;
2. Computing the difference between the targeted_bits_per_mblk and the actual bits_per_mblk:

bits_difference+=targeted_bits_per_mblk-bits_per_mblk.

3. Updating the control signal 114 based on the following:

If difference > 0 , reduce the size of the quantization parameter; else if difference < 0, increase the size of the quantization parameter; else no change.

At the end of processing each macro block, a macro block counter which counts the number of macro blocks which have been processed, is checked against the total number of macro blocks to ascertain whether or not a frame has been completed. If a frame has been completed, rate control 113 circuit commences updating the frame parameters. At block 604, the rate control 113 circuit performs the following steps:

1. Obtaining the transmission buffer 111 status;
2. Obtaining the total bits used by the frame;
3. Based upon the targeted buffer fullness (memory location occupancy rate), computing the targeted bits for the next frame and the targeted bits for each macro block;
4. Based on the targeted bits for each macro block, generating an appropriate control signal for the first macro block of the next frame.

After frame parameter updating, the new frame is checked. If there are no more bits, then the procedure ends. Otherwise, the procedure reverts back to the macro block processing step at block 601.

A third method of video bit rate matching may be employed in conjunction with a preferred embodiment disclosed herein. This third method includes all methods which represent combinations of various features of the first and second methods. The manner in which the first and second methods are combined is determined by the specific applications of a given system. One illustrative combination of the first and second methods is the process of using DCT coefficient partitioning to process intra-coded macro blocks, and then employing requantization to process the inter-coded macro blocks.

Although system 100 (FIG. 1) with the DCT processor equipped for implementing the three different processing schemes described above is satisfactory for lower rate reduction and intra-coded frames, there is a mismatch, "drift" between an endpoint device that transmits video information at a fast rate relative to other endpoint devices which decode this video information at a slower rate. This mismatch is brought about because the video encoder is required to operate at a faster bit rate than the video decoder. This mismatch exists for all the inter-coded frames and is likely to accumulate with time, unless an intra-coded frame is periodically inserted into the video bit stream. To control the accumulation of the mismatch, an improved DCT processor with the

mismatch correction elements is shown in FIG. 7.

FIG. 7 is a hardware block diagram setting forth an illustrative structure for the discrete cosine transformation (DCT) processor of FIG. 1. The hardware configuration of FIG. 7 represents an improvement over the DCT coefficient processor disclosed before in connection with FIG. 1, as well as other existing state of the art systems, such as the systems described in an ITU-T document entitled, "Low Bitrate Coding (LBC) for Videophone", document no. LBC-94-166. This document describes methods for reducing the bit rate of compressed video information with a minimal amount of associated processing delays. One implementation described in the ITU document utilizes one motion-compensated prediction storage device and two transform operations: a forward transform operation, and an inverse transform operation. The main purpose of this implementation is to correct the "drift", i.e., the mismatch, between a video encoder and a video decoder.

According to a preferred embodiment disclosed herein, the two transform operations described in the preceding paragraph are no longer required. Rather, motion compensation is performed in the transform domain, as the terms "motion compensation" and "transfer domain" are generally understood by those skilled in the art. With reference to FIG. 7, one feature of this embodiment is that the drift error signal stored in a picture memory of a prediction frame storage device 703 need not be stored with full accuracy. In particular, only a small number of the lower-frequency components of the transform coefficients need to be retained in the picture memory. Since only a relatively small number of coefficients are now involved in the motion compensation process, and the transform operations are no longer needed, implementation of the embodiments disclosed herein is simplified considerably over the system described in the above-referenced ITU-T document identified as no. LBC-94-166.

The simplified system disclosed herein is described below with reference to FIG. 7. An improved DCT (discrete cosine transformation) processor 107 is shown, which includes an inverse quantizer 701, a quantizer 702, and a prediction frame storage device 703. The inverse quantizer 701 accepts DCT coefficients and quantization parameters of an input bit stream from the first output 105 of VMD 104 (FIG. 1). The output of inverse quantizer 701 which is the reconstructed DCT coefficient, is coupled to a first input of a summer 704, and this output is also coupled to a first input of a subtractor 706. The output of summer 704 is fed to a first input of quantizer 702. A second input of quantizer 702 is under control of the signal line 114 which is coupled to rate control 113 circuit (FIG. 1).

The output of quantizer 702 (FIG. 7) which is the requantized DCT coefficient 108. is fed to a second input of subtractor 706. The output of subtractor 706, which is the difference between output 707 and output 108, representing the DCT coefficients of the error signals; i.e., "drift" signal, is connected to a first input of summer 705. The output of summer 705 is coupled to a first input of prediction frame memory storage device 703, and a second input of prediction frame memory storage device 703 is connected to the second output of VMD 104 (FIG. 1). The output of prediction frame storage device 703 is fed to a second input of summer 704 and this output is also fed to a second input of summer 705.

Inverse quantizer 701, quantizer 702, summers 704, 705, and subtractor 706 are system components which are well-known to those skilled in the art. Conventional components may be used for these items. With respect to the prediction frame storage device 703, this device includes a video buffer for storing information corresponding to one or more video frames, a random-access memory device, and a microprocessor for controlling the operation of the buffer and the random-access memory. The microprocessor is equipped to execute a software program adapted to perform the steps outlined below in connection with the prediction frame storage device 703.

The hardware configuration of FIG. 7 operates as follows. Assume that the quantized DCT coefficients of an input video bit stream having a bit rate of R1 passes from the first output 105 of VMD 104 (FIG. 1) to the input of inverse quantizer 701 (FIG. 7). At inverse quantizer 701, the quantified DCT coefficients are re-constructed to produce the DCT coefficients. The DCT coefficients plus the DCT coefficients of the "drift" error are sent to DCT coefficient processor 107. One purpose of DCT coefficients processor 107 (FIGs. 1 and 7) is to generate an output signal representing the processed coefficients. When the DCT coefficients processor 107 is initially started up, there is no drift error between output 707 and output 108 (FIG. 7). Therefore, upon initial startup, inverse quantizer 701 provides an output signal including reconstructed DCT coefficients, and this signal passes unchanged through summer 704, to quantizer 702.

The operation of quantizer 702 is controlled by a signal on signal line 114 from the rate control 113 circuit (FIG. 1), so as to provide a signal having the desired output bit rate at the output of the bit rate matching system of FIG. 1. The output of this bit rate matching system may be provided from the transmission buffer 111 (FIG. 1). Note that the output of quantizer 702 (FIG. 7) represents the DCT coefficients processor output 108. This output 108 is then recoded and multiplexed with motion vectors and quantization information by VME 109 (FIG. 1). The VME 109 may then send the recoded, multiplexed signal to transmission buffer 111. The signal is stored in the transmission buffer 111 prior to transmission at the desired output bit rate. The fullness, or buffer memory location occupancy ratio, of transmission buffer 111 is used to control the quantization levels for quantizer 702.

Next, assume that the output of inverse quantizer 701 does not equal the output of quantizer 702. The out-

put 707 of inverse quantizer 701 will be denoted as "A", and the output 108 of quantizer 702 will be denoted as "B". Thus, an error of B-A is added to the picture data. This error, denoted as Ed, is subtracted from the picture data by the system of FIG. 7. At initial startup. Ed is zero, and the data pass unchanged through summer 705 to the prediction frame storage device 703. Typically, only a small number of low-frequency coefficients are fed to subtractor 706, and thus, Ed is only an approximation of the actual drift error due to requantization. During recoding of the next video frame, Ed is approximately equal to the drift error of the previous frame.

During motion-compensated prediction, prediction frame storage device 703 uses motion vectors on the second output 106 of VMD 104 (FIG. 1) to output a displaced drift error signal. As the prediction is performed directly in the DCT domain, the output of the prediction frame storage device 703 representing the displaced drift error signal, is represented by its DCT coefficients.

To compute the displaced drift error directly in the DCT domain, the following operations are performed by the prediction frame storage device 703. Since the motion vector 106 represents an arbitrary number of pels, and the DCT representation of the reference frame stored in prediction frame storage device 703 are grouped into a block-based format, the motion compensated optimal block may overlay with four neighboring blocks in the DCT block structure.

Let D_1, D_2, D_3, D_4 be the four neighboring (adjoining) blocks in the reference frame, and PMC error be the DCT representation of the displaced drift error block. Then

$$D_{mc-error} = \sum_{i=1}^{4} G_{h\hat{}z} D_{\hat{}z} G_{\hat{}wz}$$

where G_h, G_w are the DCT representations of the spatial sparse H_n and H_w matrices of the form:

$$H_n = \begin{bmatrix} O & O \\ I_n & O \end{bmatrix} \quad H_w = \begin{bmatrix} O & I_w \\ O & O \end{bmatrix}$$

where h and w represent overlay width.

The G_{hz} and G_w can be precomputed and stored in prediction frame storage device 703. As the drift error signal contains a lot of zeroes, the required computation is greatly reduced. Further, if motion vectors are zero, or integer multiples of the block width, the above block adjustment procedure can be avoided. This drift error signal will be seen at the DCT coefficients processor output 108, and at transmission buffer 111 (FIG. 1) which receives bits at the desired output bit rate. Without correction, this drift error will accumulate over time and eventually result in unacceptable system performance. In order to ameliorate the problem of drift error accumulation, the previous frame motion compensated drift error Ed is added to the present frame signal (output 707) prior to requantization by quantizer 702. If quantizer 702 introduced very little error, this would completely correct the drift error accumulation problem. However, since quantizer 702 introduces a finite amount of error, the drift can only be partially corrected, and the output of subtractor 706 will not, in general, be zero. Thus, summer 705 adds the drift error from the current frame to the approximate accumulated drift error from previous frames to produce an approximate accumulated drift error Ed for the current frame.

The prediction frame storage device 703 only has to compute a small number (i.e., N) of compensated coefficients. Note that, for intra-blocks of video data, the prediction frame storage device 703 is programmed to set Ed to zero. The relatively small number of computations required to implement the methods disclosed herein is vastly reduced as contrasted with the relatively large number of computations required to perform existing processes using pel domain motion compensation. An additional advantage of the disclosed methods is that these methods require much less memory space than existing prior art methods.

The video transmission rate reduction system shown in FIG. 1 can be implemented, for example, by using a general-purpose microprocessor, a digital signal processor (such as an AT&T DSP 3210 or an AT&T DSP 1610), and/or a programmable video processing chip (such as an integrated circuit known to those skilled in the art as the ITT VCP chip).

Multimedia System Using Video Processing of the Present Invention

To illustrate various typical applications for the present invention in the context of multimedia conferencing, FIG. 8 shows a multimedia system using a video processor embodying the bit stream rate matching techniques disclosed herein. Referring now to FIG. 8, a block diagram setting forth the system architecture of a multimedia conferencing system 800 is shown. The conferencing system includes an MCU 810, an ISDN network 804, and a plurality of endpoint devices such as first endpoint device 801, second endpoint device 802, and third endpoint device 803.

Endpoint devices 801, 802, and 803 are coupled to MCU 810 via ISDN network 804. These endpoint devices 801, 802, and 803 may include one or more user interface devices. Each interface device includes either an input means, an output means, or an input means combined with an output means. Output means are adapted to convert multimedia electronic signals representing audio, video, or data into actual audio, video, or data. Input means are adapted to accept audio, video, and/or data inputs, and to convert these inputs into electronic signals representing audio, video, and/or data. Examples of user interface devices include video display, keyboards, microphones, speakers, and video cameras, or the like.

Endpoint devices 801, 802, and 803 are adapted to

communicate using existing multimedia communication protocols such as ISDN. The endpoint device multimedia communication protocol controls the presentation of media streams (electronic signals representing audio, video, and/or data information) to the endpoint device user. Endpoint devices may function bi-directionally, both sending and receiving multimedia information, or, alternatively, endpoint devices may function uni-directional, receiving but not sending multimedia information, or sending but not receiving multimedia information.

An example of a suitable endpoint device is an ITU-T H.320 audiovisual terminal, but any device capable of terminating a digital multimedia stream and presenting it to the user constitutes an endpoint device. A particular product example of an H.320-compatible endpoint is the AT&T-GIS Vistium.

MCU 810 is a computer-controlled device which includes a multiplicity of communications ports, such as first communications port 870 and second communications port 872, which may be selectively interconnected in a variety of ways to provide communication among a group of endpoint devices 801, 802, 803. Although the system of FIG. 8 shows two communications ports, this is done for illustrative purposes, as any convenient number of communications ports may be employed. MCU 810 also includes a control processor 840, an audio processor 841, a video processor 842, a data processor 843, and a common internal switch 819. Each communications port includes a network interface, a demultiplexer, and a multiplexer. For example, first communications port 870 includes network interface 811, demultiplexer 813, and multiplexer 822.

Although MCU 810 is shown with two communications ports 870, 872 for purposes of illustration, MCU 810 may, in fact, include any convenient number of communications ports. For an MCU 810 having N ports, there are N network interfaces, one control processor, one audio processor, one video processor, and one data processor. For each processor, there are N input signals coming from N demultiplexers and N output signals going to the N multiplexers. Therefore, MCU 810 may be conceptualized as an N-port MCU where only two communications ports 870, 872 are explicitly shown.

As shown in FIG. 8, first communications port 870 includes network interface 811, demultiplexer 813, and multiplexer 812. Network interface 811 is a circuit which provides the conversion function between the standard line signal coding used by ISDN network 804 and the Px64 kbps H.221 signal used by MCU 810. Network interface 811 includes output port 812, which is adapted to provide an output in the form of an H.221 signal. The H.221 signal is actually a multiplex of several different types of information (audio, video, data, control); therefore, network interface 811 must send the incoming MCU H.221 signal to a demultiplexing device such as demultiplexer 813. Likewise, network interface 811 has an input port 823 adapted to receive an H.221 signal from multiplexer 822. Multiplexer 822 combines a plurality of individually-processed signals which are to be transmitted to a particular endpoint device.

Demultiplexer 813 separates an incoming multimedia signal stream received from network interface 811 into four components: a first component 814, comprising electronic signals representing control; a second component 815, comprising electronic signals representing audio; a third component 816, comprising electronic signals representing video; and a fourth component 817, representing data. The first, second, third, and fourth components 814, 815, 816, 817 represent outputs of demultiplexer 813 which are coupled to common internal switch 819.

Multiplexer 822 accepts a plurality of incoming multimedia signal components from common internal switch 819, such as a first component 818 representing control, a second component 891 representing audio, a third component 820 representing video, and a fourth component 821 representing data. The multiplexer 822 integrates the first, second, third, and fourth components 818, 891, 820, 821 onto a single multimedia signal stream which is coupled to network interface 811. This single multimedia signal stream may be conceptualized as the output of multiplexer 822. The network interface 811 routes this multimedia signal stream to a specific endpoint device 801, 802, 803. For second communications port 872, the four output components are first component 824, representing control, second component 825, representing audio, third component 826, representing video, and fourth component 827, representing data. The four input components to multiplexer 834 are first component 828, representing control, second component 829, representing audio, third component 830, representing video, and fourth component 831, representing data.

Common internal switch 819 contains a plurality of electronic switches, buffers, and/or amplifiers under the control of control processor 840. Common internal switch 819 is coupled to audio processor 841 for mixing and switching electronic signals representing audio; common internal switch 819 is also coupled to video processor 842 and data processor 843 for mixing and switching electronic signals representing video and data, respectively. Therefore, common internal switch 819 effectively receives four output components from each communications port 870, 872 and routes these output components to selected ones of respective processors (control processor 840, audio processor 841, video processor 842, and/or data processor 843) within MCU 810. Likewise, common internal switch 819 receives the output components of each processor in MCU 810 and routes these outputs to the multiplexer 822 of each communications port 870.

Common internal switch 819 receives output control signals from control processor 840 over signal line 851, and provides input control signals to control processor 840 over signal line 850. Common internal switch 819 receives output audio signals from audio processor

841 over signal line 853, and provides input audio signals to audio processor 841 over signal line 852. Common internal switch 819 receives output video signals from video processor 842 over signal line 855, and provides input video signals to video processor 842 over signal line 854. Common internal switch 819 receives output data signals from data processor 843 over signal line 857, and provides input data signals to data processor 843 over signal line 856. Control processor 840 provides control signals to the audio processor 841, video processor 842, and data processor 843 over signal line 844.

ISDN network 804 is connected to MCU 810 over signal line 805. Within MCU 810, signal line 805 is parallel-connected to first and second communications ports 870, 872. For example, in the case of first communications port 870, signal line 805 is connected to network interface 811. Network interface 811 is coupled to demultiplexer 813 over signal line 812, and this network interface 811 is also coupled to multiplexer 822 over signal line 823. Signal line 812 is coupled to the input terminal of demultiplexer 813, and signal line 823 is coupled to the output terminal of multiplexer 822.

