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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1

CONFIRMATION NO. 7292

44367
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

POWER OF ATTORNEY NOTICE

OC000000093859436

Date Mailed: 09/04/2025

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/19/2025.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sltorres/

Pinterest Ex. 1004 Page 1 of 371

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1

CONFIRMATION NO. 7292

196949
Kudelski Group & MAIER & MAIER, PLLC
345 SOUTH PATRICK STREET
ALEXANDRIA, VA 22314

POA ACCEPTANCE LETTER

OC000000093859446

Date Mailed: 09/04/2025

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/19/2025.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/sltorres/

UNITED STATES
PATENT AND TRADEMARK OFFICE

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

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/645,598	**08/19/2025 01:43:51 PM Z ET**	**2050.354US1**

Title of Invention

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	11184652
CONFIRMATION #	7292	FILED BY	Mark Gambriel
PATENT CENTER #	71921106	FILING DATE	03/09/2020
CUSTOMER #	44367	FIRST NAMED INVENTOR	Amarendra N. Gogoi
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Michael Casey

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
P-18-p354-US_POA.pdf	2	Power of Attorney	339 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
P-18-p354-US_POA.pdf	9979F2F9B8595FFA655441051DA5CE753499F847867DD1085B 998455383DF0B5C3C1CAEBF58568B1D4CB7D42B7C14A7D49 8A50A9785C733EFB0ADE25DDFF0E34

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
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.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/645,598
Filing Date	March 9, 2020
First Named Inventor	Amarendra N. Gogoi
Title	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
Art Unit	2485
Examiner Name	STEFAN J GADOMSKI
Attorney Docket Number	18050055US1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Michael R. Casey/	Date (Optional)	
Name	Michael R. Casey	Registration Number	40294
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 09/30/2025. OMB 0651-0035
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

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 196949

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

OpenTV, Inc.

☐ Inventor or Joint Inventor (title not required below)
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	October 25, 2024
Name	Cheryl Franke		
Title	Patent Attorney		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of 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 0651-0035. Public burden for this form is estimated to average 3 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.** If filing this completed form by mail, 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.

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	11/23/2021	11184652	2050.354US1	7292

44367 7590 11/03/2021

SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

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

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

OpenTV, Inc., San Francisco, CA;

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Amarendra N. Gogoi et al.	Examiner: Stefan Gadomski	
Serial No.:	16/645,598	Group Art Unit: 2485	
Filed:	March 9, 2020	Docket No.: 2050.354US1	
Customer No.:	44367	Confirmation No.: 7292	
Title:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION		

COMMUNICATION RE: FEE ADDRESS

Mail Stop Issue Fee
Commissioner for Patents
P.O.Box 1450
Alexandria, VA 22313-1450

In response to the Notice of Allowance and Issue Fee Due, please record the Fee Address under the provisions of 37 CFR 1.363 as the following:

Customer Number 44367

Please direct any inquiries to the undersigned attorney at (408) 278-4057.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(408) 278-4057

Date October 21, 2021 By /Susan Yee/
Susan Yee
Reg. No. 41,388

SY:CMG:clj1

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 21st day of October, 2021.

CaTina Jensen	/CaTina Jensen/
Name	Signature

Electronic Patent Application Fee Transmittal

Application Number:	16645598
Filing Date:	09-Mar-2020
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Filer:	Joseph Juilin Wang/CaTina Jensen
Attorney Docket Number:	2050.354US1

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

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

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

Electronic Acknowledgement Receipt	
EFS ID:	44084568
Application Number:	16645598
International Application Number:	
Confirmation Number:	7292
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Customer Number:	44367
Filer:	Joseph Juilin Wang/CaTina Jensen
Filer Authorized By:	Joseph Juilin Wang
Attorney Docket Number:	2050.354US1
Receipt Date:	21-OCT-2021
Filing Date:	09-MAR-2020
Time Stamp:	08:45:46
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1200
RAM confirmation Number	E20210K946094282
Deposit Account	190743
Authorized User	CaTina Jensen
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.21 (Miscellaneous fees and charges) 37 CFR 1.20 (Post Issuance fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.492(a) (Basic national fee only)

37 CFR 1.17 (Patent application and reexamination processing fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2050354US1_IFEE.pdf	308545 f0709a55d8fde59010dc878c690e48d897ff8ec3	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Issue Fee Payment (PTO-85B)	2	2
	Miscellaneous Incoming Letter	3	3

Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38246 2ad6ca86966b453326b67f54a4173d48fb03bce5	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	346791		

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

Inventor(s): Amarendra N. Gogoi et al.
Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Docket No.:	2050.354US1	Serial No.:	16/645,598
Filed:	March 9, 2020	Due Date:	October 21, 2021
Examiner:	Stefan Gadomski	Group Art Unit:	2485
Customer No.:	44367	Confirmation No.:	7292

Notice of Allowance Date: July 21, 2021

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the following:

X Issue Fee Transmittal (Form PTOL-85) (1 pg.)
X Communication Re: Fee Address (1 pg.)

X Authorization to charge Deposit 19-0743 in the amount of $1,200.00 to cover the Large Entity Issue Fee Payment.

Please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A. By /Susan Yee/
Customer No.: 44367 Susan Yee
SY:CMG:clj1 Reg. No. 41,388

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Issue Fee, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 21st day of October, 2021.

CaTina Jensen /CaTina Jensen/
Name Signature

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

44367 7590 07/21/2021
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

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.

CaTina Jensen	(Typed or printed name)
/CaTina Jensen/	(Signature)
October 21, 2021	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1	7292

TITLE OF INVENTION: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

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	10/21/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
GADOMSKI, STEFAN J	2485	375-240010

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

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

☒ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

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

1 SCHWEGMAN LUNDBERG &
2 WOESSNER, P.A.
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: OPENTV, INC.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): SAN FRANCISCO, CALIFORNIA

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

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

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

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 19-0743

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature /Susan Yee/ Date October 21, 2021

Typed or printed name SUSAN YEE Registration No. 41,388

Pinterest Ex. 1004 Page 15 of 371

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

44367 7590 07/21/2021

SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

EXAMINER	
GADOMSKI, STEFAN J	
ART UNIT	PAPER NUMBER
2485	

DATE MAILED: 07/21/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1	7292

TITLE OF INVENTION: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

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	10/21/2021

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

Pinterest Ex. 1004 Page 16 of 371

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

44367 7590 07/21/2021
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1	7292

TITLE OF INVENTION: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

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	10/21/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
GADOMSKI, STEFAN J	2485	375-240010

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

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

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

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

1_____
2_____
3_____

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

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

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

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

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

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Pinterest Ex. 1004 Page 17 of 371

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1	7292

44367 7590 07/21/2021

SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

EXAMINER	
GADOMSKI, STEFAN J	

ART UNIT	PAPER NUMBER
2485	

DATE MAILED: 07/21/2021

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/645,598	Applicant(s) Gogoi et al.	
	Examiner STEFAN GADOMSKI	Art Unit 2485	AIA (FITF) Status Yes

-- 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 filed 06/22/2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

3. ☑ The allowed claim(s) is/are 1-20 . 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 _____.
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 _____.

/STEFAN GADOMSKI/
Examiner, Art Unit 2485

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

2. Applicant's arguments, see page 8, filed 04/07/2021, with respect to the 101 rejection have been fully considered and are persuasive. The claims have been amended to recite a machine-storage medium; the specification is specific in that machine-storage mediums exclude carrier waves, modulated data signals and other such media. The 101 rejection has been withdrawn.

3. Applicant's arguments, see pages 8-11, filed 04/07/2021, with respect to the 103 rejections have been fully considered and are persuasive.

Examiner concurs the presented prior art fails to disclose or suggest the amended claim language. Specifically, independent claims 1, 6, and 11 have been amended to specify the first rate is a bitrate adapted for playback of the first piece of content, transitioning from ongoing playback to a new piece of content, and detecting if the new piece of content can maintain playback at the first adapted bitrate during playback of the new piece of content using the first bitrate. Previously presented reference Orr's bitrate is pre-described and transitions to a new piece of content after the first is completed. Further, previously presented reference Shintani determines a codec mode during configuration of a piece of content, not during playback of a

piece of content as required by the amended claims. An updated search did not result in a reference that would, individually or in combination with the presented prior art, disclose the language of independent claims 1, 6, and 11. Dependent claims 2-5, 7-10, and 12-20 fall together accordingly. The prior art fails to disclose adapting a first bitrate for playback of a first piece of content, using the first adapted bitrate for new content after a transition caused by receiving a selection, using and maintaining the first bitrate for playback of the new content while a detection is performed to determine if the new piece of content can maintain the first bitrate and adjusting the first bitrate in response to the new piece of content unable to maintain the first bitrate. Overall, the claim language and the Applicant's remarks in response to the most recent Office Action distinguish the Applicant's invention over the cited references. The various claimed limitations are not taught or suggested by the prior art taken either singly or in combination, with emphasis that it is each claim, taken as a whole, including the interrelationships and interconnection between various claimed elements that make them allowable over the prior art of record. The 103 rejections have been withdrawn. Claims 1-20 are allowed.

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."