Audio processor 841 includes software and hardware for processing audio signals. The processing may take the form of switching the audio, mixing the audio, or both. In the case of audio mixing, the input signal to audio processor 841 is an aggregate audio signal consisting of each of the audio output signals from all of the communications ports 870, 872 of MCU 810. For an N-port MCU 810, this signal includes the N audio signals from the demultiplexers within each communications port 870, 872.

To mix the audio, audio processor 841 decodes each of the audio inputs, linearly adds the signals obtained by decoding, and then re-encodes the linear sum. For each endpoint device, this linear sum may be subjected to additional processing steps, so as to provide each endpoint device with audio information specific to that endpoint device. These additional processing steps may include, for example, any of the following: the output sum for a given endpoint device may exclude that endpoint's input; the sum may include inputs whose present or recent past values exceed a certain threshold; or the sum may be controlled from a specially-designated endpoint device used by a person termed the "chair", thereby providing a feature generally known as chair-control. Therefore, the output of the audio processor 841 is in the form ofN processed audio signals.

In the case of audio switching, the input signal to audio processor 841 is a single audio signal which is selected from a given communications port 870 or 872, based upon control signals received from control processor 840. No audio processing is implemented in the present example which involves only audio switching. The audio input is broadcast to all other audio processor 841 outputs, either automatically or under manual control.

Data processor 843 includes hardware and software means for implementing one or both of the functions generally known to those skilled in the art as "broadcast" or "MLP". For each type of broadcast data, data input is accepted from only one endpoint device at any one time. Therefore, the input signal to data processor 843 is the data output from one of the communications ports 870, 872. This data output is broadcast to the other endpoint devices as determined by control processor 840, according to the capabilities of specific endpoint devices to receive such data, as set forth in the capability codes stored in memory units (RAM or ROM) of respective endpoint devices.

Control processor 840 is responsible for determining the correct routing, mixing, switching, format and timing of the audio, video, data and control signals throughout a multimedia conference. The control processor 840 retrieves one or more capability codes from each endpoint device. Capability codes, which, are stored in endpoint device RAM and/or ROM, specify the audio, video, data, and/or control capabilities for this endpoint device. Control processor 840 retrieves the capability codes from all N endpoint devices participating in a multimedia conference. These capability codes are stored in a memory unit (RAM) of MCU 810 so that control processor 840 can correctly manage the conference for all endpoint devices. This storage may occur, for example, in a random-access memory (RAM) device associated with control processor 840. In turn, MCU 810 sends the capability codes to each of the N communications ports 870, 872 so that each of the endpoint devices 801, 802, 803 are enabled to communicate with MCU 810 at a bit rate determined by MCU 810 and appropriate for that specific endpoint device 801, 802, 803. To properly control the operations in the video processing unit 842, MCU 810 sends back different capability codes for different video operations. If the endpoints are coupled to MCU 810 via communications links with different transmission rates for switching operation, the minimum transfer rate is adapted in the capability code. The new code is sent to all the endpoint devices participating in the conference to force the endpoint devices to operate with the minimum transfer rate. For performing a transmission rate matching operation, instead of adapting the minimum transfer rate, a new maximum frame rate is specified in the capability code based on all the different transfer rates. The new capability codes, which include the specified maximum frame rates, are sent back to all the endpoint devices. In this case, the video bitstreams generated by the endpoint devices will have different transfer rates but the same frame rate.

Control processor 840 receives inputs which are entered by conference participants into the user interface of an endpoint device 801, 802, 803. These inputs are in the form of chair-control commands and commands embedded in bit streams conforming to the H. 221 standard. Commands from endpoint devices are routed to the control processor 840 to ensure the correct

distribution of bit streams to the audio, video, and data processors 841, 842, 843, respectively, to ensure that the correct audio decoding algorithm is used at the inputs to an audio mixer within audio processor 841, and to ensure that any incoming data is sent to a data broadcast unit or MLP processor within data processor 843.

The control processor 840 also directs the switching of the bit streams from the audio, video, and data processors 841, 842, 843, respectively, to each multiplexer 822, 834, and specifies the audio encoding algorithm used in the audio mixer of audio processor 841, and the algorithm used at each output from the audio mixer. The bit streams are routed to and from the various processors 841, 842, 843 by the common internal switch 819, which is under control of the control processor 840.

Video processor 842 processes the video signals received from the common internal switch 819. The processing may take the form of switching the video, or matching the video bit rate. In video switching, the video processor 842 receives one selected video signal from the switch 819, and transmits the video signal to some or all other endpoint devices participating in a given multimedia conference. Video selection may be automatic or under manual control. For instance, the audio processor 841 and the video processor 842 may be automatically controlled by control processor 840, such that an endpoint device with currently active audio (i.e., an endpoint device used by the "present speaker" which provides an audio signal to MCU 810 above a predetermined audio amplitude threshold) receives the picture of the endpoint device which previously had active audio (i.e., an endpoint device used by the "previous speaker"), while all other endpoint devices receive the picture of the present speaker.

A time delay may be incorporated into the video switching implemented by video processor 842 to avoid excessively frequent video image changes caused by spurious sounds. As in the case of audio switching, video switching may be controlled directly from a specially-designated endpoint device used by a person termed the "chair". If the delay in the video processor 842 and the delay in the audio processor 841 differ by a significant (humanly perceptible) amount, a compensating delay may be inserted into the appropriate bit stream to retain lip synchronization.

To match video bit rates, video processor 842 incorporates the video transmission rate matching techniques of the present invention.

With reference to FIG. 9, the hardware configuration of an illustrative stand-alone video processor 842 is shown. This video processor 842 may be employed with the MCU 810 of FIG. 8 or, alternatively, the video processor 842 may exist as a stand-alone unit. Such a stand-alone unit may be used to match bit rates for all types of digital video information. The video processor 842 consists of a video transmission rate reduction unit 100, a bit stuffing unit 200, an input switcher 905, and an output switcher 906. If desired, the input switcher 905 and the output switcher 906 could be combined into a single integrated switcher unit, such as common internal switch 819 (FIG. 8) and, hence, would not be incorporated into video processor 842. The inputs to the video processor 842, are for an N-port MCU, an the N-coded video bit stream obtained from N demultiplexers. The outputs of the system are the N-coded video bit streams which are processed to have different transfer rates. The outputs are the inputs to the N multiplexers. The number of required transmission rate reduction units and bit stuffing units is proportional to the difference in the transmission rates among the various endpoint devices. If there are M different video transfer rates involved in a conference, the video processor 842 needs to incorporate (M-1) bit rate reduction systems and (M-1) bit rate increasing units. In the configuration of FIG. 9, M=2 for illustrative purposes.

Signals produced by video processor 842 are coupled to signal line 844 which is used to convey the control signals which control input switcher 905, output switcher 906, transmission rate reduction unit 100 and bit stuffing unit 200. Input switcher 905 provides N-to-1, N-to-2, and N-to-3 switching capabilities. Similarly, output switcher 906 provides 1-to-N, 2-to-N, and 3-to-N switching capabilities. The switching is controlled by control signals on signal line 844. These control signals are generated by the control processor 840. Control processor 840 has control capabilities for handling different transmission rates among a plurality of endpoint devices.

If the transmission rates among all the endpoint devices are the same, the control signals sent out by control processor 840 over signal line 844 serves to place video processor 842 into a switching mode. In such a case, video processor 842 works as a buffer and switcher, such that the input switcher provides an N-to-1 switch and the output provides an 1-to-(N-1) switch. A direct signal path between input switcher 905 and output switcher 906 is utilized. whereas video transmission rate reduction unit 100 and bit stuffing unit 200 are not used.

If the transmission rates among the endpoint devices are different, and if there are more than two different transmission rates among the endpoints, extra rate reduction units 100 and extra bit stuffing units 200 are needed in the video processor 842. As an example, FIG. 10 shows a video transmission bit rate matching system which uses five endpoint devices connected to an ISDN network 804 via a five-point connection wherein the switching functions of video processor 842 are integrated into common internal switch 819. The ISDN network 804 is connected to a five-port MCU 810, including first communications port 840 and additional communications ports 871. A first endpoint device, endpoint A 901, is connected to the ISDN network 804 via a 384 kbits/s communications link. A second endpoint device, endpoint B 902, is connected via a 256 kbits/s link. Third and fourth endpoint devices, endpoint C 903 and endpoint D 904, respectively, are each connected to ISDN

network 804 via 128 kbits/s links, and a fifth endpoint device, endpoint E 905, is connected via a 64 kbits/s link. Therefore, the MCU 910 must utilize a video processor 842 having five inputs and five outputs. To produce five outputs with three different transfer rates, the video processor needs three rate reduction units 920, 921, 922, three bit stuffing units 923, 924, 925, and an optional video buffer. The three rate reduction units 920, 921, 922 provide respective rate reductions of 348-to-256 kbits/sec, 384-to-128 kbits/sec, and 384-to-64 kbits/sec. The three bit stuffing units 923, 924, 925 provide respective bit stuffing conversions of 64-to-128 kbits/sec, 64-to-256 kbits/sec, and 64-to-384 kbits/sec.

To provide the proper switching for the inputs and the outputs, the control processor 841 has to provide proper control signals. If endpoint A 901 is used by the current conference speaker and endpoint B 902 is used by the conference speaker who spoke immediately prior to the speaker using endpoint A 901, then the input switcher 305 provides an input switching function wherein 5 inputs are switched to 4 outputs, such that the coded bit stream from endpoint A 901 is switched to any one of the rate reduction units 920, 921, 922 which provide respective bit rate reductions of 384-to-256 kbits/sec, 384-to-128 kbits/sec, and 384-to-64 kbits/sec. To send the picture of the previous speaker to endpoint A 901, the coded bit stream from endpoint B 902 is switched to bit stuffing unit 925, which performs a bit stuffing from a rate of 256 kbits/sec to a rate of 384 kbits/sec. Via the output switcher 306 (FIG. 8), the output of rate reduction unit 920, which performs a bit rate reduction of 384 kbits/sec to 256 kbits/sec, is routed to endpoint B 902, the output of rate reduction unit 921, which performs a rate reduction of 384 kbits/sec to 128 kbits/sec, is routed to endpoints C and D, 903, 904, respectively, and the output of rate reduction unit 922, performing a reduction of 384-to-64 kbits/sec, is routed to endpoint E 905. The output of bit stuffing unit 925 (64-to-384 kbits/sec), is routed to endpoint A 901.

Claims

1. A bit stream rate matching apparatus characterized by:

   (a) bit rate increasing means for converting a video bit stream having a first transmission rate to a video bit stream having a second transmission rate, wherein the first transmission rate is less than the second transmission rate;
   (b) bit rate decreasing means for converting a video bit stream having a third transmission rate to a video bit stream having a fourth transmission rate wherein the third transmission rate is greater than the fourth transmission rate;
   (c) first switching means for switching each of a plurality of incoming video bit streams to any one of the bit rate increasing means the bit rate decreasing means and a second switching means; and
   (d) second switching means for switching video bit streams from the bit rate increasing means, the bit rate decreasing means, and the first switching device to each of a plurality of outgoing video bit streams.

2. A bit stream rate matching apparatus as set forth in Claim 1 characterized in that each of the plurality of incoming video bit streams is from a corresponding endpoint device, and each of the plurality of outgoing video bit streams is directed to a corresponding endpoint device, specific ones of the incoming video bit streams being associated with specific ones of the outgoing video bit streams to form an associated incoming-outgoing video bit stream, each associated incoming-outgoing video bit stream corresponding to a particular endpoint device.

3. A bit stream rate matching apparatus as set forth in Claim 1 further comprising processor means 840, coupled to the first and second switching means, bit rate increasing means, and bit rate reduction means, for controlling the first and second switching means.

4. A bit stream rate matching apparatus as set forth in Claim 2 further characterized by processor means, coupled to the first and second switching means for controlling the first and second switching means.

5. A bit stream rate matching device characterized by

   (a) bit rate increasing means for converting a video bit stream having a first transmission rate to a video bit stream having a second transmission rate, wherein the first transmission rate is less than the second transmission rate, and;
   (b) bit rate reducing means for converting a video bit stream having the second transmission rate to a video bit stream having the first transmission rate.

6. A video bit stream rate matching device for use in a system characterized by:

   a first endpoint device characterized by video transceiver means for transmitting and receiving a video bit stream having a first transmission rate, and
   a second endpoint device characterized by video transceiver means for transmitting and receiving a video bit stream having a second transmission rate, wherein the second transmission rate differs from the first transmission

rate;
the video bit stream rate matching device being coupled to the first and second endpoint devices;

CHARACTERIZED IN THAT
the video bit stream rate matching device includes rate conversion means for converting a video bit stream having a first transmission rate to a video bit stream having a second transmission rate, and for converting a video bit stream having a second transmission rate to a video bit stream having a first transmission rate.

7. The video bit stream rate matching device of Claim 1, further characterized by:

(a) video multiplex decoder means for decoding and demultiplexing an input video bit stream having a first transmission rate; the video multiplex decoder having a first output adapted to generate quantized information in the form of quantized discretet cosine transformation coefficients in response to the input video bit stream; the video multiplex decoder means having a second output adapted to generate motion vectors in response to the input video bit stream;
(b) video multiplex encoder means for encoding and multiplexing quantized discrete cosine transformation coefficients with motion vectors to generate an output video bit stream; the video multiplex encoder means having a first input adapted to receive quantized direct cosine transformation coefficients, a second input adapted to receive motion vectors, and an output adapted to generate the output video bit stream;
(c) discrete cosine transformation coefficients processor means for processing a plurality of quantized discrete cosine transformation coefficients generated from a decoded, demultiplexed video bit stream having N bits, the processor processing the quantized discrete cosine transformation coefficient such that, after processing, the quantized discrete cosine transformation coefficients provide an encoded. multiplexed video bit stream having M bits, wherein $M \neq N$; the discrete cosine transformation coefficients processor means having a rate control input for specifying a desired bit rate for the encoded, multiplexed video bit stream; and
(d) rate control means for controlling the bit rate of the encoded, multiplexed video bit stream, the rate control means having:

(i) a first communications port for receiving a desired bit rate, and adapted for coupling to an endpoint device;
(ii) a second communications port for receiving a video bit stream having a transmission rate R; and
(iii) an output port for generating a video bit stream transmission rate S^1 in response to the receipt of transmission rates at the first and second communications ports;

characterized in that the first output of the video multiplex decoder means is coupled to the direct cosine transformation coefficients processor means, the second output of the video multiplex decoder means is coupled to the second input of the video multiplex encoder means, the output of the video multiplex encoder means is coupled to the second communications port of the rate control means, and the output port of the rate control means is coupled to the rate control input of the direct cosine transformation coefficients processor.

8. A digital video transmission rate matching system characterized by:

a first switching means having N input ports, first, second, and third output ports, and a control signal input port; the control signal port being adapted to receive a plurality of control signals, each control signal specifying a particular set of connections between the N input ports and any of the first, second and third output ports; the first switching means, in response to the receipt of any one of the plurality of control signals, connecting the N input ports to any of the first, second, and third output ports as specified by the any one of the plurality of control signals;
a second switching means having first, second, and third input ports, N output ports and a control signal input port; the control signal input port being adapted to receive a plurality of control signals, each control signal specifying a particular set of connections between any of the first, second, and third input ports and the N output ports; the second switching means, in response to the receipt of any one of the plurality of control signals, connecting the N output ports to any of the first, second and third input ports as specified by the any one of the plurality of control signals;
a transmission rate reduction means having an input adapted to receive a video bit stream of bit rate R bits per second, an output adapted to transmit a video bit stream of bit rate S^1 bits per second, wherein R is greater than S^1, and video bit stream compression means for transforming a video bit stream of bit rate R bits per second

to a video bit stream of bit rate S bits per second;
a transmission rate increasing means having an input adapted to receive a video bit stream of bit rate S bits per second, an output adapted to transmit a video bit stream of bit rate R bits per second, wherein R is greater than S, and video bit stream expansion means for transforming a video bit stream of bit rate S bits per second to a video bit stream of bit rate R bits per second;
characterized in that the first output port of the first switching means is coupled to the input of the transmission rate reduction means, the second output port of the first switching means is coupled to the input of the transmission rate increasing means, the third output port of the first switching means is coupled to the third input port of the second switching means;
the first input port of the second switching means is coupled to the output of the transmission rate reduction means; the second input port of the second switching means is coupled to the output of the transmission rate increasing means;
the N input ports of the first switching means are each adapted to receive an incoming video bit stream and the N output ports of the second switching means are each adapted to transmit an outgoing video bit stream.

9. The digital video transmission rate matching system of Claim 4 characterized in that the transmission rate reduction means is the video bit stream rate matching device of Claim 1, 2 or 3.

10. The digital video transmission rate matching system of Claim 4, 5, 6 or 7 characterized in that the transmission rate increasing means is a bit stuffing device.

11. A method of providing video bit stream rate matching, characterized by the following steps:

a) demultiplexing an incoming video bit stream to generate a plurality of demultiplexed video bit streams;
b) decoding each of a plurality of the demultiplexed video bit streams;
c) performing a discrete cosine transformation (DCT) on each of the demultiplexed, decoded video bit streams to generate a plurality of DCT coefficients;
d) discarding a subset of the DCT coefficients;
e) encoding the non-discarded DCT coefficients to generate a plurality of encoded video bit streams; and
f) multiplexing the plurality of encoded video bit streams to generate a multiplexed, encoded, outgoing video bit stream.

12. A method of providing video bit stream rate matching as set forth in Claim 11, characterized in that the DCT coefficients include a first subset of DCT coefficients corresponding to low-frequency video information and a second subset of DCT coefficients corresponding to high-frequency video information, the step of discarding being performed by discarding the second subset of DCT coefficients.

13. A method of providing video bit stream rate matching as set forth in Claim 12 characterized in that the high-frequency video information corresponds to video information above approximately 4.5 mHz.

FIG. 1

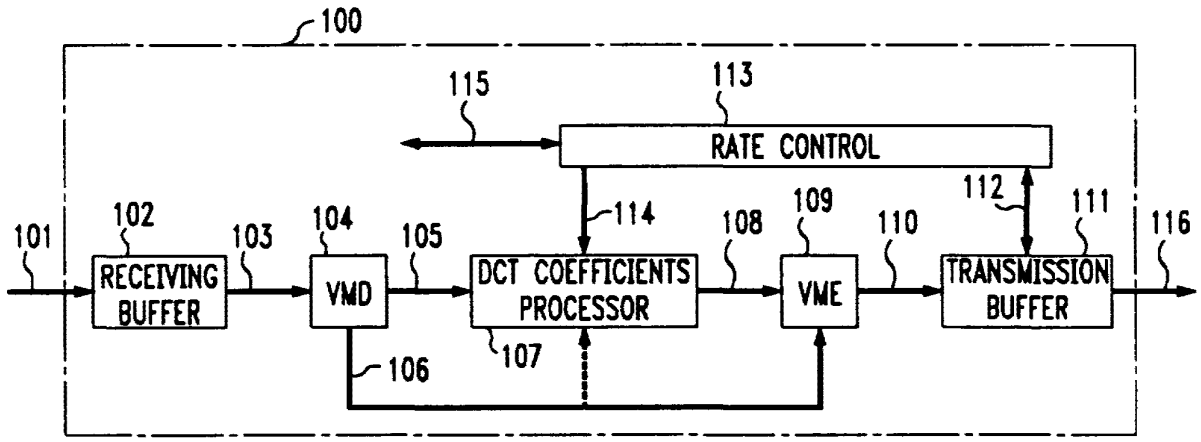

100
115
113
RATE CONTROL
112
111
116
101
102
103
104
105
114
108
109
110
RECEIVING BUFFER
VMD
DCT COEFFICIENTS PROCESSOR
VME
TRANSMISSION BUFFER
106
107

FIG. 9

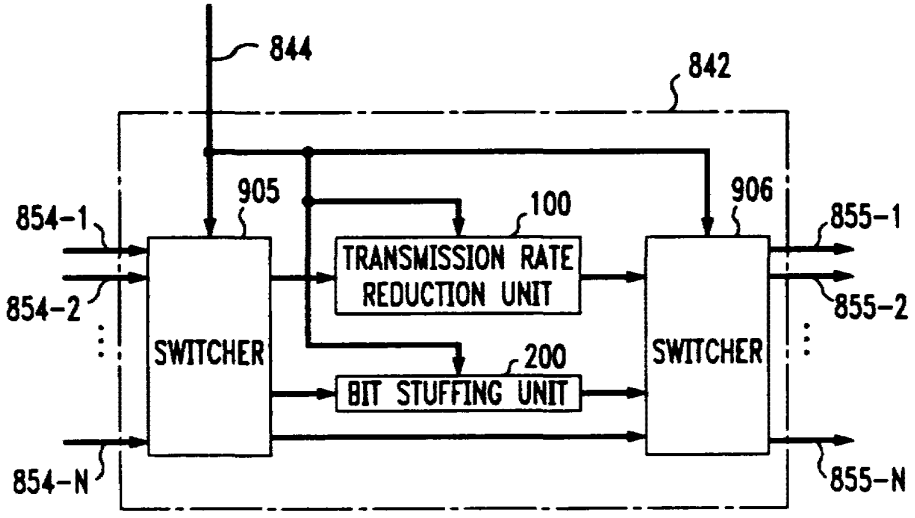
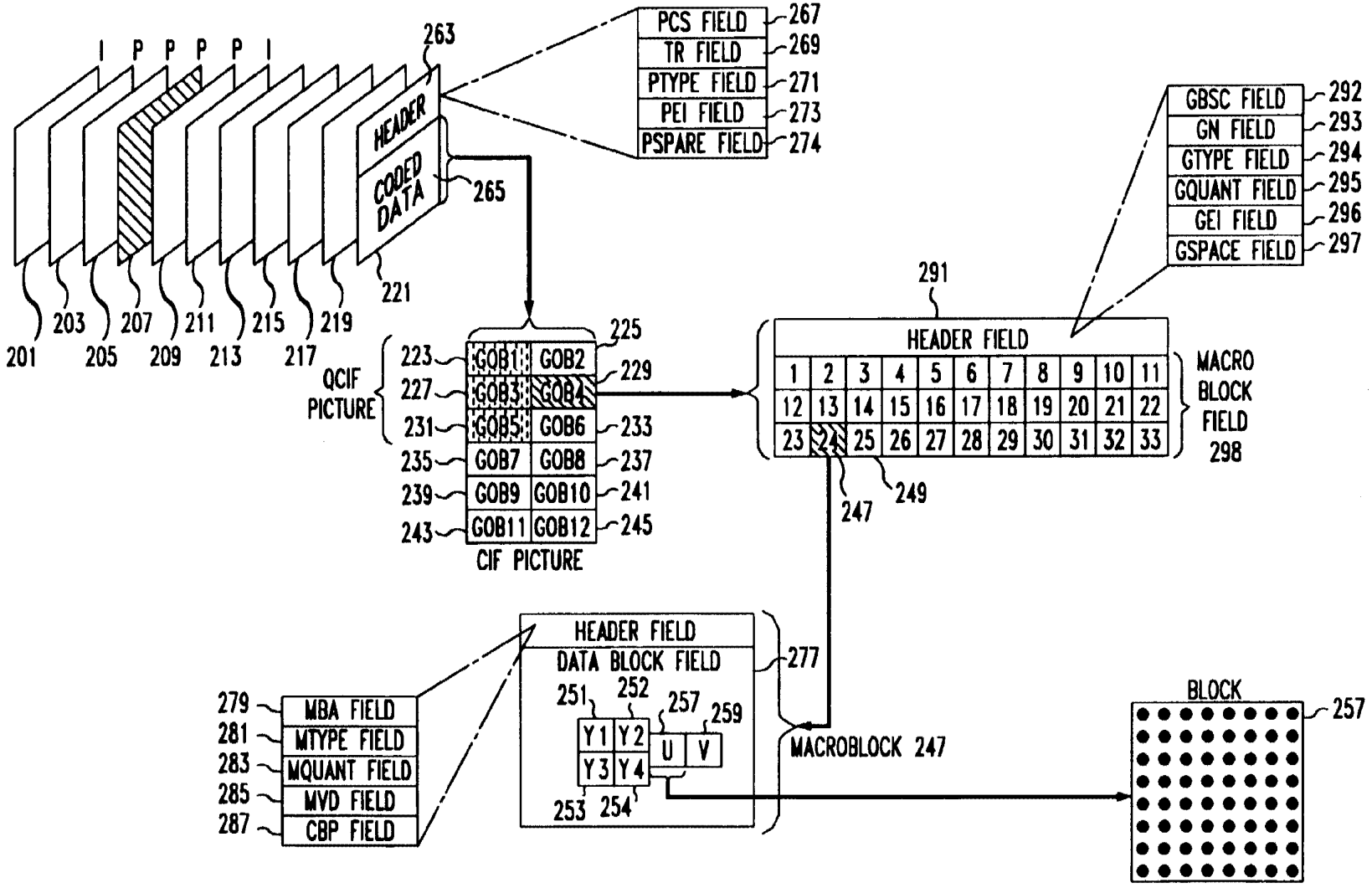

844
842
905
906
100
854-1
854-2
854-N
SWITCHER
TRANSMISSION RATE REDUCTION UNIT
200
BIT STUFFING UNIT
SWITCHER
855-1
855-2
855-N

FIG. 2



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FIG. 3

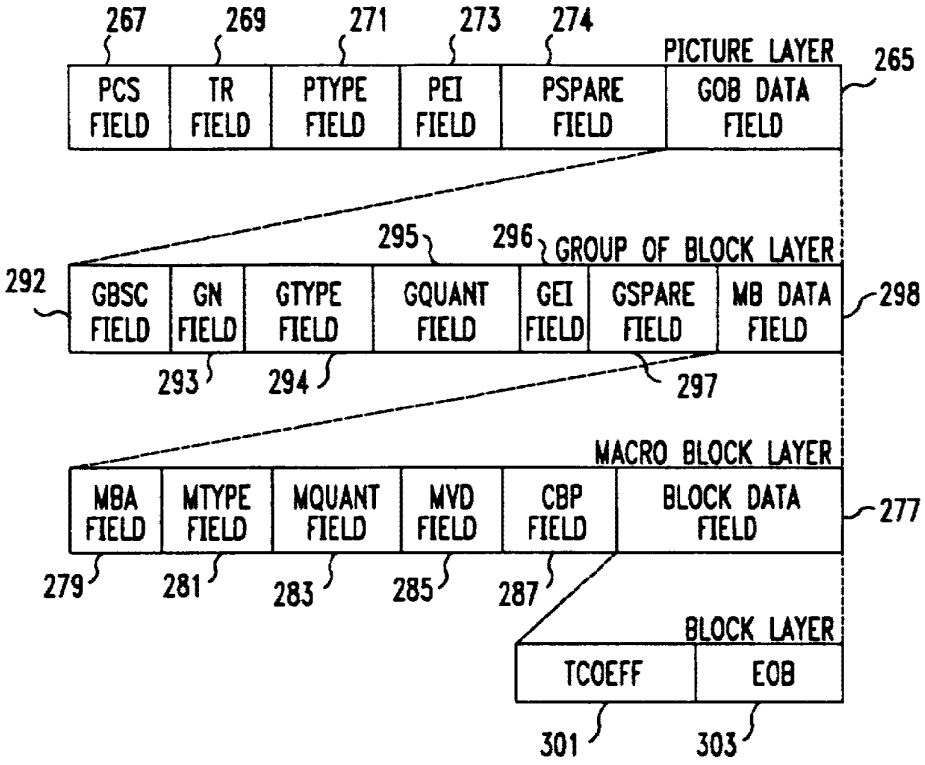

267
269
271
273
274
PICTURE LAYER
265
PCS FIELD
TR FIELD
PTYPE FIELD
PEI FIELD
PSPARE FIELD
GOB DATA FIELD
295
296
GROUP OF BLOCK LAYER
292
GBSC FIELD
GN FIELD
GTYPE FIELD
GQUANT FIELD
GEI FIELD
GSPARE FIELD
MB DATA FIELD
298
293
294
297
MACRO BLOCK LAYER
MBA FIELD
MTYPE FIELD
MQUANT FIELD
MVD FIELD
CBP FIELD
BLOCK DATA FIELD
277
279
281
283
285
287
BLOCK LAYER
TCOEFF
EOB
301
303

FIG. 4

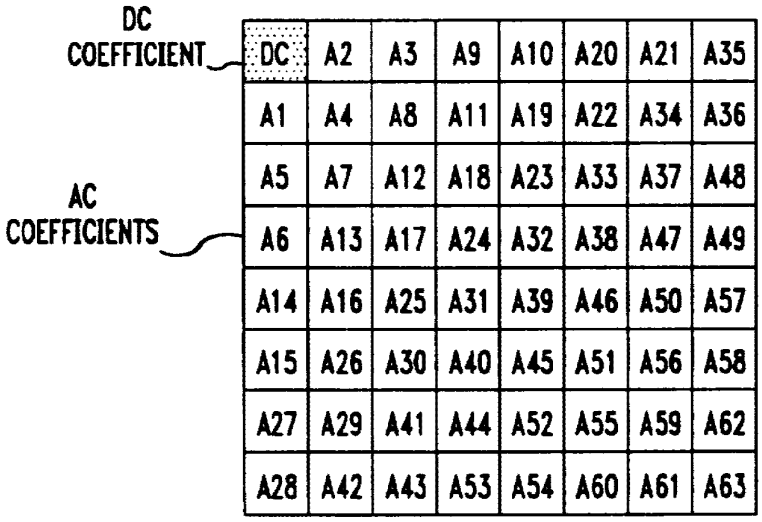

DC COEFFICIENT
AC COEFFICIENTS
DC A2 A3 A9 A10 A20 A21 A35
A1 A4 A8 A11 A19 A22 A34 A36
A5 A7 A12 A18 A23 A33 A37 A48
A6 A13 A17 A24 A32 A38 A47 A49
A14 A16 A25 A31 A39 A46 A50 A57
A15 A26 A30 A40 A45 A51 A56 A58
A27 A29 A41 A44 A52 A55 A59 A62
A28 A42 A43 A53 A54 A60 A61 A63

FIG. 5

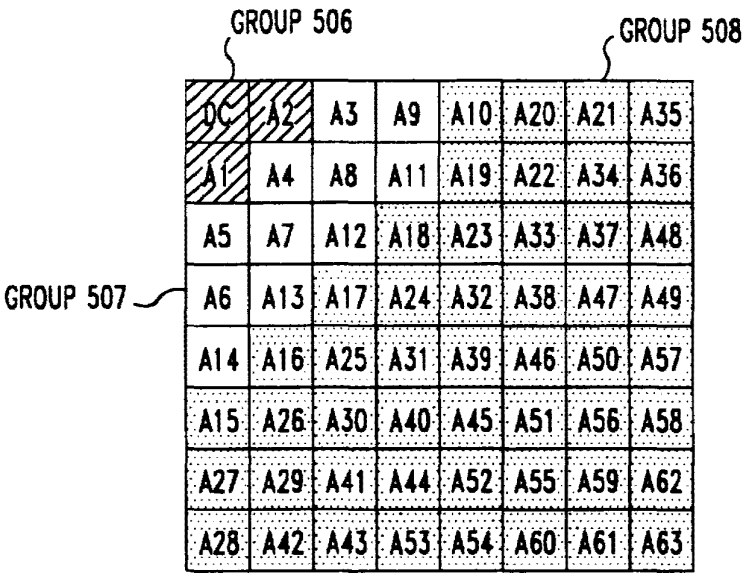

500
GROUP 506
GROUP 508
GROUP 507
DC
A2
A3
A9
A10
A20
A21
A35
A1
A4
A8
A11
A19
A22
A34
A36
A5
A7
A12
A18
A23
A33
A37
A48
A6
A13
A17
A24
A32
A38
A47
A49
A14
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A25
A31
A39
A46
A50
A57
A15
A26
A30
A40
A45
A51
A56
A58
A27
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A28
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A53
A54
A60
A61
A63