Citation of Pertinent Prior Art

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Forman et al. US 2018/0205778 A1 discloses improved playback of media content checking available bandwidth after a content request but before providing playback of the requested content
- Ickin et al. US 2019/0334803 A1 discloses adaptive initial bitrate selection for a video delivery session
- Srinivasan et al. US 2018/0241796 A1 discloses switching between multiple content delivery networks during adaptive bitrate streaming

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEFAN GADOMSKI whose telephone number is (571)270-5701. The examiner can normally be reached on Monday - Friday, 12-8PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. 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 https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

STEFAN GADOMSKI
Examiner
Art Unit 2485

/STEFAN GADOMSKI/
Examiner, Art Unit 2485

Notice of References Cited	Application/Control No. 16/645,598	Applicant(s)/Patent Under Reexamination Gogoi et al.	
	Examiner STEFAN GADOMSKI	Art Unit 2485	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-20110296458-A1	12-2011	Di Mattia; James F.	H04N21/23655	725/36
*	B	US-20100091888-A1	04-2010	Nemiroff; Robert S.	H04N21/4385	375/240.28
*	C	US-20060215760-A1	09-2006	Monaco; Joseph Wilson	H04N21/8456	375/240.16
*	D	US-20190334803-A1	10-2019	Ickin; Selim	H04L65/4092	1/1
*	E	US-20180241796-A1	08-2018	Srinivasan; Mayur	H04L65/4084	1/1
*	F	US-20180205778-A1	07-2018	Forman; Benjamin	H04L65/608	1/1
*	G	US-20120177101-A1	07-2012	van der Schaar; Auke Sjoerd	H04N19/30	375/240.01
*	H	US-20170188072-A1	06-2017	Major; Robert Drew	H04N21/238	1/1
*	I	US-20170070758-A1	03-2017	Phillips; Chris	H04N21/64769	1/1
*	J	US-20170070757-A1	03-2017	Phillips; Chris	H04N21/64738	1/1
*	K	US-20170070551-A1	03-2017	Phillips; Chris	H04L47/781	1/1
*	L	US-20150172352-A1	06-2015	Gopalakrishnan; Vijay	H04L65/4084	709/219
*	M	US-20180375915-A1	12-2018	Sridhar; Kamakshi	H04L65/4084	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	**Art Unit**
	STEFAN GADOMSKI	2485

✓	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	01/02/2021	07/15/2021							
	1	✓	=							
	2	✓	=							
	3	✓	=							
	4	✓	=							
	5	✓	=							
	6	✓	=							
	7	✓	=							
	8	✓	=							
	9	✓	=							
	10	✓	=							
	11	✓	=							
	12	✓	=							
	13	✓	=							
	14	✓	=							
	15	✓	=							
	16	✓	=							
	17	✓	=							
	18	✓	=							
	19	✓	=							
	20	✓	=							

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	**Art Unit**
	STEFAN GADOMSKI	2485

CPC							
Symbol						**Type**	**Version**
H04N	/	21	/	23655		F	2013-01-01
H04L	/	65	/	607		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	
/STEFAN GADOMSKI/ Examiner, Art Unit 2485	15 July 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

U.S. Patent and Trademark Office — Part of Paper No.: 20210706

Pinterest Ex. 1004 Page 27 of 371

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	**Art Unit**
	STEFAN GADOMSKI	2485

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04N21/2365	/	21	/	2365
H04L29/06	/	29	/	06
H04N21/2662	/	21	/	2662

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
375	240.01

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

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/STEFAN GADOMSKI/ Examiner, Art Unit 2485 (Primary Examiner)	15 July 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 3

U.S. Patent and Trademark Office

Part of Paper No.: 20210706

Pinterest Ex. 1004 Page 28 of 371

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	Art Unit
	STEFAN GADOMSKI	2485

☐ 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	1	10	10	19	19										
2	2	11	11	20	20										
3	3	12	12												
4	4	13	13												
5	5	14	14												
6	6	15	15												
7	7	16	16												
8	8	17	17												
9	9	18	18												

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/STEFAN GADOMSKI/ Examiner, Art Unit 2485	15 July 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

U.S. Patent and Trademark Office — Part of Paper No.: 20210706

Pinterest Ex. 1004 Page 29 of 371

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	Art Unit
	STEFAN GADOMSKI	2485

CPC - Searched*		
Symbol	**Date**	**Examiner**
See print out for complete history	01/02/2021	SG
See print out for complete history	07/15/2021	SG

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.

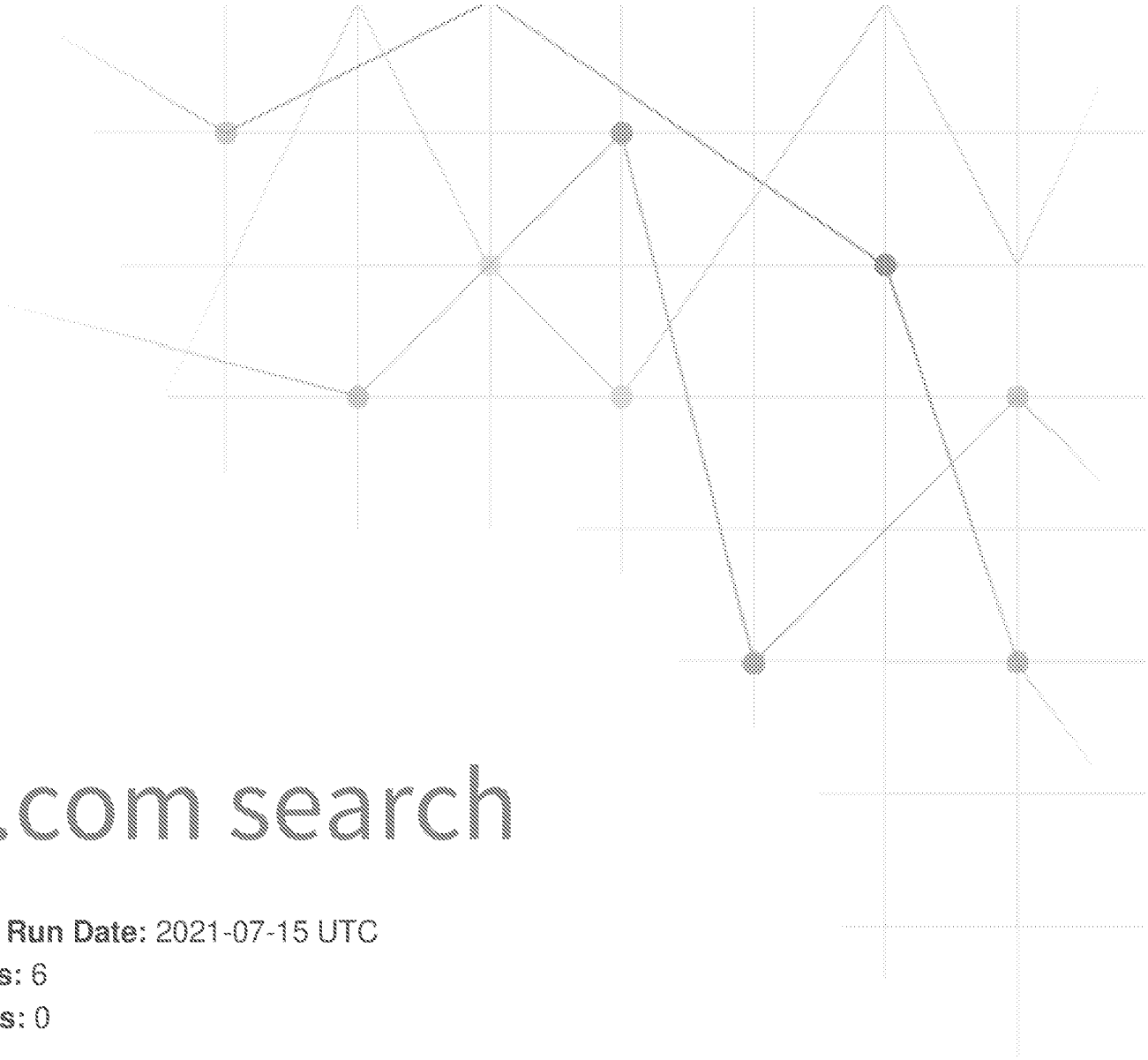
/STEFAN GADOMSKI/ Examiner, Art Unit 2485	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	Art Unit
	STEFAN GADOMSKI	2485

Search Notes		
Search Notes	**Date**	**Examiner**
EAST inventor search limited by a text string, see print out for complete history	01/02/2021	SG
EAST assignee search limited by a text string, see print out for complete history	01/02/2021	SG
EAST text search	01/02/2021	SG
EAST patent number search	01/02/2021	SG
Google Scholar text search	01/02/2021	SG
IP.com text search	01/02/2021	SG
IP.com patent number search	01/02/2021	SG
Review of previously cited prior art	07/15/2021	SG
EAST text search	07/15/2021	SG
Google Scholar text search	07/15/2021	SG
IP.com text search	07/15/2021	SG

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	USPG, UPAD, UPAT databases + claims	07/15/2021	SG

/STEFAN GADOMSKI/ Examiner, Art Unit 2485	



IP.com search

Report Run Date: 2021-07-15 UTC
Queries: 6
Markers: 0

Query #	Timestamp	Results	Page
1	2021-07-15 19:45 UTC	137,056	3
2	2021-07-15 19:49 UTC	137,056	3
3	2021-07-15 19:50 UTC	81,925	4
4	2021-07-15 19:51 UTC	137,056	4
5	2021-07-15 19:51 UTC	137,056	4
6	2021-07-15 19:51 UTC	137,056	4

Content: Patent Publications (164)

US Patents | US Designs | US Applications | EPO Patents | EPO Applications | China Patents | China Applications | Japan Patents | Japan Applications | Korea Patents | Korea Applications | WIPO Applications | Argentina Patents | Argentina Applications | Brazil Patents | Brazil Applications | Canada Patents | Canada Applications | Chile Patents | Chile Applications | Colombia Applications | Costa Rica Applications | Cuba Patents | Cuba Applications | Dominican Republic Applications | Ecuador Patents | Ecuador Applications | El Salvador Applications | Guatemala Applications | Honduras Applications | Mexico Patents | Mexico Applications | Nicaragua Patents | Panama Applications | Peru Applications | Trinidad & Tobago Patents | Uruguay Applications | Austria Patents | Austria Applications | Belarus Patents | Belgium Patents | Belgium Applications | Bosnia & Herzegovina Patents | Bosnia & Herzegovina Applications | Bulgaria Patents | Bulgaria Applications | Croatia Patents | Croatia Applications | Czech Republic Patents | Czech Republic Applications | Czechoslovakia Patents | Czechoslovakia Applications | Denmark Patents | Denmark Applications | Estonia Patents | Estonia Applications | EUIPO Patents | Finland Patents | Finland Applications | France Patents | France Applications | Germany Patents | Germany Applications | Great Britain Patents | Great Britain Applications | Greece Patents | Greece Applications | Hungary Patents | Hungary Applications | Iceland Patents | Iceland Applications | Ireland Patents | Ireland Applications | Italy Patents | Italy Applications | Latvia Patents | Latvia Applications | Lithuania Patents | Lithuania Applications | Luxembourg Patents | Malta Patents | Monaco Patents | Montenegro Patents | Montenegro Applications | Netherlands Patents | Netherlands Applications | Norway Patents | Norway Applications | Poland Patents | Poland Applications | Portugal Patents | Portugal Applications | Republic of Moldova Patents | Republic of Moldova Applications | Romania Patents | Romania Applications | San Marino Patents | San Marino Applications | Serbia Patents | Serbia Applications | Slovakia Patents | Slovakia Applications | Slovenia Patents | Spain Patents | Spain Applications | Sweden Patents | Sweden Applications | Switzerland Patents | Switzerland Applications | Ukraine Patents | Yugoslavia/Serbia and Montenegro Patents | Yugoslavia/Serbia and Montenegro Applications | Armenia Patents | Australia Patents | Australia Applications | Cyprus Patents | Gulf Cooperation Council Patents | Hong Kong Patents | India Patents | India Applications | Indonesia Patents | Indonesia Applications | Israel Applications | Jordan Patents | Kyrgyzstan Patents | Macao Applications | Malaysia Patents | Mongolia Patents | New Zealand Patents | Philippines Patents | Philippines Applications | Saudi Arabia Patents | Singapore Patents | Singapore Applications | Taiwan Patents | Taiwan Applications | Tajikistan Patents | Tajikistan Applications | Thailand Applications | Uzbekistan Patents | Vietnam Patents | Algeria Patents | ARIPO Patents | ARIPO Applications | Egypt Patents | Kenya Patents | Malawi Patents | Morocco Patents | Morocco Applications | OAPI Patents | South Africa Patents | Tunisia Applications | Zambia Patents | Zimbabwe Patents | EAPO Patents | EAPO Applications | Georgia Patents | Georgia Applications | Kazakhstan Patents | Kazakhstan Applications | Russia Patents | Russia Applications | Turkey Patents | Turkey Applications

1 **2021-07-15 19:45 UTC | 137,056 results from**

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

Main Concept: Text
maintain bitrate channel change

Concept Modifiers: None

Filters (1):
Earliest Priority Date: To 2017-09-08

2 **2021-07-15 19:49 UTC | 137,056 results from**

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

Main Concept: Text

maintain bitrate channel switch

Concept Modifiers: None

Filters: Same as Query 1

3 **2021-07-15 19:50 UTC | 81,925 results from**

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

Main Concept: Text
maintain bitrate content switch

Concept Modifiers: None

Filters: Same as Query 1

4 **2021-07-15 19:51 UTC | 137,056 results from**

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

Main Concept: Text
maintain bitrate content change

Concept Modifiers: None

Filters: Same as Query 1

5 **2021-07-15 19:51 UTC | 137,056 results from**

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

Main Concept: Text
keep bitrate content change

Concept Modifiers: None

Filters: Same as Query 1

6 **2021-07-15 19:51 UTC | 137,056 results from**

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

Main Concept: Text
keep bitrate channel change

Concept Modifiers: None

Filters: Same as Query 1

Bibliographic Data

Application No: 16/645,598

Foreign Priority claimed: ◉ Yes ○ No

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

Verified and Acknowledged: /STEFAN GADOMSKI/ Examiner's Signature | Initials

Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/09/2020	375	2485	2050.354US1
RULE			

APPLICANTS

OpenTV, Inc., San Francisco, CA, UNITED STATES

INVENTORS

Amarendra N. Gogoi, Fremont, CA, UNITED STATES

Sanjay Gupta, Bangalore, INDIA

Ravikant Swami, Bangalore, INDIA

CONTINUING DATA

This application is a 371 of PCT/US2018/046723 08/14/2018

FOREIGN APPLICATIONS

INDIA IN201741031917 09/08/2017

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/12/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV

P.O. BOX 2938

MINNEAPOLIS, MN 55402-0938

UNITED STATES

FILING FEE RECEIVED

$1,200

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

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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

Application Number	16645598
Filing Date	2020-03-09
First Named Inventor	Amarendra N. Gogoi
Art Unit	2485
Examiner Name	Stefan Gadomski
Attorney Docket Number	2050.354US1, P-18-p354-US

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]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	2485
	Examiner Name	Stefan Gadomski
	Attorney Docket Number	2050.354US1, P-18-p354-US

	1	"European Application Serial No. 18853974.6, Response filed 03-25-21 to Extended European Search Report mailed 09-29-20", 21 pages.

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

EXAMINER SIGNATURE

Examiner Signature	/STEFAN GADOMSKI/	Date Considered	07/15/2021

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	2485
	Examiner Name	Stefan Gadomski
	Attorney Docket Number	2050.354US1, P-18-p354-US

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	/Susan Yee/	Date (YYYY-MM-DD)	2021-06-21
Name/Print	Susan Yee	Registration Number	41,388

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

Web Search History

date, time	web site	search string
7/15/2021 12:31:23 PM	Google Scholar	[before:2017] maintain bitrate after channel change
7/15/2021 12:31:36 PM	Google Scholar	[before:2017] maintain bitrate channel change
7/15/2021 12:31:49 PM	Google Scholar	[before:2017] keep bitrate channel change
7/15/2021 12:31:56 PM	Google Scholar	[before:2017] keep bitrate after channel change
7/15/2021 12:32:13 PM	Google Scholar	[before:2017] keep bitrate after channel switch
7/15/2021 12:32:32 PM	Google Scholar	[before:2017] keep bitrate after content change
7/15/2021 12:33:14 PM	Google Scholar	[before:2017] keep bitrate after content switch
7/15/2021 12:33:31 PM	Google Scholar	[before:2017] maintain bitrate after content switch
7/15/2021 12:33:46 PM	Google Scholar	[before:2017] maintain bitrate after content change

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S34	2,306	(H04N21/23655).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 10:27
S35	168	S34 AND ((content channel) NEAR5 (switch$3 transition$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 10:29
S36	149	S35 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 10:29
S37	263	S34 AND ((content channel) NEAR5 (chang$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 10:35
S38	237	S37 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 11:22
S39	154	S34 AND (((content channel) NEAR5 (chang$3)) SAME (bit$rate bandwidth))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 11:23
S40	138	S39 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 11:23
S41	698	((adaptive NEAR3 bit$rate) WITH stream$3) SAME ((content channel) WITH (chang$3 switch$3 select$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 11:57
S42	1	S41 AND (preserv$4 WITH previous$2 WITH bit$rate)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2021/07/07 11:58

			EPO; JPO; DERWENT; IBM_TDB			
S43	140	S41 AND (previous$2 WITH bit$rate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 12:02
S44	79	S41 AND (previous$2 NEAR5 bit$rate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 12:03
S45	50	S44 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 12:03
S46	23	S41 AND (maintain$3 NEAR5 bit$rate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 12:17
S47	7	S41 AND (keep NEAR5 bit$rate)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/07/07 12:25

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L11	0	(bit$rate AND adapt$5 AND select$3 AND new AND ongoing AND maintain$3).CLM.	US-PGPUB; USPAT	OR	ON	2021/07/15 12:07
L12	14	(bit$rate AND adapt$5 AND select$3 AND new AND maintain$3).CLM.	US-PGPUB; USPAT	OR	ON	2021/07/15 12:07
L13	53	(bit$rate AND adapt$5 AND select$3 AND content AND maintain$3).CLM.	US-PGPUB; USPAT	OR	ON	2021/07/15 12:08
L14	22	(bit$rate AND adapt$5 AND select$3 AND content AND maintain$3 AND playback).CLM.	US-PGPUB; USPAT	OR	ON	2021/07/15 12:08
L15	3	(bit$rate AND adapt$5 AND select$3 AND content AND maintain$3 AND ongoing).CLM.	US-PGPUB; USPAT	OR	ON	2021/07/15 12:09

7/15/2021 12:11:10 PM
C:\Users\sgadomski\Desktop\16645598\FAOM_598.wsp

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

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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

Application Number	16645598
Filing Date	2020-03-09
First Named Inventor	Amarendra N. Gogoi
Art Unit	2485
Examiner Name	Stefan Gadomski
Attorney Docket Number	2050.354US1, P-18-p354-US

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	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	2485
	Examiner Name	Stefan Gadomski
	Attorney Docket Number	2050.354US1, P-18-p354-US

	1	"European Application Serial No. 18853974.6, Response filed 03-25-21 to Extended European Search Report mailed 09-29-20", 21 pages.

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

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	2485
	Examiner Name	Stefan Gadomski
	Attorney Docket Number	2050.354US1, P-18-p354-US

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	/Susan Yee/	Date (YYYY-MM-DD)	2021-06-21
Name/Print	Susan Yee	Registration Number	41,388

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:	16645598
Filing Date:	09-Mar-2020
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Filer:	Garrett M. Hall/Clayton Finn
Attorney Docket Number:	2050.354US1
Filed as Large Entity	

Filing Fees for U.S. National Stage under 35 USC 371

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:	43060150
Application Number:	16645598
International Application Number:	
Confirmation Number:	7292
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Customer Number:	44367
Filer:	Garrett M. Hall/Clayton Finn
Filer Authorized By:	Garrett M. Hall
Attorney Docket Number:	2050.354US1
Receipt Date:	22-JUN-2021
Filing Date:	09-MAR-2020
Time Stamp:	21:06:35
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$260
RAM confirmation Number	E20216LL06514283
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	Information Disclosure Statement (IDS) Form (SB08)	16645598_IDS_6-21-2021.pdf	625220 1d05bb759fed6b29059f612cfe749562f9a38e84	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.					
2	Non Patent Literature	0001_2_npl_2050354ep1_e122r4_03252021_f.pdf	3687700 6eb006593e0490b872cef939761bd52ccdae0658	no	21
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30419 bb46ebb09a0b2d44977e268346418e0af8334cf6	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	4343339		

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

Inventors: Amarendra N. Gogoi *et al.* Examiner: Stefan J. Gadomski
Application No.: 16/645,598 Group Art Unit: 2485
Filed: March 9, 2020 Docket No.: 2050.354US1
Confirmation No.: 7292
Title: BITRATE AND PIPELINE PRESERVARION FOR CONTENT PRESENTATION

AMENDMENT & RESPONSE UNDER 37 C.F.R. § 1.111

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

In response to the Non-Final Office Action (*Office Action*) dated January 7, 2021, please enter the following amendments and consider the remarks herein.

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A method comprising:

causing playback, by a digital receiver, of a first piece of content at a first bitrate, the first bitrate being a bitrate adapted for playback of the first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content;

in response to the receiving of the selection, transitioning from ongoing playback of the first piece of content to the new piece of content by initiating playback of the new piece of content using the first bitrate used for playback of the first piece of content; [[;]]

during playback of the new piece of content using the first bitrate, detecting whether the new piece of content can maintain playback at the first bitrate; and

in response to the detecting that the new piece of content cannot continue playback at the first bitrate, adjusting the first bitrate.