FIG. 6

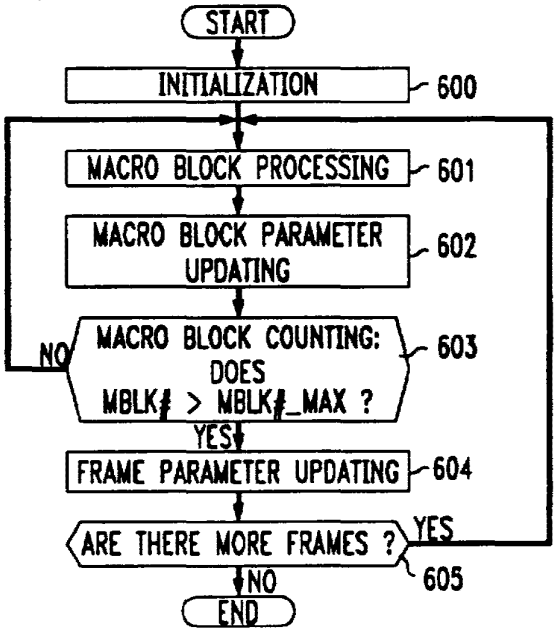

START
INITIALIZATION
600
MACRO BLOCK PROCESSING
601
MACRO BLOCK PARAMETER UPDATING
602
NO
MACRO BLOCK COUNTING: DOES MBLK# > MBLK#_MAX ?
603
YES
FRAME PARAMETER UPDATING
604
ARE THERE MORE FRAMES ?
YES
605
NO
END

FIG. 7

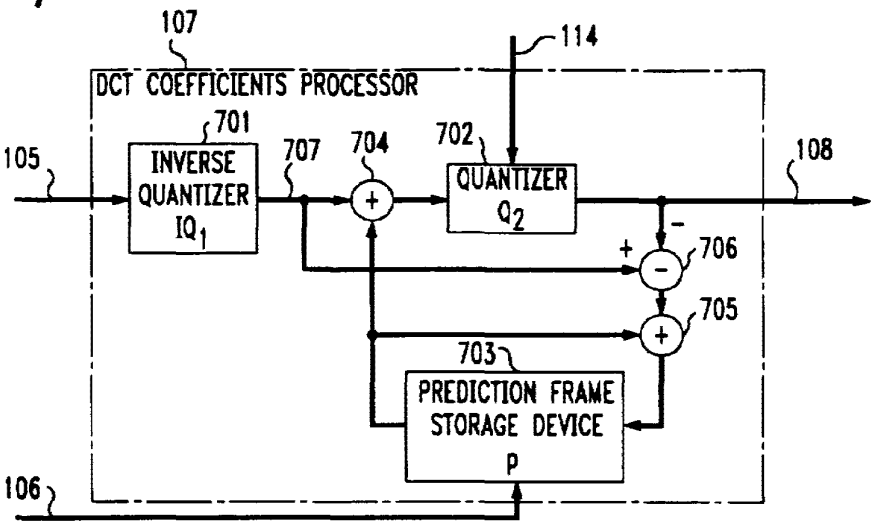

107
DCT COEFFICIENTS PROCESSOR
114
701
INVERSE QUANTIZER IQ1
105
707
704
702
QUANTIZER Q2
108
706
705
703
PREDICTION FRAME STORAGE DEVICE P
106

FIG. 10

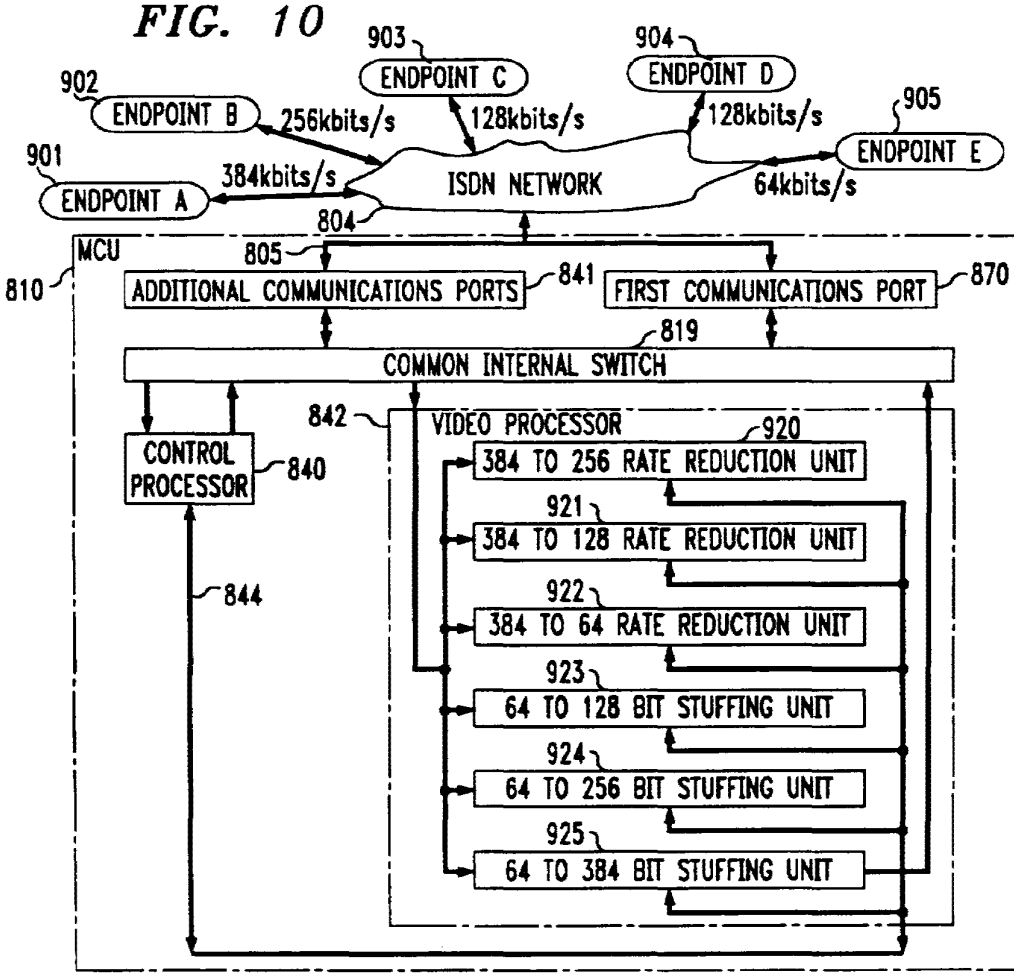
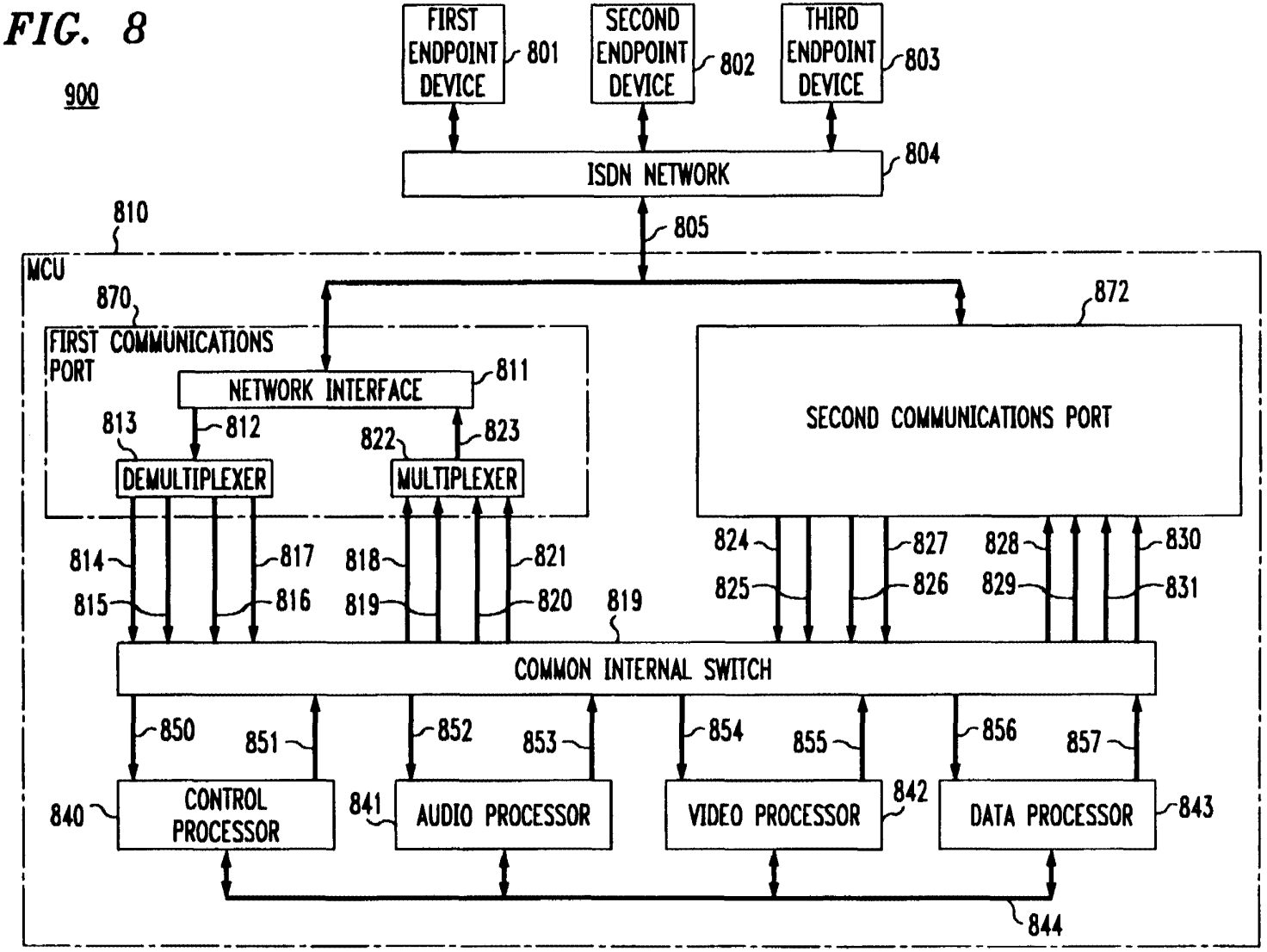

903
ENDPOINT C
904
ENDPOINT D
902
ENDPOINT B
256kbits/s
128kbits/s
128kbits/s
905
ENDPOINT E
901
384kbits/s
ISDN NETWORK
64kbits/s
ENDPOINT A
804
MCU
805
810
ADDITIONAL COMMUNICATIONS PORTS
841
FIRST COMMUNICATIONS PORT
870
819
COMMON INTERNAL SWITCH
842
VIDEO PROCESSOR
920
CONTROL PROCESSOR
840
384 TO 256 RATE REDUCTION UNIT
921
384 TO 128 RATE REDUCTION UNIT
844
922
384 TO 64 RATE REDUCTION UNIT
923
64 TO 128 BIT STUFFING UNIT
924
64 TO 256 BIT STUFFING UNIT
925
64 TO 384 BIT STUFFING UNIT

FIG. 8



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PTO/SB/08a (01-10)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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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	14	7065250		Sep. 18, 1998	Lennon	
	15	7073028		Jun. 12, 2001	Lango	
	16	7073127		Jul. 1, 2002	Zhao	
	17	7076560		Jun. 12, 2001	Lango	
	18	7107532		Aug. 29, 2001	Billmaier	
	19	7111044		Jul. 17, 2002	Lee	
	20	7124164		Apr. 17, 2001	Chemtob	

	21	7133451		Mar. 5, 2001	Kim	
	22	7133881		Apr. 29, 2002	Sirivara	
	23	7155531		Jun. 12, 2001	Lango	
	24	7174512		Dec. 1, 2000	Martin	
	25	7176957		25-May-04	Ivashin	
	26	7177642		Jul. 3, 2001	Sanchez Herrero	
	27	7178107		Sep. 16, 1999	Sezan	
	28	7185082		Aug. 9, 2000	Val	
	29	7190670		Oct. 4, 2002	Varsa	
	30	7200857		Jun. 9, 2000	Rodriguez	
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(Not for submission under 37 CFR 1.99)

Application Number	18069450
Filing Date	2022-12-21
First Named Inventor	David F. Brueck
Art Unit	2454
Examiner Name	Chirag R. Patel
Attorney Docket Number	9401-00279

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

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OR

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☐ See attached certification statement.

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

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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 Carlson/	Date (YYYY-MM-DD)	2023-10-19
Name/Print	Brett Carlson	Registration Number	39928

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DEUTSCHES PATENT- UND MARKENAMT

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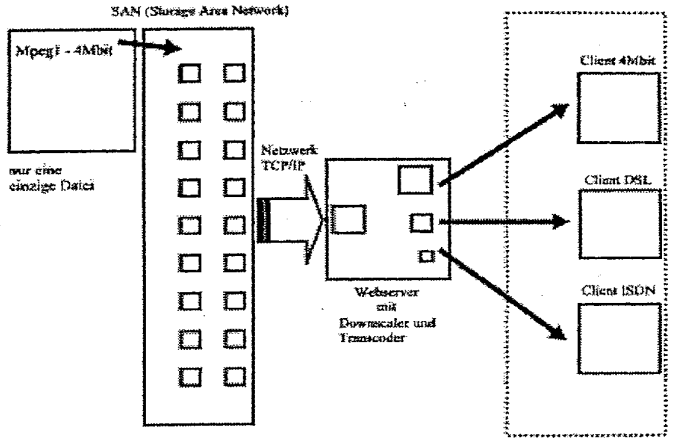
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EP 7 31 468 A2
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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Verfahren und Mediendistributionssystem zur Speicherung und Übertragung von Videodateien

(57) Verfahren zur Speicherung und Übertragung von als Videodateien ausgebildeten Contents im Rahmen eines digitalen Mediendistributionssystems mit einer Datenbasis, auf die eine Mehrzahl von Nutzern über Datenkanäle und mit Endgeräten mit unterschiedlichen Hard- und Softwarespezifikationen zugreifen kann, wobei jeder Content in der Datenbasis genau einmal in Form einer Primär-Videodatei mit maximalem Informationsinhalt gespeichert wird, bei jedem Zugriff eines Nutzers die Hard- und Softwarespezifikation von dessen Endgerät und des Datenkanals zu diesem erfaßt und das Erfassungsergebnis einem Steuereingang eines Dateianpassungsrechners zugeführt, im Dateianpassungsrechner in Echtzeit oder schneller als Echtzeit die Primär-Videodatei in eine an die Hard- und Softwarespezifikation angepaßte Sekundär-Videodatei umgerechnet und die Sekundär-Videodatei ohne Endspeicherung in der Datenbasis im wesentlichen in Echtzeit an das Endgerät übermittelt wird.



DE 101 01 075 A 1

Beschreibung

[0001] Die Erfindung betrifft ein Verfahren zur Speicherung und Übertragung von als Videodateien ausgebildeten Contents nach dem Oberbegriff des Anspruchs 1 sowie ein entsprechend ausgebildetes Mediendistributionssystem.

[0002] Im Zuge der sich schnell ausweitenden Nutzung des Internet als Infrastruktur zur Verteilung von Informationsinhalten (Contents) werden seit einigen Jahren auch völlig neuartige Möglichkeiten der Distribution verschiedenartiger Bewegtbildfolgen (Spielfilme, Videoclips, Veranstaltungsmitschnitte etc.) erprobt und teilweise auch bereits kommerziell realisiert. Für den direkten Abruf von Videos durch private Nutzer hat sich bereits der Begriff "Video-on-Demand" eingebürgert.

[0003] Beim derzeitigen Stand der Technik gibt es für die digitale Mediendistribution, speziell die Bereitstellung von Videodateien in heterogenen Netzwerken, jedoch noch differenzierte Limitierungen hinsichtlich der Bandbreiten und der Leistungsstabilität. Nur eine Minderheit der privaten Nutzer verfügt über die technischen Voraussetzungen hinsichtlich Endgerät und Datenkanal, um Videos in hoher Qualität (mit ca. 1 bis 4 Mbit/s) in Echtzeit – d. h. ohne vorheriges Herunterladen auf einen internen Massenspeicher – abzurufen.

[0004] Eine große Gruppe von Nutzern ist bereits über DSL-Leitungen an das Internet angeschlossen, womit Datenraten von 384 bis 768 Kbit/s realisiert werden. Für diese Nutzergruppe müssen also entsprechende Videostreams existieren. Nutzer von ISDN- und Analoganlagen benötigen den Videostream mit Datenraten zwischen 33,6 Kbit und 128 Kbit.

[0005] Ein zusätzliches Problem bei der Realisierung von Video-on-Demand stellen die in Abhängigkeit von der Netzauslastung im tatsächlichen Betrieb stark variierenden erreichbaren Datenraten dar.