2. (Currently Amended) The method of claim 1, further comprising:

determining whether the new piece of content is of a same content type as the first piece of content; and

based on the new piece of content being the same content type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to play back the first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

3. (Currently Amended) The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new piece of content; and

determining whether the audio decoder and the video decoder in the playback pipeline are of the types indicated by the codec information.

4. (Previously Presented) The method of claim 3, further comprising preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

5. (Previously Presented) The method of claim 3, further comprising:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

6. (Currently Amended) A system comprising:

one or more hardware processors; and

a storage device storing instructions that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content at a first bitrate, the first bitrate being a bitrate adapted for playback of the first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content;

in response to the receiving of the selection, transitioning from ongoing playback of the first piece of content to the new piece of content by initiating playback of the new piece of content using the first bitrate used for playback of the first piece of content;

during playback of the new piece of content using the first bitrate, detecting whether the new piece of content can maintain playback at the first bitrate; and

in response to the detecting that the new piece of content cannot continue playback at the first bitrate, adjusting the first bitrate.

7. (Currently Amended) The system of claim 6, wherein the operations further comprise:

determining whether the new piece of content is of a same content type as the first piece of content; and

based on the new piece of content being the same content type as the first piece of content,

determining whether to preserve at least a portion of a playback pipeline used to play back the first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

8. (Currently Amended) The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new piece of content;

determining whether the audio decoder and the video decoder in the playback pipeline are of the types indicated by the codec information.

9. (Previously Presented) The system of claim 8, wherein the operations further comprise preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

10. (Previously Presented) The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

11. (Currently Amended) A machine-~~readable~~ storage medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content, the first bitrate being a bitrate adapted for playback of the first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, transitioning from ongoing playback of the first piece of content to the new piece of content by initiating playback of the new piece of content using

the first bitrate used for playback of the first piece of content;

during playback of the new piece of content using the first bitrate, detecting whether the new piece of content can maintain playback at the first bitrate; and

in response to the detecting that the new piece of content cannot continue playback at the first bitrate, adjusting the first bitrate.

12. (Currently Amended) The machine-~~readable~~ storage medium of claim 11, wherein the operations further comprise:

determining whether the new piece of content is of a same content type as the first piece of content; and

based on the new piece of content being the same content type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to playback the first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

13. (Currently Amended) The machine-~~readable~~ storage medium of claim 12, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new piece of content; and

determining whether the audio decoder and the video decoder in the playback pipeline are of the types indicated by the codec information.

14. (Currently Amended) The machine-~~readable~~ storage medium of claim 13, wherein the operations further comprise preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

15. (Currently Amended) The machine-~~readable~~ storage medium of claim 13, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types

indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

16. (Currently Amended) The method of claim 1, wherein:

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download of the new piece of content is taking less time than anticipated; and

the adjusting comprises increasing the first bitrate.

17. (Currently Amended) The method of claim 1, wherein:

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download of the new piece of content is taking longer than anticipated; and

the adjusting comprises decreasing the first bitrate.

18. (Currently Amended) The system of claim 6, wherein:

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download of the new piece of content is taking less time than anticipated; and

the adjusting comprises increasing the first bitrate.

19. (Currently Amended) The system of claim 6, wherein:

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download is taking longer than anticipated; and

the adjusting comprises decreasing the first bitrate.

20. (Currently Amended) The machine-~~readable~~ storage medium of claim 11 wherein:

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download of the new piece of content is taking less time than anticipated and the adjusting comprises increasing the first bitrate; or

the detecting whether the new piece of content can maintain playback at the first bitrate comprises determining that download is taking longer than anticipated and the adjusting comprises decreasing the first bitrate.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Amarendra N. Gogoi et al.
Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Docket No.:	2050.354US1	Serial No.:	16/645,598
Filed:	March 9, 2020	Due Date:	April 7, 2021
Examiner:	Stefan Gadomski	Group Art Unit:	2485
Customer No.:	44367	Confirmation No.:	7292

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the following attached items (as indicated with an "X"):

X Amendment and Response under 37 C.F.R. § 1.111 (13 pgs.)

If not provided for in a separate paper filed herewith, please consider this a PETITION FOR EXTENSION OF TIME for sufficient number of months to enter these papers and please charge any additional fees or credit overpayment to Deposit Account No. 19-0743. If applicable, any papers or fees supplied herewith are considered to be timely filed pursuant to 37 C.F.R. § 1.7(a), the response period falling on a Federal Holiday, Saturday or Sunday being extended to the next succeeding business day.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer No.: 44367

By: /Susan Yee/
Susan Yee
Reg. No. 41,388

REMARKS

This communication responds to the *Office Action* dated January 7, 2021. Although the undersigned believes the previously pending claims defined over the cited art, the undersigned has nonetheless amended claims 1-3, 6-8, and 11-20 for clarity and to advance prosecution. No claims are canceled or added. As a result, claims 1-20 remain pending in this application.

Request for Telephonic Interview

If the present remarks do not result in allowance of all claims and the Examiner believes a conference would help advance prosecution, the undersigned is available, before issuance of any further Office Action, for a telephonic interview to be held between the Examiner and the undersigned, at the Examiner's convenience. The Examiner is requested to phone the undersigned at (408) 278-4057 to arrange a time for such telephonic interview.

The Rejection of Claims Under § 101

Claims 11-15 and 20 were rejected under 35 U.S.C. § 101 as allegedly being directed to non-statutory subject matter. Merely to advance prosecution, claims 11-15 and 20 have been amended to recite a "machine-storage medium." As discussed in the as-filed Application, a machine-storage medium "specifically exclude carrier waves, modulated data signals, and other such media."[1] As such, the undersigned requests Examiner to withdraw the rejection under 35 U.S.C. § 101.

The Rejection of Claims Under § 103

Claims 1-15 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over *Orr* (U.S. Patent Publication No. 2011/0296047) in view of Shintani *et al.* (U.S. Patent Publication No. 2017/0244924; *Shintani*[2]). The basis for an obviousness rejection is grounded in a consideration of all claim elements. "All words in a claim must be considered in judging the patentability of that claim against the prior art."[3] Additionally, to render the claimed subject matter obvious, the prior

[1] As-filed Application at [0047].
[2] The *Office Action* indicated Blanchard, who is the second named inventor.
[3] *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). *See also* MPEP § 2143.03.

art references must teach or suggest every feature of the claims.[4] The undersigned will show that the cited references, singly or in combination, fail to teach or suggest all limitations of the present claims.

For example, amended claim 1 recites

> causing playback, by a digital receiver, of a first piece of content at a first bitrate, **the first bitrate being a bitrate adapted for playback of the first piece of content**;
>
> receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content;
>
> in response to the receiving of the selection, **transitioning from ongoing playback of the first piece of content to the new piece of content** by initiating playback of the new piece of content using the first bitrate used for playback of the first piece of content;
>
> **during playback of the new piece of content using the first bitrate, detecting whether the new piece of content can maintain playback at the first bitrate**; and
>
> in response to the detecting that the new piece of content cannot continue playback at the first bitrate, adjusting the first bitrate.[5]

Each of independent claims 6 and 11 recite similar claim language as that emphasized above with respect to claim 1. Therefore, the following remarks apply to all of the independent claims.

In rejecting the limitations directed to causing playback of the first piece of content and initiating playback of the new piece of content using the first bitrate, the *Office Action* relied on various paragraphs of *Orr*. While, *Orr* is directed to seamless playback of media, this is performed by converting the media files to a standard file format and playing the media file at "pre-described audio characteristics (e.g., bit depth, bit rate, etc.)"[6] of the media player application. As such, the bitrate used in *Orr* is a pre-described bitrate associated with the media player application and not a first bit rate "adapted for playback of the first piece of content" as recited by claim 1.

---

[4] *See* Manual of Patent Examining Procedure §§ 706.02(j), 2143(A) (2008); MPEP § 2142 (2006) (citing *In re Vaeck,* 947 F.2d, 488 (Fed. Cir. 1991). Cited approvingly in *Ex parte* WEN WEN and PATRICIA NG at 7; Appeal No. 2009-000776; decided September 25, 2009.

[5] Emphasis added.

[6] *Orr* at [0033].

Further still, *Orr* transitions to playback of the second media file after the first media file is completed or terminated. *Orr* determines "a time period for pre-loading a second media file during playback of the first media file . . . such as five seconds **prior to the endpoint (e.g., termination) of the first media file**."[7] *Orr* then loads data for the second media file during this time period. Finally, "the application can **initiate playback of the second media file following termination of the first media file**."[8] Thus, *Orr* does not transition while the first piece of content is playing, but waits until the first piece of content is completed or terminated before transitioning. As such, *Orr* does not teach "transitioning from ongoing playback of the first piece of content to the new piece of content" as recited by claim 1.

The *Office Action* concedes that *Orr* fails to teach detecting whether the new content can maintain playback at the first bitrate and adjusting the first bitrate if it cannot continue playback at the first bitrate. Instead, *Shintani* was exclusively relied on to allegedly teach these limitations. However, the cited portions of *Shintani* merely provide that the system tunes to a channel and "identifies the one or more codec modes associated with the channel."[9] In some cases, *Shintani* "processes the metadata to confirm whether the stored information [e.g., codec modes] are accurate either **during or before the reception apparatus 100 configures itself**."[10] After configuration, the reception application then "processes the content for presentation to the user."[11] As such *Shintani* determines the correct codec to use prior to processing the content and thus will adjust any component prior to playback of a new piece of content. Therefore, *Shintani* fails to teach or even suggest "during playback of the new piece of content using the first bitrate, detecting whether the new piece of content can maintain playback at the first bitrate" as recited by claim 1.

The undersigned further notes that there appears to be no discussion of bitrates anywhere in the entirety *Shintani*, let alone adjusting a bitrate in response to detecting, during the playback of the new piece of content using the bitrate, that the new piece of content cannot maintain playback at the bitrate. Therefore, *Shintani* fails to cure the deficiencies of *Orr*.

---

[7] *Id.* at [0034], emphasis added.
[8] *Id.* at [0037], emphasis added.
[9] *Shintani* at [0042].
[10] *Id.*, emphasis added.
[11] *Id.*

For at least these reasons, the scope and content of *Orr* and *Shintani*, even if combined, do not teach or suggest all claimed elements or support rational inferences that one skilled in the art reasonably would be expected to draw to reach all claimed elements. As a result, a determination of obviousness is not established with respect to independent claims 1, 6, and 11 and its dependent claims 35 and 36. Moreover, the dependent claims each are patentable based on limitations recited therein. Thus, the undersigned respectfully requests that these rejections be reconsidered and withdrawn and that the claims be allowed.

Claims 16-20 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over *Orr* and *Shintani* in view of Melnyk *et al.* (U.S. Patent Publication No. 2009/0254657; *Melnyk*). However, each of these claims depends from independent claim 1 that the undersigned asserts is patentable. The cited reference to *Melnyk* fails to supply the elements of the independent claims that were shown above to be missing from *Orr* and *Shintani*. Furthermore, these dependent claims each contains additional patentable subject matter. Consequently, the undersigned respectfully requests that the rejection made under 35 U.S.C. §103(a) with respect to dependent claims 16-20 be reconsidered and withdrawn.

Reservation of Rights

In the interest of clarity and brevity, every assertion made in the Office Action may not have been equally addressed. Silence regarding any such assertion does not constitute any admission or acquiescence. All rights not exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference, are reserved. It is not admitted that any of the cited references or any other references of record are relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, timely objection to such reliance on Official Notice is made, and all rights to request that the Examiner provide a reference or affidavit in support of such assertion, as required by MPEP §

2144.03, are reserved. All rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04, are likewise reserved.

CONCLUSION

The undersigned respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone the undersigned at (408) 278-4057 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402-0938
(612) 373-6900

Date April 7, 2021

By /Susan Yee/

Susan Yee
Reg. No. 41,388

UNITED STATES
PATENT AND TRADEMARK OFFICE

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

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
16/645,598	**04/07/2021 06:24:00 PM ET**	**2050.354US1**

Title of Invention

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	7292	FILED BY	Farah O'Sullivan
PATENT CENTER #	60172728	FILING DATE	03/09/2020
CUSTOMER #	44367	FIRST NAMED INVENTOR	Amarendra N. Gogoi
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Susan Yee

Documents

TOTAL DOCUMENTS: 4

DOCUMENT		PAGES	DESCRIPTION	SIZE (KB)
2050.354US1 OA Response As Filed.pdf		14	-	217 KB
2050.354US1 OA Response As Filed-TRAN.LET.pdf	(1-1)	1	Transmittal Letter	131 KB
2050.354US1 OA Response As Filed-A....pdf	(2-2)	1	Amendment/Req. Reconsideration-After Non-Final Reject	129 KB
2050.354US1 OA Response As Filed-CLM.pdf	(3-8)	6	Claims	113 KB

2050.354US1 OA Response As Filed-REM.pdf	(9-14)	6	Applicant Arguments/Remarks Made in an Amendment	185 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2050.354US1 OA Response As Filed.pdf	F5B61A3AD9F7EDA399931A4895EBAF0E0F4F0C4E4437DF8B71A4A913B22B9F2189C794740AEC69EA7CD572CB274CCE090266701A8AD5B2DD24D5AABD4F4AA2FC
2050.354US1 OA Response As Filed-TRAN.LET.pdf	692AB3EAF540AADCEF70E96696E343608DFBA108BF13A316818DB82A4037AE3ECF74F674B710C0B7891D3084BC267A7B11E2FBAD17187E34221603CBA58E2A01
2050.354US1 OA Response As Filed-A....pdf	0D56D08FDEB759765617D7AE6305A238A846B2EEAB7A18049466CAC878DDA503FF369A3A5E25F89497C4CC70C0CFFF753CC3D636C9106AC08D3FFBBC44CC4F26
2050.354US1 OA Response As Filed-CLM.pdf	2B3117C4A4EB57D55DEF58B62C8A2DD09E19B71B12E969EF0E3130B023C4B214A3FD0DB7E7894973AF0BF768C5AB81786E6B274F39ACF2447BD182BAF7708B37
2050.354US1 OA Response As Filed-REM.pdf	0D674A94DB52AE88C35A893F469ABADDEDF74FB067CC394FC359C43FCE80CEA6FDA909B81DAF7A413E6469B536A4DEF0E44BA89553F3C149557F4695A2A395C9

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/645,598	Filing Date 03/09/2020	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	04/07/2021	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".	/GAIL D WOOTEN/
*** 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1	7292

44367 7590 01/07/2021

SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

EXAMINER	
GADOMSKI, STEFAN J	

ART UNIT	PAPER NUMBER
2485	

NOTIFICATION DATE	DELIVERY MODE
01/07/2021	ELECTRONIC

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

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

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

SLW@blackhillsip.com
uspto@slwip.com

Office Action Summary	**Application No.** 16/645,598	**Applicant(s)** Gogoi et al.	
	Examiner STEFAN GADOMSKI	**Art Unit** 2485	**AIA (FITF) Status** Yes

-- 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 03/09/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

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

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 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) 1-20 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 03/09/2020 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

1.☑ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Priority

2. Receipt is acknowledged of certified copies of papers required by 37 CFR 1.55.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 03/09/2020 and 12/01/2020 were considered by the examiner.

Drawings

4. The drawings were received on 03/09/2020. These drawings are acceptable.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. **Claims 11-15 and 20 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention because the broadest reasonable interpretation of the instant claims in light of the specification encompasses transitory embodiments.**

Claim 11 does not fall within at least one of the four categories of patent eligible subject matter because "machine-readable medium" as claimed, per se do not fit within recognized categories of statutory subject matter. "Machine-readable medium" in light of the supporting disclosure is broad enough to encompass transitory embodiments. Transitory signals are not within one of the four statutory categories (i.e. non-statutory subject matter). *See* MPEP 2106(I); *In re Nuijten*, 500 F.3d 1346, 1357 (Fed. Cir. 2007). However, claims directed toward a non-transitory machine-readable medium may qualify as a manufacture and make the claim patent-eligible subject matter. MPEP 2106(II)(A). Dependent claims 12-15 and 20 fall together accordingly.

Claim Rejections - 35 USC § 103

7. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

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

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective

filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

9. The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. Claims 1-15 are rejected under 35 U.S.C. 103 as being unpatentable over Orr US 2011/0296047 A1, hereafter Orr, in view Shintani et al. US 2017/0244924 A1, hereafter Shintani.

Regarding claim 1, Orr discloses a method *(method and apparatus for seamless playback of media) [title]* comprising:

causing playback, by a digital receiver, of a first piece of content at a first bitrate *(playback at block 410 may include loading a first media file ... playback at pre-described audio characteristics (e.g., bit depth, bitrate, etc.) [0033]*;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content *(selection of a media file by the media player application may be based on one or more sources selected by the user based on one or more*

used preferences…the media player application can select one or more media files based on media file type (e.g., audio video, etc.) [0035];

in response to the receiving of the selection, transitioning to the new piece of content by initiating playback of the new piece of content using, the first bitrate used for playback of the first piece of content *(turning the media application on for playback at pre-described audio characteristics; the buffer portion may be pre-loaded in the time interval between the time period and the end time of the first media file; at block 425 the application can initiate playback of the second media file following termination of the first media file…a seamless transition may be provided for playback wherein data from the second file is played immediately following the first media file without a delay…; Initiating playback of the second media file at block 425 may be based on the media player application that is already on; conversion of media files to a standard file format by the application, media files may be converted to a single audio format, such as 16bit data at 44.1 kHz stereo by the media player application) [0033; 0036; 0037; 0039].*

However, while Orr discloses a method for seamless playback of media, Orr fails to explicitly disclose detecting whether the new content can maintain playback at the first bitrate; and in response to the detecting that the new content cannot continue playback at the first bitrate, adjusting the first bitrate.

Shintani, in an analogous environment, discloses detecting whether the new content can maintain playback at the first bitrate; and in response to the detecting that the new content cannot continue playback at the first bitrate, adjusting the first bitrate *(metadata requirements may specify HDR…or SDR…or different audio codecs;even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100*

configures itself based on the previously indicated one or more codec modes…loads one or more codes) [0022; 0042].

Orr and Shintani are analogous because they are both related to playback of media files. Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to use the codec checking as disclosed by Shintani, with the invention disclosed by Orr, the motivation being motivation being reduce delay [0041].

Regarding claim 2, Orr and Shintani address all of the features with respect to claim 1 as outlined above.

Orr further discloses determining whether the new piece of content is of a same type as the first piece of content *(conversion of media files to a standard file format by the application, media files may be converted to a single audio format, such as 16bit data at 44.1 kHz stereo by the media player application) [0039];* and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to play back the first piece of content *(conversion of media files to a standard file format by the application, media files may be converted to a single audio format, such as 16bit data at 44.1 kHz stereo by the media player application) [0039]*, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder *(processor 300) [0025]*.

Regarding claim 3, Orr and Shintani address all of the features with respect to claim 2 as outlined above.

Shintani further discloses the determining whether to preserve comprises: detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content *(determines one or more codec modes for processing the content provided by the service on that channel) [0040]*; and

determining whether the audio decoder and the video decoder in the playback pipeline are of the types indicated by the codec information *(metadata may identify one or more encoding formats (e.g., audio and/or video encoding formats); table is generated or updated based one the one or more codec modes determines…stores an indication of the one or more codes modes…in associated with the service for future reference; identify one or more codec modes associated with the channel…processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes) [0040; 0041; 0042]*.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to use the codec modes, as disclosed by Shintani, with the invention disclosed by Orr, the motivation being reduce delay [0041].

Regarding claim 4, Orr and Shintani address all of the features with respect to claim 3 as outlined above.

Shintani further discloses preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information *(even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously*

indicated one or more codec modes…loads one or more codes, or performs routing) [0042]. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to use the codec modes, as disclosed by Shintani, with the invention disclosed by Orr, the motivation being reduce delay [0041].

Regarding claim 5, Orr and Shintani address all of the features with respect to claim 3 as outlined above.

Shintani further discloses the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information *(even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes…loads one or more codes, or performs routing) [0042].* It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to use the codec modes, as disclosed by Shintani, with the invention disclosed by Orr, the motivation being reduce delay [0041].