[0006] Diese Situation stellt die Anbieter der in Rede stehenden Contents (Videodateien) vor das Problem, ihr Angebot für die verschiedenen Nutzergruppen mit mehreren Datenraten bereitstellen zu müssen, um ein breites Spektrum an Zugriffsgeschwindigkeiten der Nutzer abzudecken. Derzeit halten die Anbieter daher höchst umfangreiche Datenbasen vor, in denen jeder Content in den gängigen Videostream-Varianten bezüglich der benötigten Datenrate bzw. Bandbreite vorgehalten wird. Es gibt also für jeden Content eine Mehrzahl von verschiedenen Dateien und folglich auch entsprechend viele Datenbankeinträge.

[0007] Diese Situation ist offensichtlich in mehreren Aspekten höchst nachteilig: Zum einen benötigen die auf diese Weise aufgebauten Datenbasen sehr viel Speicherplatz, so daß ihre Erstellung mit hohen Hardwarekosten verbunden ist. Weiterhin sind sie schwer adressierbar, weshalb die Anbieter mit sogenannten "großen" Datenbanken (etwa Oracel8i o. ä.) arbeiten – obgleich einfache Perl-, PHP- oder andere scriptbasierte Datenbanken grundsätzlich den gleichen Zweck erfüllen würden. Schließlich ist ein entsprechend aufgebautes Komplettsystem nur noch relativ schwer zu skalieren, d. h. um einzelne Komponenten zur Leistungsverbesserung oder Erweiterung zu ergänzen.

[0008] Zusätzliche Probleme bestehen bei der gegenwärtigen Praxis auf Seiten der Nutzer: Die Nutzer müssen sich üblicherweise für einen Videostream mit einer bestimmten Datenrate entscheiden, verfügen aber oftmals nicht über das Wissen, um die verschiedenen lieferbaren Videostreams bezüglich ihrer Datenraten und Qualitäten hinreichend zu unterscheiden. In der Regel ist zudem für die Übertragung von Videodateien mit niedriger Datenrate ("Low-Bitrate Videos") zusätzlich die Installation von separater Software oder eines sogenannten Plugin nötig.

[0009] Zum Problemkreis der Bilddatenkodierung, speziell einschließlich Kompression, und der Umkodierung auf andere Datenraten (Transcoding) gibt es umfangreichen Stand der Technik.

[0010] So beschreibt die WO 00/30359 ein Verfahren zum Transcoding von Videosignalen und einen entsprechenden Transcoder, bei denen durch Einfügen eines sogenannten "Downsampling Filter" eine Reduzierung der Auflösung erreicht werden kann. Das Verfahren schließt eine geeignete Bearbeitung der dekodierten Bewegungsvektoren ein und wird zur Anwendung speziell bei Mpeg-2-Transcodern empfohlen.

[0011] In der US 5,805,224 werden ein Verfahren und ein Gerät zum Transcoding von Videosignalen unter Einsatz einer Bitratensteuerung beschrieben, wobei die Aufteilung jedes Bildes in eine Mehrzahl von Teilbildern (Subpictures) und eine Quantisierung der dekodierten Signale mit einer Schrittweite vorgesehen ist, welche auf eine Ausgangs-Bitrate abgestimmt ist.

[0012] In der EP-A-0 942 605 wird ein Transcoder speziell für den Mpeg-Standard beschrieben, mit dem unterschiedliche Bitraten realisierbar sind. Die in einem vorangehenden Kodierungsverfahren relevanten Kodierungsparameter können an den Mpeg-Kodierer übertragen werden und dieser führt eine aktuelle Kodierung aufgrund dieser Information zur Vorgeschichte aus. Mit diesem Verfahren wird eine Verschlechterung der Bildqualität bei einer wiederholten Ausführung von Dekodierungs- und Kodierungsverfahren weitgehend verhindert.

[0013] Aus der WO 00/51357 ist ein Transcoding zwischen unterschiedlichen Bildkompressionsstandard auf DCT-Basis bekannt. Das Verfahren kommt ohne vollständige Dekodierung des ersten Bitstroms und ohne vollständige Kodierung gemäß dem zweiten Bildkompressionsstandard aus, sondern wendet Schritte des ersten Kompressionsstandards auf den Eingangs-Bitstrom an, um dequantisierte DCT-Koeffizientendaten zu gewinnen. Ein DCT-Datenwandler des Transcoding-Systems wandelt dann die dequantisierten DCT-Koeffizientendaten in der DCT-Domäne insoweit um, als dies zur Anwendung von Schritten des zweiten Bildkompressionsstandards auf die konvertierten DCT-Koeffizientendaten zur Erzeugung des Ausgangs-Bitstroms erforderlich ist.

[0014] Der Erfindung liegt die Aufgabe zugrunde, ein verbessertes Verfahren der gattungsgemäßen Art sowie ein entsprechendes Mediendistributionssystem bereitzustellen, mit denen eine erhebliche Vereinfachung und Kosteneinsparung bei der Speicherung und Handhabung der Contents erreicht werden können.

[0015] Diese Aufgabe wird hinsichtlich ihres Verfahrensaspektes durch ein Verfahren mit den Merkmalen des Anspruchs 1 und hinsichtlich ihres Vorrichtungsaspektes durch ein Mediendistributionssystem mit den Merkmalen des Anspruchs 10 gelöst.

[0016] Die Erfindung schließt den grundlegenden Gedanken der Bereitstellung eines Verfahrens bzw. Mediendistributionssystems ein, welches präzise auf die Spezifikationen der Nutzer (nachfolgend auch als "User" oder "Clients" bezeichnet) Bezug nimmt, indem es Videostreams mit entsprechend optimierten Parametern bereitstellt. Die Videostreams werden erfindungsgemäß auf die spezifische Umgebung des jeweiligen Client angepaßt, welche durch eine Vielzahl von Variablen – insbesondere Leitungsgeschwindigkeit, Stabilität, Betriebssystemversion, Prozessorarchitektur und bereits implementierte Video-Software – gekennzeichnet ist.

[0017] Weiterhin schließt die Erfindung den Gedanken ein, jeden Content in der Datenbasis (nachfolgend auch be-

zeichnet als "SAN = Storage-Area-Network" bezeichnet) nur noch in Form einer einzigen Videodatei vorzuhalten. Diese Datei ist ein Video mit einem Informationsgehalt, der dem technisch realisierbaren Maximum entspricht. Diese eine optimale Videodatei wird dann erfindungsgemäß – nach Erfassung der relevanten Parameter der Client-Umgebung – exakt an diese Umgebung angepaßt, d. h. speziell durch eine "Herunterrechnung" (Downscaling) in eine Datei transformiert, die vom Client auf dem ihm verfügbaren Übertragungskanal stabil empfangen werden kann. Wesentlich ist weiterhin, daß dieser Vorgang in Echtzeit oder schneller als Echtzeit abläuft, so daß letztlich die Videodatenübertragung an den Client in Echtzeit erfolgen kann und kein vorhergehendes Herunterladen auf einen internen Speicher beim Endgerät des Nutzers erforderlich ist.

[0018] Die vorgeschlagene Lösung bietet eine ganze Reihe wesentlicher Vorteile: Zum einen ist jeder Informationsinhalt oder Content (oder auch "Stream") nur ein einziges Mal im Datenbanksystem (nachfolgend auch bezeichnet als SAN = Storage-Area-Network) vorhanden, wodurch der größte Teil der bisher erforderlichen Speicherkapazität eingespart werden kann. Weiterhin ergibt sich eine sehr leichte Skalierbarkeit, indem der Dateianpassungsrechner (Transcoder) in Abhängigkeit vom aktuellen Bedarf an Verarbeitungsleistung beliebig oft parallel eingesetzt werden kann.

[0019] Desweiteren bietet die Lösung besonders einfache Möglichkeiten der Bedienung über ein Netzwerk-Interface und damit der logischen und physikalischen Separation von vorhandenen Serversystemen sowie der unabhängigen Erweiterung der einzelnen Komponenten (SAN, Server und Transcoder). Schließlich ermöglicht die Lösung universelle Schnittstellen und Bereitstellung der Dateien und den Einsatz herkömmlicher Umgebungen zur Bereitstellung von Schnittstellen für die Datenbasis-Anbindung. Die Schnittstellen für die Datenbasis-Anbindung können insbesondere über ODBC-, JDBC-, SQL-, Perl- oder PHB-Umgebungen realisiert werden, die dem Fachmann als solche bekannt sind und daher hier keiner weiteren Erläuterung bedürfen.

[0020] In der praktisch bei weitem relevantesten Ausführungsform des Systems erfolgen die Nutzerzugriffe über ein IP-Netz (speziell das Internet), und die Erfassung der Hard- und Softwarespezifikation umfaßt das Auslesen von nutzerseitig bereitgestellten Informationen über eine Serverumgebung auf der Basis eines entsprechenden Standardprotokolls, insbesondere über eine HTTP-Server-Umgebung. Die Hard- und Softwarespezifikationen umfassen in praxi speziell die maximale stabil erreichbare Datenrate bzw. Übertragungsbandbreite für die Übertragung zum jeweiligen Nutzer. Bedeutsam ist weiterhin die Erfassung der Art des Prozessors bzw. Betriebssystems und/oder Browsers, der am Endgerät des Nutzers installiert ist, da die Bereitstellung eines nutzerbezogen optimierten Video-Bitstreams auch von diesen Faktoren abhängt.

[0021] Bevorzugt ist weiterhin eine Ausführung des Systems, bei der in verschiedenen Speicherbereichen eines Programmspeichers des Datenanpassungsrechners jeweils spezifizierte Anpassungsalgorithmen für vorbestimmte Hard- und Softwarekonfigurationen gespeichert sind. Bei jedem Zugriff wird hierbei insbesondere eine für dessen Dauer gültige, die aktuelle Hard- und Softwarespezifikation des Nutzers reflektierende Nutzer-ID vergeben, über die der Speicherbereich mit dem "passenden" Anpassungsalgorithmus adressiert wird.

[0022] Die Übertragung des konkreten Video-Bitstreams erfolgt bevorzugt über eine von mehreren, jeweils an eine bestimmte Hard- und Softwarespezifikation angepaßten Schnittstellen, welche anhand des Erfassungsergebnisses (insbesondere durch Adressierung einer Auswahlrichtung mit der oben erwähnten Nutzer-ID) ausgewählt wird.

[0023] Aus derzeitiger Sicht wird die Umrechnung der einen in der Datenbasis gespeicherten Primär-Videodatei in die jeweils zu übertragende Sekundär-Videodatei im wesentlichen hardwarebasiert auszuführen sein – softwarebasierte Lösungen sind aus Gründen der Verarbeitungsgeschwindigkeit eher zur manuellen Umsetzung einzelner Videostreams oder zum sogenannten Batch-Transcoding von Bedeutung.

[0024] Die Systemstruktur kann in einer ersten Ausführungsform so aussehen, daß der Dateianpassungsrechner (Transcoder/Downscaler) mit dem Server für den eigentlichen Netzbetrieb des Distributionssystems (Webserver) integriert ausgeführt ist, während in einer alternativen Ausführungsform beide Komponenten als logisch und physikalisch getrennte Rechnereinheiten ausgebildet sind. Weiterhin kann eine Mehrzahl von Dateianpassungsrechnern in einem Distributionssystem vorgesehen sein, welche insbesondere in sogenannten Cluster-Lösungen zusammenwirken. Schließlich kann der (oder jeder) Dateianpassungsrechner selbst in eine Mehrzahl von einzelnen Rechnerkomponenten aufgeteilt sein, um eine optimale Anpassung an die Anforderungen bezüglich der Verarbeitungskapazität zu realisieren.

[0025] Vorteile und Zweckmäßigkeiten der Erfindung ergeben sich im übrigen aus den Unteransprüchen sowie der nachfolgenden Beschreibung bevorzugter Ausführungsprinzipien anhand der Figuren. Von diesen zeigen:

[0026] **Fig.** 1 eine schematische Darstellung eines Mediendistributionssystems gemäß dem Stand der Technik,

[0027] **Fig.** 2 eine schematische Darstellung eines Mediendistributionssystems gemäß einer ersten Ausführungsform der Erfindung,

[0028] **Fig.** 3 eine schematische Darstellung eines Mediendistributionssystems gemäß einer zweiten Ausführungsform der Erfindung,

[0029] **Fig.** 4 eine schematische Darstellung eines Mediendistributionssystems gemäß einer dritten Ausführungsform der Erfindung,

[0030] **Fig.** 5 eine schematische Darstellung eines Mediendistributionssystems gemäß einer vierten Ausführungsform der Erfindung,

[0031] **Fig.** 6 eine schematische Darstellung eines Mediendistributionssystems gemäß einer fünften Ausführungsform der Erfindung,

[0032] **Fig.** 7 eine schematische Darstellung eines Mediendistributionssystems gemäß einer sechsten Ausführungsform der Erfindung und

[0033] **Fig.** 8 eine schematische Darstellung zur Erläuterung eines speziellen Aspekts einer Ausführungsform des erfindungsgemäßen Verfahrens.

[0034] **Fig.** 1 zeigt in einer Prinzipdarstellung ein herkömmliches Mediendistributionssystem, bei dem in einem SAN eine Mehrzahl von Videodateien gespeichert ist, die gemäß dem Mpeg1-Standard zur Übertragung in verschiedenen Datenraten zugeschnitten sind. Das SAN ist über ein TCP-IP-Netz mittels eines Webservers mit verschiedenen Nutzern verbunden, für die in der Figur stellvertretend die Nutzer Client **2** Mbit, Client DSL und Client ISDN symbolisch dargestellt sind. Kernstück des Systems ist also eine Datenbank, die, um gleichzeitig verschiedene Datenratenanforderungen erfüllen zu können, ein und denselben Content in einer Mehrzahl von Videodateien speichert und über den Webserver diese vorgehaltenen Dateien als Videostreams in den verschiedenen Datenraten ausgibt.

[0035] Dem gegenüber gibt es bei dem in **Fig.** 2 gezeigten erfindungsgemäßen System im SAN für jeden Content nur eine einzige Datei, nämlich eine auf die maximale anforder-

bare Datenrate von 4 Mbit zugeschnittene Mpeg1-Datei. Bei einer Anforderung eines Contents wird die entsprechende Datei aufgerufen und in einem Webserver mit integriertem Downscaler und Transcoder entsprechend der Spezifikation des jeweiligen Nutzers umkodiert und dabei auf die Datenratenanforderung des Nutzers herabskaliert. (Falls der Nutzer die im SAN gespeicherte "Maximaldatei" direkt verarbeiten kann und der Webserver dies bei der Erfassung der Hard- und Softwarespezifikation des Nutzers erfaßt hat, erfolgt natürlich eine Übermittlung der gespeicherten Videodatei ohne Transcoding/Downscaling.)

[0036] In **Fig.** 3 ist eine gegenüber **Fig.** 2 insofern modifizierte Systemkonfiguration dargestellt, als hier die Funktionsbereiche Downscaler/Transcoder einerseits und Webserver andererseits relativ unabhängig voneinander realisiert sind. Dies verbessert – wie weiter oben bereits angemerkt – die Skalierbarkeit des Systems.

[0037] **Fig.** 4 zeigt eine weiter modifizierte Ausführung, bei der der eigentliche Dateianpassungsrechner (Downscaler und Transcoder) eine vom Webserver logisch und physikalisch völlig getrennte Einheit ist, was die Ausbaumöglichkeiten des Systems weiter verbessert.

[0038] In **Fig.** 5 ist als weiteres Ausführungsbeispiel eine sogenannte Cluster-Lösung dargestellt, bei der – ähnlich dem an sich bekannten Distributed-Supercomputing – mehrere Dateianpassungsrechner zusammenwirken. Hinsichtlich der logisch und physikalisch getrennten Ausführung von Dateianpassungsrechner und Webserver ist diese Variante an die vorbeschriebene Ausführung nach **Fig.** 4 angelehnt. Mit der Cluster-Lösung läßt sich besonders leicht eine Lastverteilung für den Fall des Ausfalls einer oder mehrerer Transcoder/Downscaler realisieren.

[0039] In **Fig.** 6 ist eine weitere Ausführung dargestellt, bei der die zentrale Verarbeitungseinheit des Mediendistributionssystems neben einem separaten Webserver drei weitere separate Einheiten umfaßt, nämlich einen Demultiplexer, einen Scaler und Transcoder und einen Multiplexer. Dieser Aufbau ergibt eine noch höhere Skalierbarkeit und präzisere Aufteilung der Verarbeitungsleistung auf die verschiedenen Verarbeitungsprozesse bzw. -schritte. Für den Gesamtprozeß lassen sich dadurch sehr hohe symmetrische Prozeßauslastungen erzielen, und die einzelnen Recheneinheiten lassen sich im laufenden Betrieb relativ einfach austauschen, wenn jeweils mehrere parallele Einheiten gleiche Funktion bzw. gleichen Typs vorhanden sind.