Regarding claims 6-10, claims 6-10 are drawn to a system adapted to implement the method claimed in claims 1-5, and are therefore rejected in the same manner as above. However, the claims also recite one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors to perform operations, which Orr

also teaches *(processor; code segments can be stored in a processor readable medium) [0023; [0024].*

Regarding claims 11-15, machine-readable medium claims 11-15 are drawn to the instructions corresponding to the method claimed in claims 1-5. Therefore, machine-readable medium claims 11-15 correspond to method claims 1-5 and are rejected for the same reasons of unpatentability as used above. However, the claims also recite one or more hardware processors, which Orr also teaches *(processor; code segments can be stored in a processor readable medium) [0023; 0024].*

11. Claims 16-20 are rejected under 35 U.S.C. 103 as being unpatentable over Orr and Shintani further in view of Melnyk et al. US 2009/0254657 A1, hereafter Melnyk.

Regarding claim 16, Orr and Shintani address all of the features with respect to claim 1 as outlined above.

However, while the combination discloses media playback without delay, the combination fails to explicitly disclose the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated; and the adjusting comprises increasing the first bitrate.

Melnyk, in an analogous environment, discloses the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated *(download pattern; network conditions of a streaming*

media network; any number of algorithms can be used to determine the stability critereon) [0074; 0079; 0080]; and

the adjusting comprises increasing the first bitrate *(estimating one or more network conditions of a network…determining an optimal session bitrate based on the estimated or more more network conditions) [abstract]*.

Orr, Shintani and Melnyk are analogous because they are all related to playback of media data. Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to adjust bitrate according to download speed as disclosed by Melnyk, with the invention disclosed by Orr and Shintani, the motivation being achieve good user experience [0011].

Regarding claim 17, Orr and Shintani address all of the features with respect to claim 1 as outlined above.

However, while the combination discloses media playback without delay, the combination fails to explicitly disclose the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking longer than anticipated; and the adjusting comprises decreasing the first bitrate.

Melnyk, in an analogous environment, discloses the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking longer than anticipated*(download pattern; network conditions of a streaming media network; any number of algorithms can be used to determine the stability critereon) [0074; 0079; 0080]*; and

the adjusting comprises decreasing the first bitrate *(estimating one or more network conditions of a network…determining an optimal session bitrate based on the estimated or more more network conditions) [abstract]*.

Orr, Shintani and Melnyk are analogous because they are all related to playback of media data. Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to adjust bitrate according to download speed as disclosed by Melnyk, with the invention disclosed by Orr and Shintani, the motivation being achieve good user experience [0011].

Claims 18 and 19 are drawn to a control system adapted to implement the method of using the same as claimed in claims 16 and 17, and are therefore rejected in the same manner as above.

Regarding claim 20, Orr and Shintani address all of the features with respect to claim 11 as outlined above.

However, while the combination discloses media playback without delay, the combination fails to explicitly disclose the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated and the adjusting comprises increasing the first bitrate; or the detecting whether the new content can maintain playback at the first bitrate comprises determining that download is taking longer than anticipated and the adjusting comprises decreasing the first bitrate.

Melnyk, in an analogous environment, discloses the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated *(download pattern; network conditions of a streaming media network; any number of algorithms can be used to determine the stability critereon) [0074; 0079; 0080]*; and

the adjusting comprises increasing the first bitrate *(estimating one or more network conditions of a network…determining an optimal session bitrate based on the estimated or more more network conditions) [abstract]*;

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking longer than anticipated *(download pattern; network conditions of a streaming media network; any number of algorithms can be used to determine the stability critereon) [0074; 0079; 0080]*; and

the adjusting comprises decreasing the first bitrate *(estimating one or more network conditions of a network…determining an optimal session bitrate based on the estimated or more more network conditions) [abstract]*.

Orr, Shintani and Melnyk are analogous because they are all related to playback of media data. Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to adjust bitrate according to download speed as disclosed by Melnyk, with the invention disclosed by Orr and Shintani, the motivation being achieve good user experience [0011].

Citation of Pertinent Prior Art

12. The prior art made of record on form PTO-892 and not relied upon is considered pertinent to applicant's disclosure:

- Do et al. US 2017/0188056 A1 discloses a data flow control method for managing media data through an adaptive bitrate mode
- Major et al. US 2013/0142499 A1 discloses requesting different bitrate for a media content file when memory storage devices cannot maintain real-time delivery of encoded media segments having the requested bitrate
- Friedrich et al. US 2015/0052236 A1 discloses downshifting a bit-rate for a video session when an existing bit-rate cannot be maintained

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEFAN GADOMSKI whose telephone number is (571)270-5701. The examiner can normally be reached on Monday - Friday, 12-8PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. 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 https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

STEFAN GADOMSKI
Examiner
Art Unit 2485

/STEFAN GADOMSKI/
Examiner, Art Unit 2485

Notice of References Cited	Application/Control No. 16/645,598	Applicant(s)/Patent Under Reexamination Gogoi et al.	
	Examiner STEFAN GADOMSKI	Art Unit 2485	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20110296047-A1	12-2011	Orr; Brian	G11B27/105	709/231
*	B	US-20170244924-A1	08-2017	SHINTANI; Peter	H04N21/4383	1/1
*	C	US-20090254657-A1	10-2009	Melnyk; Miguel A.	H04N21/6583	709/224
*	D	US-20100158101-A1	06-2010	WU; CHUNG-PING	H04N21/23439	375/240.01
*	E	US-8532171-B1	09-2013	Narayanan; Karthik	H04N21/2187	375/240.01
*	F	US-20170188056-A1	06-2017	Do; Manh Hung Peter	H04L47/25	1/1
*	G	US-20130142499-A1	06-2013	Major; Robert Drew	H04N21/2312	386/341
*	H	US-20150052236-A1	02-2015	Friedrich; Eric Colin	H04L43/08	709/224
*	I	US-20140149497-A1	05-2014	Takagaki; Keiichi	H04N21/43615	709/203
*	J	US-20100118697-A1	05-2010	Shumate; John	H04N21/2402	370/230
*	K	US-20130097309-A1	04-2013	Ma; Kevin J.	H04L67/2847	709/224
*	L	US-20180338170-A1	11-2018	STOKKING; Hans Maarten	H04N21/2662	1/1
*	M	US-20180205778-A1	07-2018	Forman; Benjamin	H04L65/608	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 16/645,598	Applicant(s)/Patent Under Reexamination Gogoi et al.	
	Examiner STEFAN GADOMSKI	Art Unit 2485	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20180063590-A1	03-2018	Her; Horngwei Michael	H04N21/8146	1/1
*	B	US-20110225302-A1	09-2011	PARK; ANTHONY N.	H04L69/14	709/227
*	C	US-20170064400-A1	03-2017	RIEGEL; BRIAN M.	H04N21/2743	1/1
*	D	US-20150188962-A1	07-2015	Bulava; Yuri	H04L65/80	709/231
*	E	US-20170085933-A1	03-2017	Czeck, JR.; David J.	H04N21/26258	1/1
*	F	US-20160234504-A1	08-2016	Good; Charles F.	H04N19/40	1/1
*	G	US-20160119657-A1	04-2016	Sun; Wendell	H04N21/8456	725/94
*	H	US-20150281303-A1	10-2015	Yousef; Mohamed	H04N21/4524	709/219
*	I	US-20150039726-A1	02-2015	Hoffert; Eric	H04N21/42623	709/219
*	J	US-20160173954-A1	06-2016	SPEELMANS; Pieter-Jan	H04N21/6125	725/116
*	K	US-8887215-B2	11-2014	Fisher; Yuval	H04N21/6125	725/93
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	Art Unit
	STEFAN GADOMSKI	2485

CPC - Searched*		
Symbol	**Date**	**Examiner**
See print out for complete history	01/02/2021	SG

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

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

Search Notes		
Search Notes	**Date**	**Examiner**
EAST inventor search limited by a text string, see print out for complete history	01/02/2021	SG
EAST assignee search limited by a text string, see print out for complete history	01/02/2021	SG
EAST text search	01/02/2021	SG
EAST patent number search	01/02/2021	SG
Google Scholar text search	01/02/2021	SG
IP.com text search	01/02/2021	SG
IP.com patent number search	01/02/2021	SG

/STEFAN GADOMSKI/ Examiner, Art Unit 2485	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	Art Unit
	STEFAN GADOMSKI	2485

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/STEFAN GADOMSKI/ Examiner, Art Unit 2485	

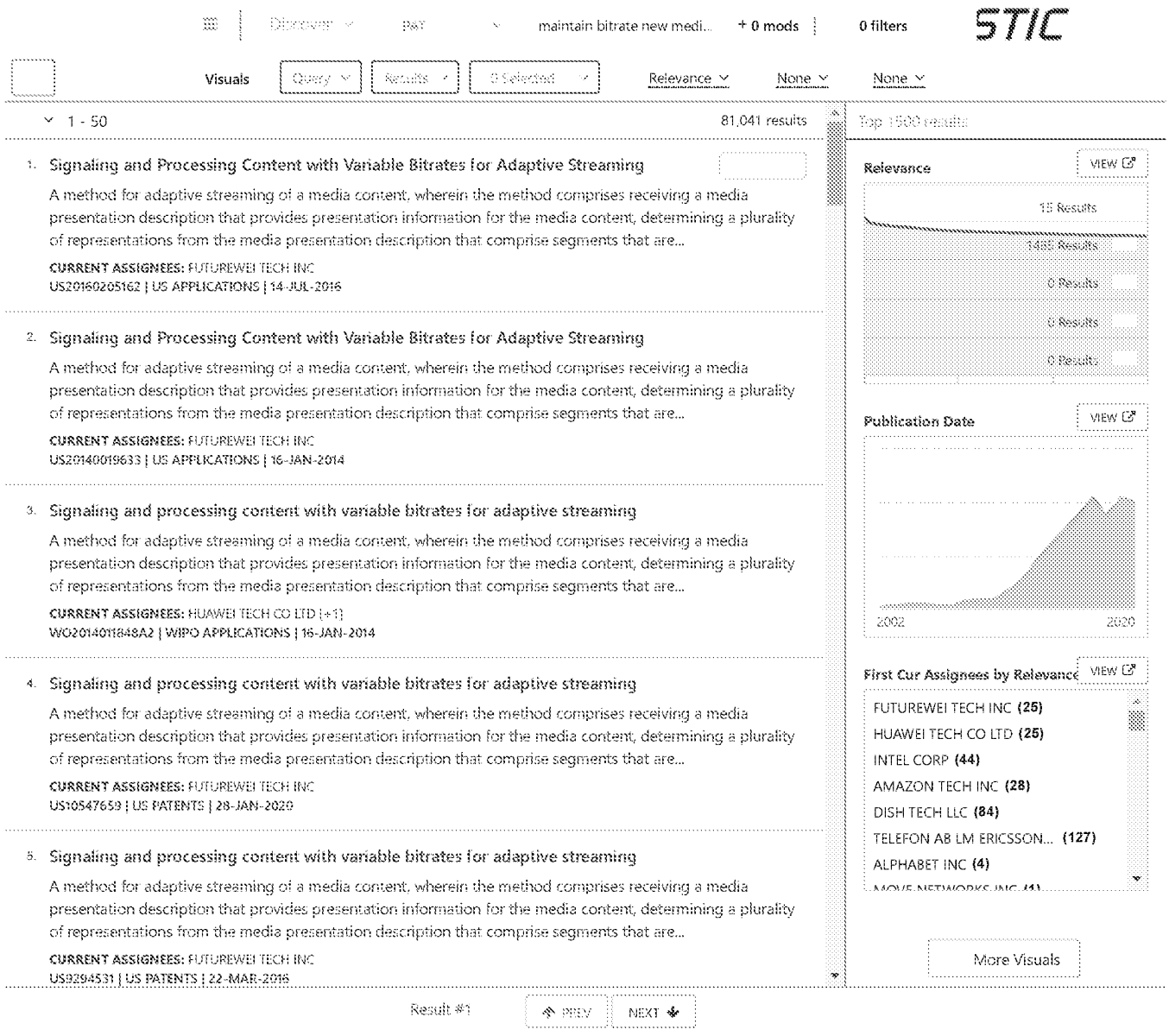
Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/645,598	Gogoi et al.
	Examiner	**Art Unit**
	STEFAN GADOMSKI	2485

✓	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	01/02/2021								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								



Pinterest Ex. 1004 Page 92 of 371

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

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

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

Application Number	16645598
Filing Date	2020-03-09
First Named Inventor	Amarendra N. Gogoi
Art Unit	
Examiner Name	
Attorney Docket Number	2050.354US1, P-18-p354-US

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	111194565	CN		2020-05-22	Gogoi, Amarendra N, et al.	English abstract included.	X
	2	1775953	EP		2007-04-18	Van, Quickenborne Frederic, et al.		☐
	3	3050307	EP		2016-08-03	Phillips, Chris, et al.		☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2050.354US1, P-18-p354-US

	4	202047011998	IN		2020-05-15	Gogoi, Amarendra N, 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]
	1	"International Application Serial No. PCT US2018 046723, International Preliminary Report on Patentability mailed 04-01-20", 4 pages.	
	2	"European Application Serial No. 18853974.6, Extended European Search Report mailed 09-29-20", 9 pages.	
	3	SUMAN, KALYAN MANDAL, "Intelligent Pre-fetching to Reduce Channel Switching Delay in IPTV Systems", Internet Citation, (1 January 2009), pages 1-6.	
	4	TOSHIAKI, AKO, "A Novel Multichannel Streaming Scheme to Reduce Channel Switching Delay in Application Layer Multicast", IEEE Systems Journal vol. 5, no. 4, (1 December 2011), pages 545-554.	

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

EXAMINER SIGNATURE

Examiner Signature	/STEFAN GADOMSKI/	Date Considered	01/02/2021

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2050.354US1, P-18-p354-US

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	/Susan Yee/	Date (YYYY-MM-DD)	2020-11-27
Name/Print	Susan Yee	Registration Number	41,388

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./


Discover
pat
US 20200267428
+ 0 mods
0 filters
STIC
Visuals
Query
Results
0 Selected
Relevance
None
None
1 - 1
1 results
Top 1 results
1. Bitrate and pipeline preservation for content presentation
Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In...
CURRENT ASSIGNEES: OPENTV INC
US20200267428 | US APPLICATIONS | 20-AUG-2020
End of results
BACK TO TOP
Relevance
VIEW
0 Results
0 Results
1 Results
0 Results
0 Results
Publication Date
VIEW
Aug-2020
Aug-2020
First Cur Assignees by Relevance
VIEW
OPENTV INC (1)
More Visuals
Result #1
PREV
NEXT

Web Search History

date, time	web site	search string
1/2/2021 3:28:35 PM	Google Scholar	maintain bitrate for new media content
1/2/2021 3:28:51 PM	Google Scholar	adjust bitrate for new media content
1/2/2021 3:28:58 PM	Google Scholar	adjust bitrate for media content
1/2/2021 3:29:05 PM	Google Scholar	maintain bitrate for media content
1/2/2021 3:29:30 PM	Google Scholar	cannot maintain bitrate

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	Unknown
	Filing Date	Herewith
	First Named Inventor	Amarendra N. Gogoi
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 1	Attorney Docket No: 2050.354US1	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-8,532,171	9/10/2013	Narayanan, Karthik, et al.
	US-20090254657A1	10/8/2009	Melnyk, Miguel A, et al.
	US-20100158101A1	6/24/2010	Wu, Chung-Ping, et al.
	US-20110296047A1	12/1/2011	Orr, Brian
	US-20170244924A1	8/24/2017	Shintani, Peter, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T1
	TW-201931861A	8/1/2019	Gogoi, Amarendra N, et al.	
	WO-2019050660A1	3/14/2019	Gogoi, Amarendra N., et al.	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T1
	"International Application Serial No. PCT/US2018/046723, International Search Report mailed 10-22-18", 2 pgs	
	"International Application Serial No. PCT/US2018/046723, Written Opinion mailed 10-22-18", 9 pgs	

EXAMINER /STEFAN GADOMSKI/ **DATE CONSIDERED** 01/02/2021

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.G./

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1,331	maintain WITH bit$rate	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:06
L2	2,428	maintain$3 WITH bit$rate	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:07
L3	42	maintain$3 WITH bit$rate WITH (cannot)	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:07
L4	34	3 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:08
L5	42	maintain$3 WITH bit$rate WITH (cannot)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/02 15:17
L6	27,272	(H04N21/23655 or H04L65/607 or H04N21/2662 or H04L65/80 or H04L65/604 or H04W28/02).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:17
L7	9	3 AND L6	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:17
L8	5	7 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:18
L9	473,001	new WITH (media content)	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:20
L10	7,345	6 AND 9	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:20
L11	8,772	contin$4 WITH playback WITH (media content)	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:21
L12	193	contin$4 WITH playback WITH (media content) SAME bit$rate	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:21
L13	156	12 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:21
L14	47	contin$4 WITH playback WITH (media content) SAME codec	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:26
L15	43	14 AND @AD<"20170908"	US-PGPUB; USPAT; USOCR	OR	ON	2021/01/02 15:26
S1	341	((("GOGOI") near3 ("Amarendra")) OR (("GUPTA") near3 ("Sanjay")) OR	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/12/28 15:21

		(("SWAMI") near3 ("Ravikant"))).INV.				
S2	15	S1 AND (select$3 AND content).CLM.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2020/12/28 15:23
S3	205	((("OPENTV") near3 ("INC"))).AS,AANM.	USPAT	OR	ON	2020/12/28 15:24
S4	79	S3 AND (select$3 AND content).CLM.	US-PGPUB; USPAT	OR	ON	2020/12/28 15:25
S5	1	S3 AND (select$3 AND content AND bit$rate).CLM.	US-PGPUB; USPAT	OR	ON	2020/12/28 15:25
S6	2	("20200267428").PN.	US-PGPUB; USPAT; USOCR; DERWENT	OR	ON	2020/12/28 15:26
S7	87,040	(H04N21/23655 or H04L65/607 or H04N21/2662 or H04L65/80 or H04L65/604 or H04W28/02).cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/12/28 15:30
S8	27,503	(H04N21/23655 or H04L65/607 or H04N21/2662 or H04L65/80 or H04L65/604 or H04W28/02).cpc.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:30
S9	3,108	(adjust$3 WITH bit$rate)	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:31
S10	780	S8 AND S9	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:31
S11	1	"20110296047".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:37
S12	1	"20170244924".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:38
S13	1	"20090254657".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:39
S14	1	"20100158101".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:40
S15	1	"6532171".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:41
S16	1	"8532171".pn.	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:41
S17	6,111	(adapt$4 WITH bit$rate)	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:50
S18	1,612	S8 AND S17	US-PGPUB; USPAT; USOCR	OR	ON	2020/12/28 15:50

EAST Search History (Interference)

<This search history is empty>

1/2/2021 3:32:35 PM
C:\Users\sgadomski\Desktop\16645598\FAOM_598.wsp

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	16645598
Filing Date	2020-03-09
First Named Inventor	Amarendra N. Gogoi
Art Unit	
Examiner Name	
Attorney Docket Number	2050.354US1, P-18-p354-US

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	111194565	CN		2020-05-22	Gogoi, Amarendra N, et al.	English abstract included.	X
	2	1775953	EP		2007-04-18	Van, Quickenborne Frederic, et al.		☐
	3	3050307	EP		2016-08-03	Phillips, Chris, et al.		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2050.354US1, P-18-p354-US

	4	202047011998	IN		2020-05-15	Gogoi, Amarendra N, 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]
	1	"International Application Serial No. PCT US2018 046723, International Preliminary Report on Patentability mailed 04-01-20", 4 pages.	
	2	"European Application Serial No. 18853974.6, Extended European Search Report mailed 09-29-20", 9 pages.	
	3	SUMAN, KALYAN MANDAL, "Intelligent Pre-fetching to Reduce Channel Switching Delay in IPTV Systems", Internet Citation, (1 January 2009), pages 1-6.	
	4	TOSHIAKI, AKO, "A Novel Multichannel Streaming Scheme to Reduce Channel Switching Delay in Application Layer Multicast", IEEE Systems Journal vol. 5, no. 4, (1 December 2011), pages 545-554.	

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	16645598
	Filing Date	2020-03-09
	First Named Inventor	Amarendra N. Gogoi
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2050.354US1, P-18-p354-US

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	/Susan Yee/	Date (YYYY-MM-DD)	2020-11-27
Name/Print	Susan Yee	Registration Number	41,388

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.