[0040] Die in **Fig.** 6 dargestellte Komponenten-Untergliederung ist lediglich beispielhaft zu verstehen und stellt einzelne Komponenten einer auch als "Downscaling-Engine" zu bezeichnenden Verarbeitungseinheit dar, die im wesentlichen die folgenden Verfahrensschritte ausführt:

1. Erfassen der Client-Daten (System, Browser, Übertragungsgeschwindigkeit, usw.),
2. Selektion (durch Datenbank) des vorliegenden Stream-Systems (Video- und Audio-Daten) im Netzwerk,
3. Einlesen des Streams in einen Zwischenspeicher (Buffer),
4. Demultiplexung der einzelnen Komponenten (Video- und Audioteil, Subtitles usw.) und Extraktion einiger Daten des Systemstreams (Motion Vectors, Color Scales, Timestamps),
5. Umrechnung der extrahierten Daten auf die neue Anforderung (Parameter wurden bei der Erfassung der Client-Eigenschaften ermittelt),
6. Herabskalieren der Video- und Audiodaten mit Wiederverwendung einiger Komponenten des ursprünglichen Sytem-Streams,
7. Erneutes Multiplexing der System-Stream-Komponenten mit Erstellung neuer Timestamps und Ausschreiben in Zwischenspeicher,
8. Serverseitiges Auslesen und Versenden der Stream-Datenpakete.

[0041] Hierbei ist zu beachten, daß dieses Verfahren mit einem herkömmlichen Dekodierungs-Neukodierungs(Decode-Reencode)-Verfahren nichts gemein hat. In den oben genannten Schritten **4**, **5** und **6** wird der Videostream nämlich nicht im eigentlichen Sinne neu kodiert, sondern es findet eine Umrechnung aus dem ursprünglichen Videostream statt. Der hohe Zeitaufwand einer A-priori-Kodierung, bei der die Abhängigkeiten der einzelnen Bilder voneinander berücksichtigt werden müssen, wird damit vermieden. Es werden hier insbesondere keine Sprungvorhersagen getroffen, um ein folgendes Bild zu einem vorhergehenden Bild in eine mathematisch Abhängigkeit zu bringen. Statt dessen werden gewisse extrahierte Daten aus dem ursprünglichen Videostream weiterverwendet, wodurch der Verarbeitungs-Zeitaufwand erheblich reduziert und eine Echtzeitverarbeitung von Videostreams auch mit hohen Datenraten ermöglicht wird.

[0042] Dieses Prinzip ist in **Fig.** 7 schematisch skizziert. Diese Figur ist aufgrund der Beschriftung selbsterklärend, so daß sich weitere Ausführungen dazu hier erübrigen.

[0043] In der praktischen Ausführung ist aus derzeitiger Sicht eine Realisierung des Dateianpassungsrechners bzw. der Downscaling-Engine auf einer oder mehreren Einsteckkarte(n), insbesondere für IBM-kompatible Rechner, bevorzugt. Die Einsteckkarte enthält programmierbare Logikbausteine, in denen die Verarbeitungsalgorithmen hardwaremäßig implementiert sind. Weiterhin enthält sie – abhängig von der gewünschten Skalierbarkeit und Verfügbarkeit – RISC-Prozessoren mit einer Rechenleistung, die eine Abarbeitung der Algorithmen in höherer Geschwindigkeit als eine Standard-CPU ermöglichen.

[0044] In einem einzigen Host-System lassen sich mehrere derartige Downscaling-Engines einbauen und betreiben, und über Cluster-Lösungen wiederum lassen sich mehrere Host-Systeme als eigenständige Transcoder/Downscaler benutzen. Im letzteren Fall ist eine Management-Einheit zur Steuerung der Arbeitsverteilung auf die einzelnen Einheiten vorzusehen. Aus derzeitiger Sicht bietet sich insbesondere eine Realisierung über ein UNIX-System bzw. freie Derivate (Linux o. ä.) an.

[0045] Wie in **Fig.** 8 skizziert, können die einzelnen Stufen der Downscaling-Engine auch auf separaten Einsteckkarten realisiert sein. Dargestellt ist eine Ausführung, bei der ein Demultiplexer auf einer separaten Karte untergebracht ist und dieser eine Audio-Transcoder-Karte und mehrere verschiedene Video-Transcoder-Karten versorgt, die auf unterschiedlichen Standards – in der Figur den Standards Mpeg-1, Mpeg-2 und Mpeg-4 – basieren. Die in der Audio-Transcoder-Karte und den Video-Transcoder-Karten umgewandelten Audio- bzw. Videodaten werden einer wiederum separat ausgeführten Multiplexer-Karte zugeführt, wo sie zum Videostream des jeweiligen Standards zusammengesetzt werden.

[0046] Auch hierbei erfolgt eine Umsetzung und Wiederverwendung von gewissen aus der Ursprungs-Videodatei extrahierten Teilen.

[0047] Die Ausführung der Erfindung ist nicht auf die oben beschriebenen Beispiele beschränkt, sondern im Rahmen der anhängenden Ansprüche in einer Vielzahl von Abwandlungen möglich, die im Rahmen fachgemäßen Handelns liegen.

Patentansprüche

1. Verfahren zur Speicherung und Übertragung von als Videodateien ausgebildeten Contents im Rahmen eines digitalen Mediendistributionssystems mit einer Datenbasis, auf die eine Mehrzahl von Nutzern über Datenkanäle und mit Endgeräten mit unterschiedlichen Hard- und Softwarespezifikationen zugreifen kann, **dadurch gekennzeichnet**, daß
jeder Content in der Datenbasis genau einmal in Form einer Primär-Videodatei mit maximalem Informationsinhalt gespeichert wird,
bei jedem Zugriff eines Nutzers die Hard- und Softwarespezifikation von dessen Endgerät und des Datenkanals zu diesem erfaßt und das Erfassungsergebnis einem Steuereingang eines Dateianpassungsrechners zugeführt,
im Dateianpassungsrechner in Echtzeit oder schneller als Echtzeit die Primär-Videodatei in eine an die Hard- und Softwarespezifikation angepaßte Sekundär-Videodatei umgerechnet und
die Sekundär-Videodatei ohne Endspeicherung in der Datenbasis im wesentlichen in Echtzeit an das Endgerät übermittelt wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Nutzerzugriffe über ein IP-Netz erfolgen und die Erfassung der Hard- und Softwarespezifikation das Auslesen von nutzerseitig bereitgestellten Informationen über eine Serverumgebung auf der Basis eines Standardprotokolls, insbesondere über eine HTTP-Server-Umgebung, erfolgt.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß als Hard- und Softwarespezifikationen die maximale stabil erreichbare Datenrate bzw. Übertragungsbandbreite für die Übertragung zum Nutzer erfaßt wird.

4. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß als Hard- und Softwarespezifikation die Art des Prozessors und/oder Betriebssystems und/oder Browsers des Endgerätes des Nutzers erfaßt wird.

5. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß bei jedem Zugriff eine für dessen Dauer gültige, die Hard- und Softwarespezifikation reflektierende Nutzer-ID vergeben wird, über die ein Speicherbereich eines Programmspeichers des Datenanpassungsrechners zum Auslesen eines gespeicherten Anpassungsalgorithmus adressiert wird.

6. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Übertragung über eine von mehreren, jeweils an eine Hard- und Softwarespezifikation angepaßten Schnittstellen erfolgt, welche anhand des Erfassungsergebnisses, insbesondere durch Adressierung einer Auswahleinrichtung mit der Nutzer-ID, ausgewählt wird.

7. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß Schnittstellen für die Datenbasisanbindung über ODBC-, JDBC-, SQL-, Perl- und PHB-Umgebungen realisiert werden.

8. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Umrechnung der Primär-Videodatei in die Sekundär-Videodatei im wesentlichen hardwarebasiert ausgeführt wird.

9. Verfahren nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß
die Primär-Videodatei vor der Umrechnung in einen ersten Pufferspeicher eingelesen wird,
ein Demultiplexen der Komponenten der Primär-Videodatei in Video- und Audiodaten, Untertitel und dergleichen ausgeführt wird,
aus der Pufferspeicher-Kopie ausgewählte Daten des Systemstreams, insbesondere Bewegungsvektoren, Farbskalenwerte und/oder Zeitmarken extrahiert werden,
die extrahierten Daten auf die erfaßte Hard- und Softwarespezifikation umgerechnet werden,
die Video- und Audiodaten, insbesondere unter Wiederverwendung ausgewählter Komponenten der Primär-Videodatei, skaliert werden,
ein Multiplexen der skalierten und gegebenenfalls wiederverwendeten Komponenten, insbesondere unter Erstellung neuer Zeitmarken, zur Sekundär-Videodatei ausgeführt und diese in einen zweiten Pufferspeicher eingelesen wird und
die Kopie der Primär-Videodatei im ersten Pufferspeicher gelöscht wird.

10. Digitales Mediendistributionssystem, insbesondere zur Durchführung des Verfahrens nach einem der vorangehenden Ansprüche, mit einer Datenbasis zur Speicherung von als Videodateien ausgebildeten Contents und einem Server zur Verwaltung der Datenbasis zur Realisierung von Zugriffen durch eine Mehrzahl von Nutzern, dadurch gekennzeichnet, daß
die Datenbasis genau eine Primär-Videodatei jedes Contents enthält und
eine Erfassungseinrichtung zur Erfassung der jeweiligen Hard- und Softwarespezifikation des Endgerätes eines auf die Datenbasis zugreifenden Nutzers und des Datenkanals zu diesem sowie
ein über einen Steuereingang mit dem Ausgang der Erfassungseinrichtung verbundener Dateianpassungsrechner zur Umrechnung einer Primär-Videodatei, auf die ein Nutzer einen Zugriff wünscht, in eine an die Hard- und Softwarespezifikation seines Endgerätes und Datenkanals angepaßte Sekundär-Videodatei im Ansprechen auf das Erfassungsergebnis der Erfassungseinrichtung vorgesehen ist.

11. Mediendistributionssystem nach Anspruch 10, dadurch gekennzeichnet, daß die Erfassungseinrichtung in einer HTTP-Server-Umgebung realisiert ist.

12. Mediendistributionssystem nach Anspruch 10 oder 11, dadurch gekennzeichnet, daß zwischen die Erfassungseinrichtung und den Dateianpassungsrechner eine ID-Zuweisungseinrichtung zur Vergabe einer die Hard- und Softwarespezifikation reflektierenden, für die Dauer des Zugriffs gültigen Nutzer-ID bei jedem Zugriff geschaltet ist, deren Ausgang mit einem Programmspeicher des Dateianpassungsrechners verbunden ist derart, daß mit der Nutzer-ID ein Speicherbereich desselben zum Auslesen eines gespeicherten konkreten Anpassungsalgorithmus adressierbar ist.

13. Mediendistributionssystem nach einem der Ansprüche 10 bis 12, gekennzeichnet durch eine Mehrzahl von jeweils an eine Hard- und Softwarespezifikation angepaßter Schnittstellen und eine mit der Erfassungseinrichtung verbundene Auswahleinrichtung zur Auswahl einer der Schnittstellen im Ansprechen auf das Erfassungsergebnis.

14. Mediendistributionssystem nach einem der Ansprüche 10 bis 13, gekennzeichnet durch ODBC-, JDB-, SQL-, Perl- und PHB-Umgebungen realisierte Schnittstellen für die Datenbasisanbindung.

15. Mediendistributionssystem nach einem der Ansprüche 10 bis 14, dadurch gekennzeichnet, daß der Dateianpassungsrechner mit dem Server integriert ausgeführt ist.

16. Mediendistributionssystem nach einem der Ansprüche 10 bis 14, dadurch gekennzeichnet, daß der Dateianpassungsrechner und der Server als logisch und physikalisch getrennte Rechnereinheiten ausgeführt sind.

17. Mediendistributionssystem nach einem der Ansprüche 10 bis 16, gekennzeichnet durch das Vorsehen einer Mehrzahl von Dateianpassungsrechnern, die insbesondere in Cluster-Lösungen zusammenwirken.

18. Mediendistributionssystem nach einem der Ansprüche 10 bis 17, dadurch gekennzeichnet, daß der oder jeder Dateianpassungsrechner in eine Mehrzahl von einzelnen Rechnereinheiten aufgeteilt ist.

19. Mediendistributionssystem nach einem der Ansprüche 10 bis 18, dadurch gekennzeichnet, daß der oder jeder Dateianpassungsrechner zwei Pufferspeicher zur Zwischenspeicherung von Primär-Videodateien bzw. Sekundär-Videodateien sowie einen Demultiplexer zum Separieren von Audio-, Video- und weiteren Komponenten von Primär-Videodateien sowie einen Multiplexer zum Zusammenführen von umgerechneten Video-, Audio- und weiteren Komponenten zu einer Sekundär-Videodatei im Zusammenhang mit der Umrechnung von Primär-Videodateien in Sekundär-Videodateien aufweist.

Hierzu 8 Seite(n) Zeichnungen

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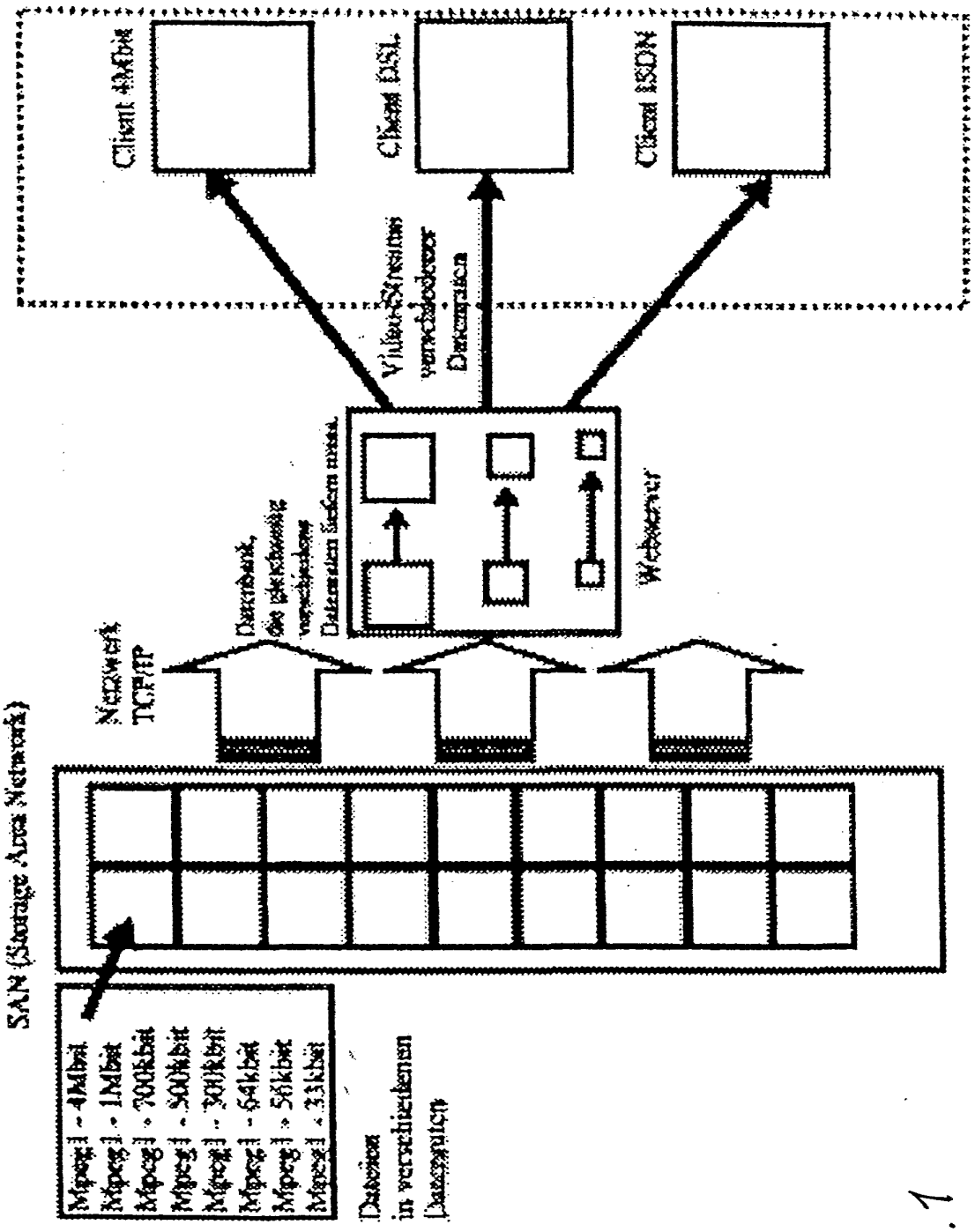


Fig. 1

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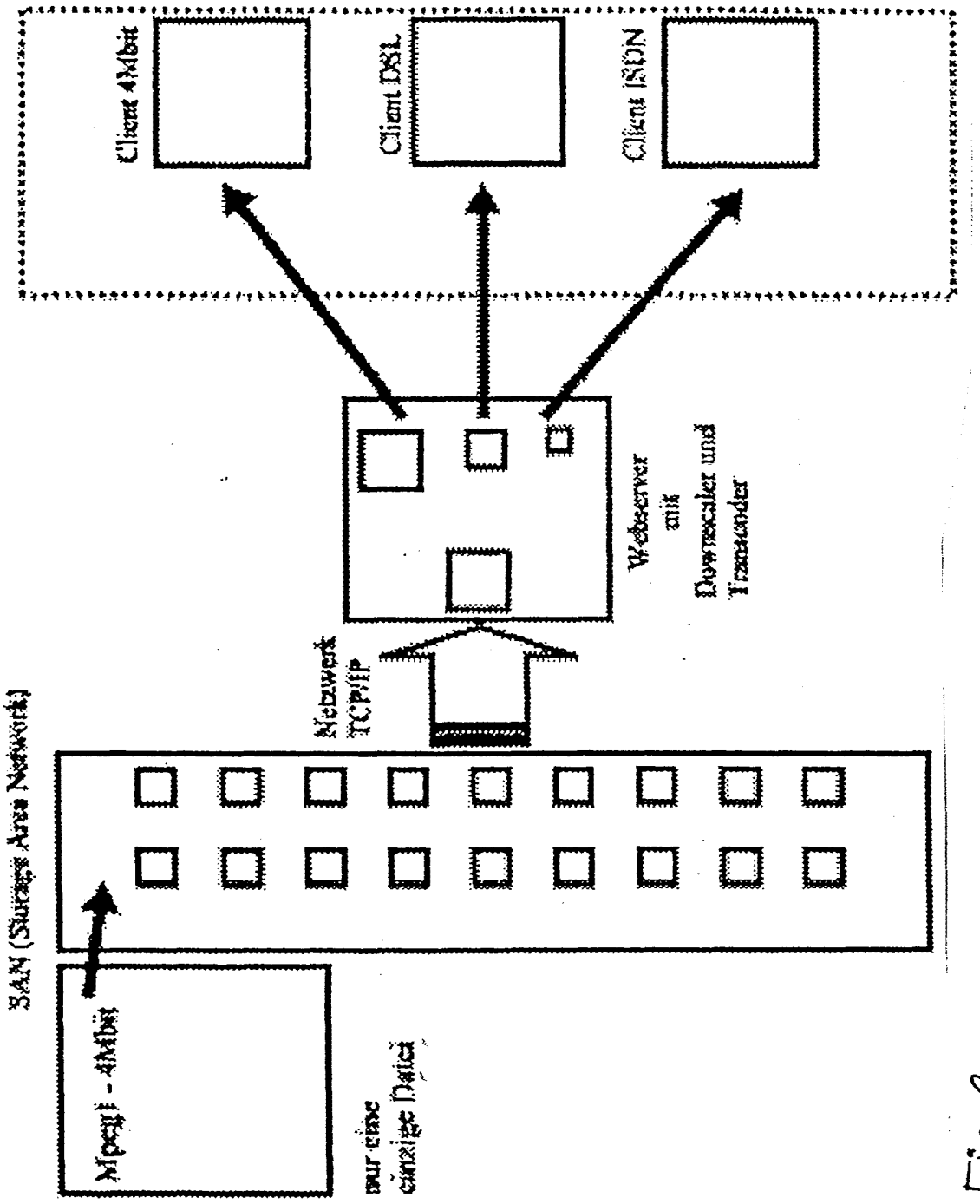


Fig. 2

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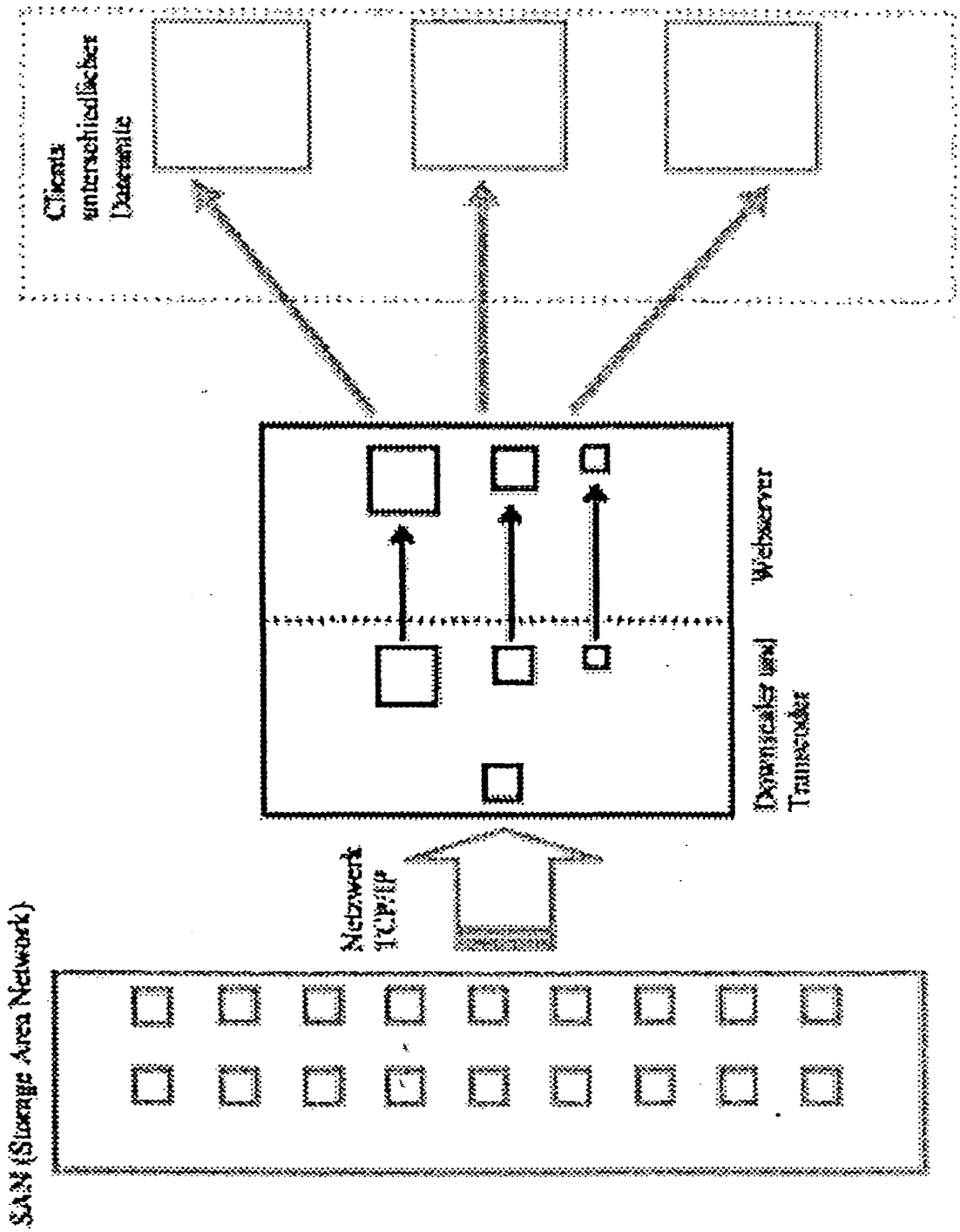


Fig. 3

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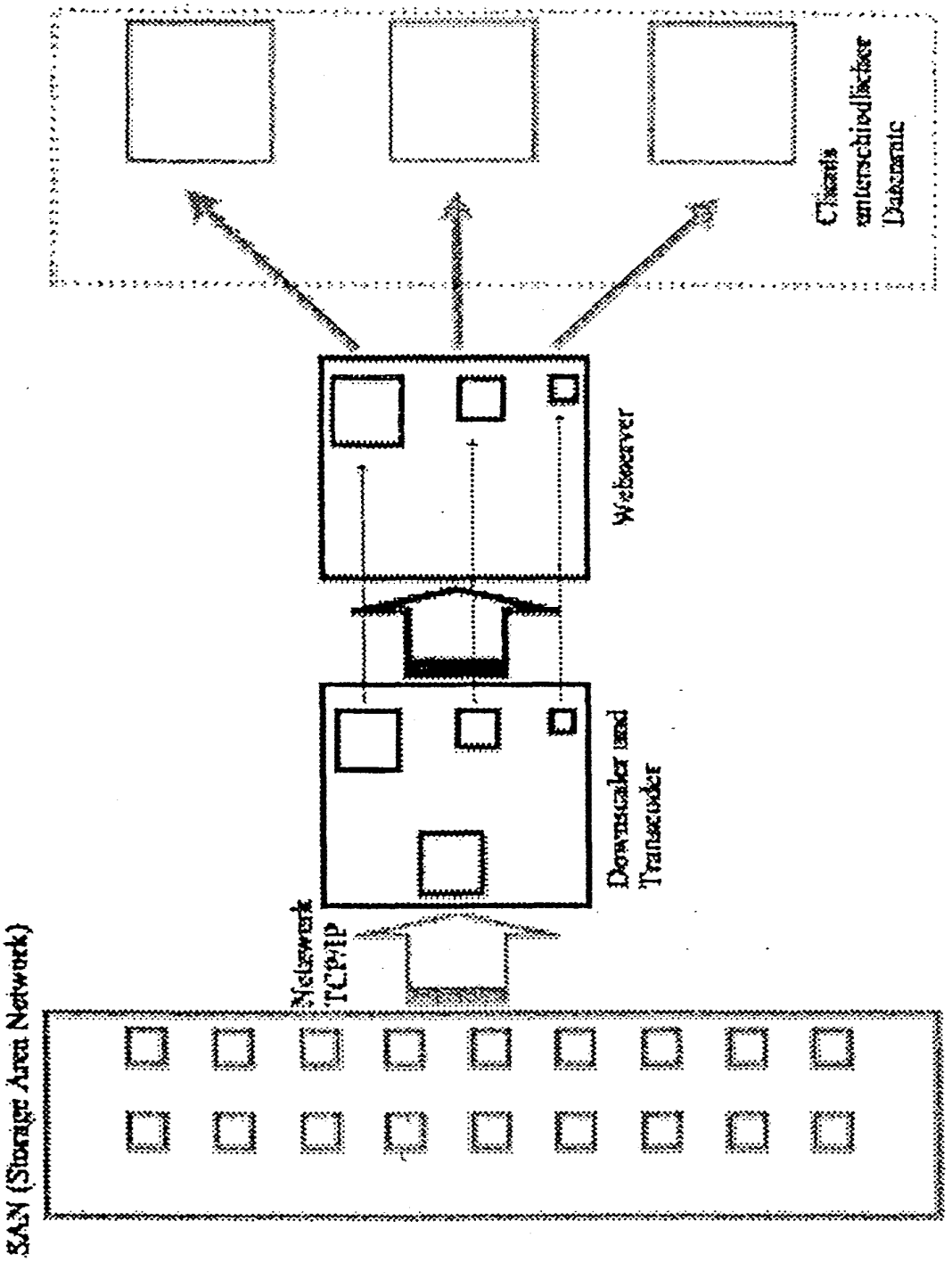


Fig. 4

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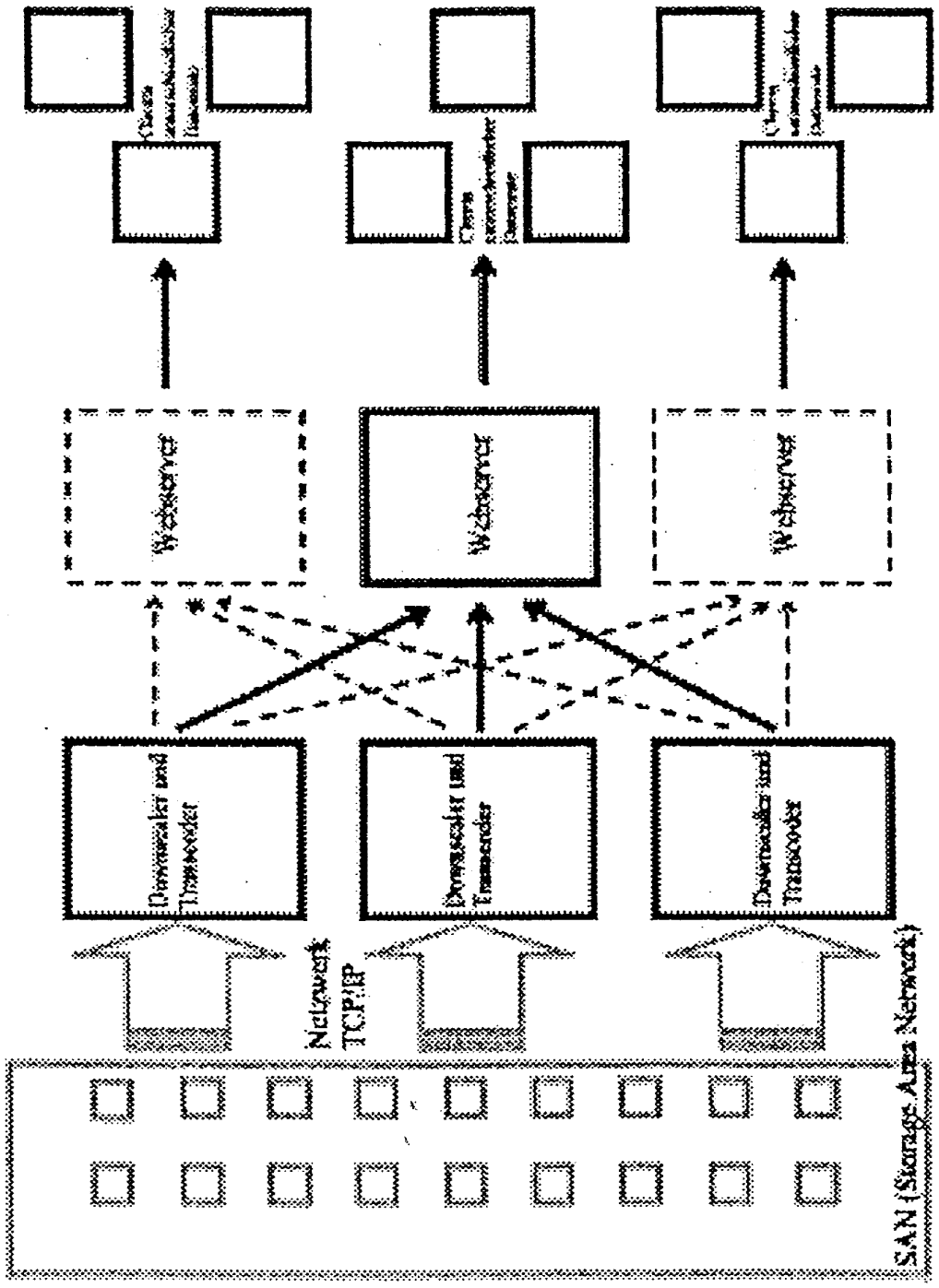


Fig. 5

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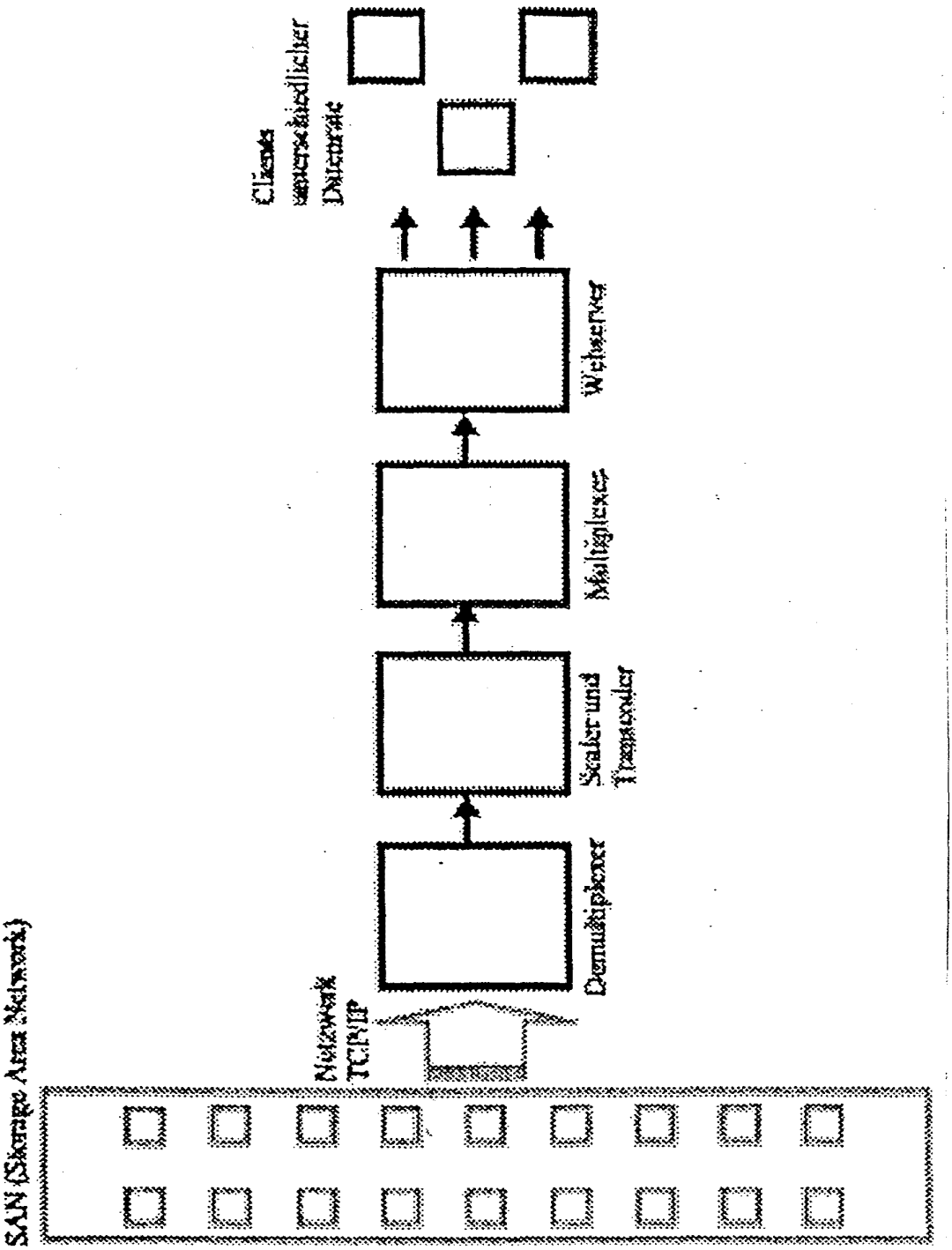


Fig. 6

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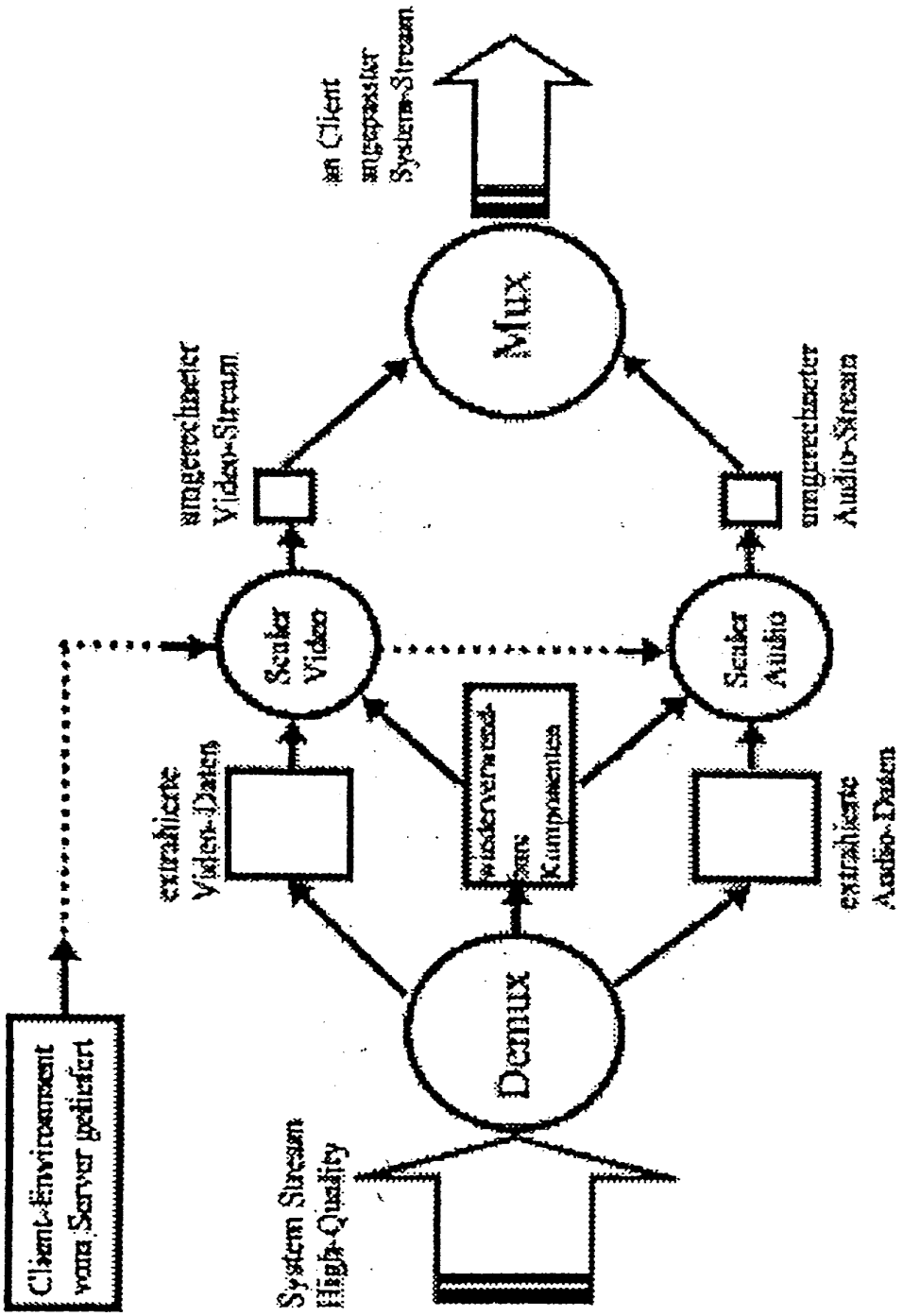


Fig. 7

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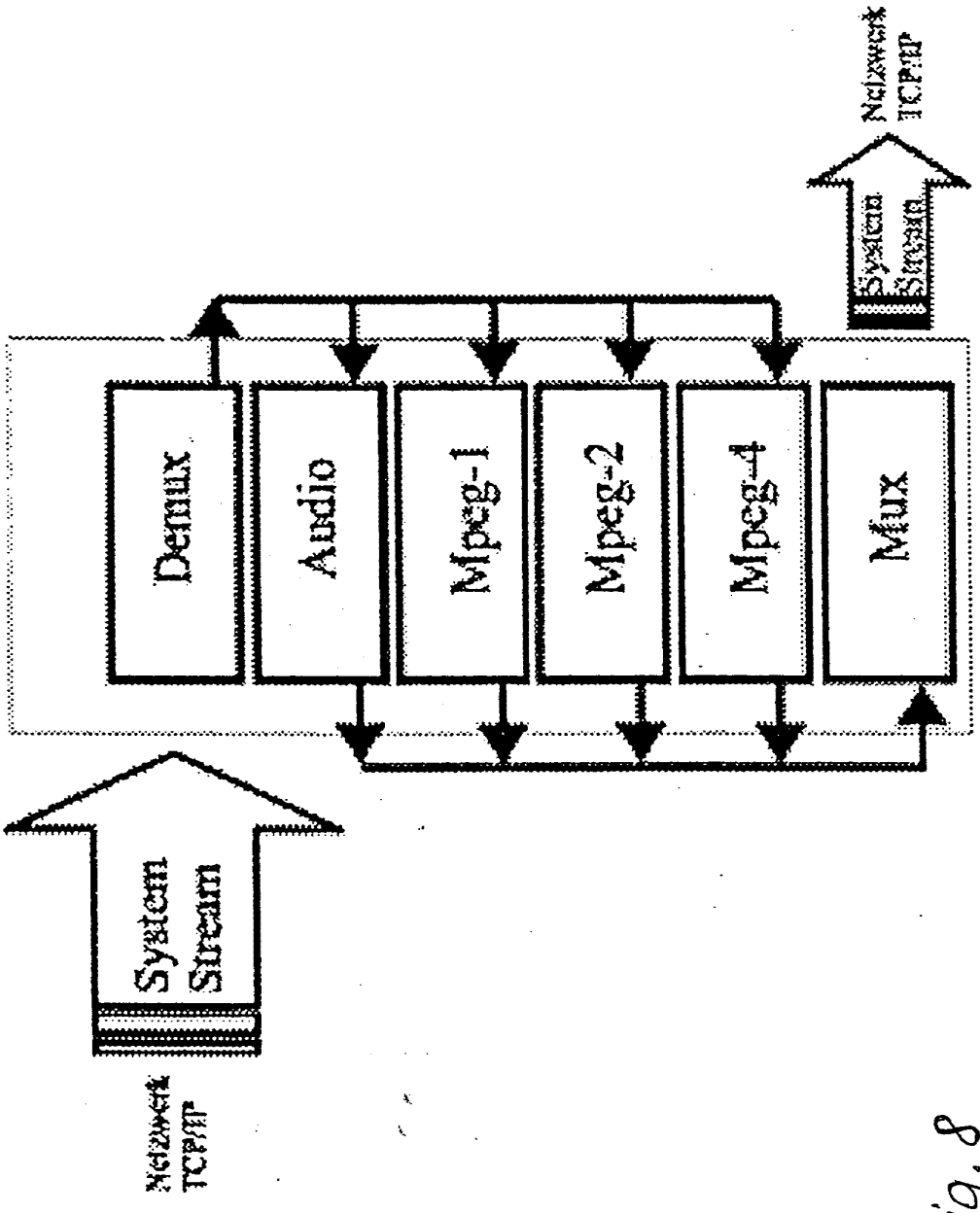


Fig. 8

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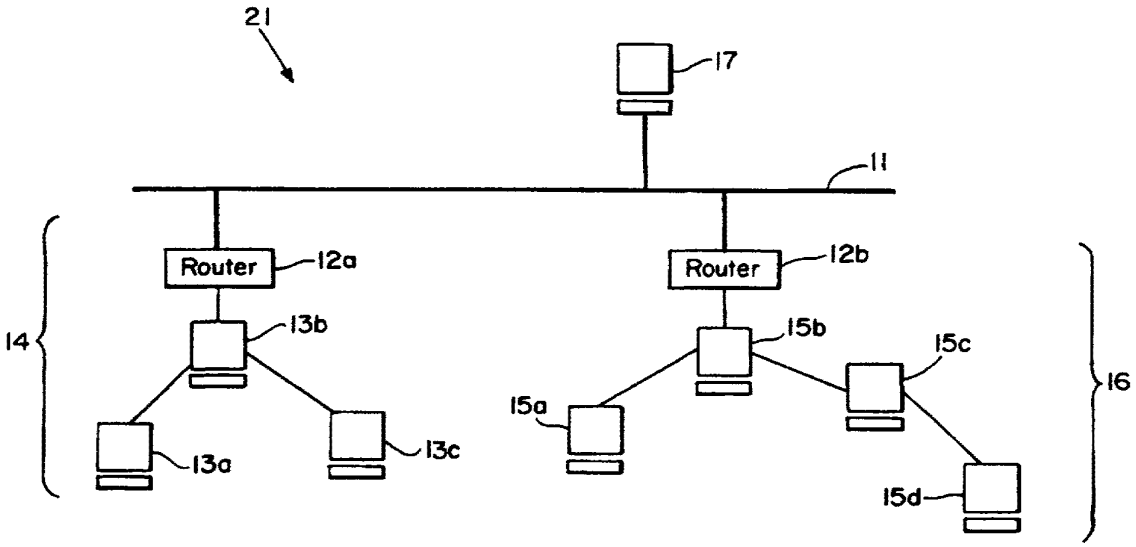
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(54) Title: COMPUTER METHOD AND APPARATUS FOR OBJECT STREAMING



(57) Abstract

In a distributed computing environment, a data stream is formed of a sequence of requested objects. The defined order of the sequence of objects is determined from a client request for data. The order may be a default order, or, alternatively, the server may track client criteria to determine the order. For example, the server (17) may track objects previously transmitted in the stream to the client (13) such that there is no duplication of objects. In other instances, the server may select an object from a class of objects, depending upon object quality, bandwidth, client location, and other client-specific criteria. The server compiles and transmits the object data stream in real-time (on-the-fly) based on the criteria. Buffering of data with pausing to rectify buffer debt is provided by the client.

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COMPUTER METHOD AND APPARATUS FOR OBJECT STREAMING

REFERENCE TO CO-PENDING APPLICATION

This application claims the benefit of a United States Provisional Application Serial No. 60/018,256 filed May 24, 1996.

BACKGROUND

"Distributed computing" makes use of a computer network formed out of one or more computers loosely coupled together to allow processes on different computers to communicate with each other and to provide services for each other. One of the most common paradigms of distributed computing is known as the "client-server model", in which consumers of services are called "clients", and make requests of service providers, called "servers".

In object oriented distributed computing, there is a notion of computer entities called "objects". Each object comprises a particular state and a set of defined behaviors. The state is represented by data maintained by the object. The behavior is specified in terms of operations that the object can perform with the operations, typically realized by executable code. Conceptually, the data and the code are inextricably bound together in the object. Objects may be "persistent", that is, they may continue to exist even though they are inactive or the computer on which they exist has failed or has been turned off. Further, objects may issue requests for services to other objects as well as supply services.

Typically, data is held in linear files on a server. When a client requests that data or a part thereof, a connection is formed between the data source (server) and delivery (client) point.

In the prior art there are in general two different types of servers. The first, known as a web server, typically stores data files of a number of different types. Web servers typically communicate with clients over a network such as the Internet using the well known TCP/IP protocol. The second type of server, known as a streaming media server, stores and transmits media files of various types.

More particularly, the web servers presently in use typically store data files in a format known as Hyper Text Markup Language(HTML). HTML permits the web servers to handle container files which reference other files of varying formats. Using HTML, a given web document may include content information in various formats and may also refer to other files by including reference information known as a Uniform Reference Locator (URL). URL's specify the location of remote servers at which files referenced in the HTML file may be located.

Upon receipt of an HTML file from the original web server, a client then must access each document referenced from its source. Each such request typically requires a full cycle of communication with a remote server, including opening a connection socket with the remote server, requesting that the file be transferred, waiting for the file to download, closing the connection, and then, finally parsing the file. To render a given web page may therefore require many such cycles.

The other type of server, known as a streaming media server, has been developed to be particularly suited for multimedia of various types. Such servers may handle single data types, such as a RealAudio™ file, or may

include mixed media types, in formats such as NetShow™ (RealAudio™ is a trademark of Progressive Networks, Inc., and NetShow™ is a trademark of Microsoft Corporation). In any event, media files are typically laid out in a linear fashion in a single file. Thus, when the client requests a file from a streaming server, a socket is simply opened and delivery of data is begun.

The client may perform a caching or buffering operation prior to actual play back of the media file. This ensures that the media file is played back to the user of the client computer in a continuous stream. In particular, the client may calculate in advance an amount of data that it must have on hand prior to actually beginning to render the media file, so that the user has an impression of continuous delivery of the media.

In such a linear streaming server, files may be formatted in advance with a specific communication transfer bandwidth in mind. For example, a Real Audio file may have been compressed for receipt at a baud rate such as 14.4 kilo bits per second (kbps). Another file would be made available for optimum playback at 28.8 kbps. These different file formats provide for allowances in playing back data such that it is rendered in a continuous fashion at the respective rates.

In streaming media server, the connection remains open with the server during the full duration of the play back of the file. Thus, for example, even on a high speed network connection such as a T1 line, if the media file is a ten minute audio file, then the connection will remain open for ten minutes, even though the available information transfer rate on a T1 line is much greater than the audio bandwidth.

In addition, one other disadvantage of streaming media servers is that they typically implement a lossy type of compression algorithm. Thus, if network traffic increases