Espacenet

Bibliographic data: CN111194565 (A) — 2020-05-22

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Inventor(s): A·N·戈戈伊, ; S·K·古普塔, ; R·斯瓦米

Applicant(s): 开放电视公司

Classification: **- international:** ***H04W28/02***
- cooperative: **H04W28/02 (EP)**

Application number: CN20188065328 20180814 Global Dossier

Priority number(s): IN201741031917 20170908 ; WO2018US46723 20180814

Also published as: TW201931861 (A) WO2019050660 (A1)

Abstract not available for CN111194565 (A)
Abstract of corresponding document: WO2019050660 (A1)

Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

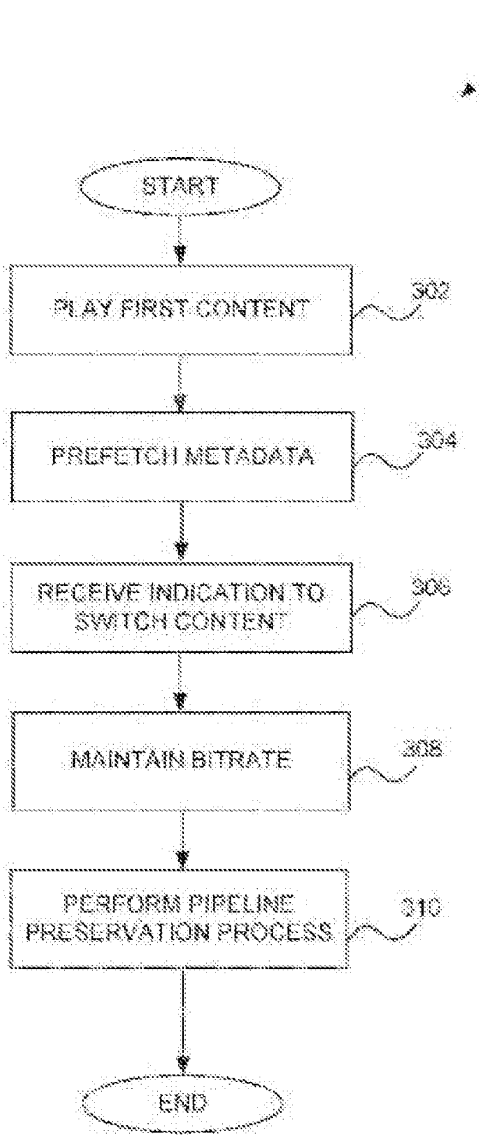


FIG. 3

Pinterest Ex. 1004 Page 108 of 371

(19)中华人民共和国国家知识产权局

(12)发明专利申请

(10)申请公布号 CN 111194565 A
(43)申请公布日 2020.05.22

(21)申请号 201880065328.8
(22)申请日 2018.08.14
(30)优先权数据
201741031917 2017.09.08 IN
(85)PCT国际申请进入国家阶段日
2020.04.07
(86)PCT国际申请的申请数据
PCT/US2018/046723 2018.08.14
(87)PCT国际申请的公布数据
WO2019/050660 EN 2019.03.14
(71)申请人 开放电视公司
地址 美国加利福尼亚州
(72)发明人 A·N·戈戈伊 S·K·古普塔 R·斯瓦米
(74)专利代理机构 北京戈程知识产权代理有限公司 11314
代理人 程伟 甄雁翔
(51)Int.Cl.
H04W 28/02(2006.01)

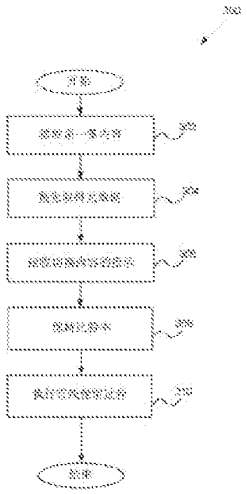
权利要求书2页 说明书11页 附图5页

(54)发明名称

用于内容呈现的比特率和管线保留

(57)摘要

提供了用于优化内容更改过程的系统和方法。在示例性实施方案中，数字接收器使得播放第一段内容。在第一段内容播放期间，数字接收器接收对用于播放的新的一段内容的选择。响应于接收到选择，数字接收器保持用于播放第一段内容的比特率，以开始新的一段内容的播放。



CN 111194565 A

1.一种方法,其包括:

通过数字接收器,使得播放第一段内容;

在第一段内容播放期间,通过数字接收器接收对用于播放的新的一段内容的选择;以及

响应于接收到选择,通过数字接收器的处理器保持用于播放第一段内容的比特率,以开始新的一段内容的播放。

2.根据权利要求1所述的方法,其进一步包括:

确定新的一段内容是否与第一段内容类型相同;以及

基于新的一段内容与第一段内容的类型相同,确定是否保留播放管线的至少一部分。

3.根据权利要求2所述的方法,其中,确定是否保留包括:

检测新的一段内容的编解码器信息,所述编解码器信息指示新内容所需的解码器的类型;以及

确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

4.根据权利要求3所述的方法,其进一步包括:响应于管线中的音频解码器和视频解码器为由编解码器信息指示的类型,保留整个管线。

5.根据权利要求3所述的方法,其进一步包括:

响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型,释放管线中的音频解码器和视频解码器;以及

基于编解码器信息获得新的音频解码器和新的视频解码器。

6.一种系统,其包括:

一个或更多个硬件处理器;以及

存储设备,其存储配置一个或更多个硬件处理器以执行以下操作的指令,所述操作包括:

通过数字接收器,使得播放第一段内容;

在第一段内容播放期间,通过数字接收器接收对用于播放的新的一段内容的选择;以及

响应于接收到选择,保持用于播放第一段内容的比特率,以开始新的一段内容的播放。

7.根据权利要求6所述的系统,其中,所述操作进一步包括:

确定新的一段内容是否与第一段内容类型相同;以及

基于新的一段内容与第一段内容的类型相同,确定是否保留播放管线的至少一部分。

8.根据权利要求7所述的系统,其中,确定是否保留包括:

检测新的一段内容的编解码器信息,所述编解码器信息指示新内容所需的解码器的类型;以及

确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

9.根据权利要求8所述的系统,其中,所述操作进一步包括:响应于管线中的音频解码器和视频解码器为由编解码器信息指示的类型,保留整个管线。

10.根据权利要求8所述的系统,其中,所述操作进一步包括:

响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型,释放管线中的音频解码器和视频解码器;以及

Pinterest Ex. 1004 Page 110 of 371

基于编解码器信息获得新的音频解码器和新的视频解码器。

11.一种机器可读介质，其存储指令，所述指令在由机器的一个或更多个硬件处理器执行时使机器执行如下操作，所述操作包括：

通过数字接收器，使得播放第一段内容；

在第一段内容播放期间，通过数字接收器接收对用于播放的新的一段内容的选择；以及

响应于接收到选择，保持用于播放第一段内容的比特率，以开始新的一段内容的播放。

12.根据权利要求11所述的机器可读介质，其中，所述操作进一步包括：

确定新的一段内容是否与第一段内容类型相同；以及

基于新的一段内容与第一段内容的类型相同，确定是否保留播放管线的至少一部分。

13.根据权利要求12所述的机器可读介质，其中，确定是否保留包括：

检测新的一段内容的编解码器信息，所述编解码器信息指示新内容所需的解码器的类型；以及

确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

14.根据权利要求13所述的机器可读介质，其中，所述操作进一步包括：响应于管线中的音频解码器和视频解码器为由编解码器信息指示的类型，保留整个管线。

15.根据权利要求13所述的机器可读介质，其中，所述操作进一步包括：

响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型，释放管线中的音频解码器和视频解码器；以及

基于编解码器信息获得新的音频解码器和新的视频解码器。

Pinterest Ex. 1004 Page 111 of 371

用于内容呈现的比特率和管线保留

[0001] 相关申请的交叉引用

[0002] 本申请要求于2017年9月8日提交的印度申请序列No.201741031917的优先权，其全部内容通过引用结合于此。

技术领域

[0003] 本发明总体上涉及配置为优化内容更改过程(例如，频道更改)的专用机器的技术领域的机器，所述机器包括这种专用机器的计算机化变体以及对这些变体的改进，并且涉及与其他有助于优化内容更改的专用机器相比，使得这种专用机器得到改进的技术。具体地，本发明提出了用于在内容更改过程期间保留下载比特率和内容播放管线的系统和方法。

背景技术

[0004] 通常，在(例如，由频道更改或对不同段内容的选择引起的)内容切换期间，由于在渲染和显示新的一段内容(例如，节目、电影、节目)之前要获取某些信息，所以会发生延迟。此外，对于自适应比特率流式传输的内容，该内容通常以低(或最低)比特率开始流式传输或下载，然后缓慢增加比特率直到获得最佳比特率。这导致初始视频或图像呈颗粒状。此外，每次发生内容变化时，都需要建立内容播放管线来增加延迟。

附图说明

[0005] 所附附图中的各个附图仅示出了本发明的示例性实施方案，并且不能视为限制本发明的范围。

[0006] 图1是示出用于优化内容更改的示例性环境的示意图；

[0007] 图2是示出根据示例性实施方案的数字接收器内的组件的示例性实施方案的框图。

[0008] 图3是根据示例性实施方案的用于优化内容更改过程的方法的流程图。

[0009] 图4是根据示例性实施方案的用于保留内容传递管线的方法的流程图。

[0010] 图5是根据示例性实施方案的以计算系统的示例形式的机器的示意图，在该机器中可以执行一组指令以使该机器执行本文所讨论的方法中的任何一种或更多种。

具体实施方式

[0011] 以下描述包括实现本发明主题的示例性实施方案的系统、方法、技术、指令序列和计算机器程序产品。在下面的描述中，出于解释的目的，阐述了许多具体细节以便提供对发明主题的各种实施方案的理解。然而，对于本领域技术人员将显而易见的是，可以在没有这些具体细节中的一些或其他的情况下实践本发明主题的实施方案。通常，不会详细示出众所周知的指令实例、协议、结构和技术。示例仅代表可能的变化。除非另有明确说明，否则结构(例如，结构性组件，诸如模块)是可选的，并且可以被组合或细分，并且操作(例如，在过

Pinterest Ex. 1004 Page 112 of 371

程、算法或其他功能中)可以顺序变化或被组合或细分。

[0012] 本文描述的示例性实施方案提供了用于优化内容更改或切换正在观看的内容的系统和方法,例如通过频道更改或从观看列表中选择不同段内容。在一些实施方案中,系统利用浏览上下文(例如,用户与应用交互的方式)来识别观看者的(潜在)感兴趣的内容。然后,系统从内容提供商预先取得感兴趣内容的元数据,并将元数据存储到本地缓存。元数据包括用于渲染和显示一段内容的前提条件,这些前提条件包括系统无需解密内容即可获取的最小数据集。在示例性实施方案中,可以利用预先取得的元数据来确定是否保留内容播放管线(在本文中也称为"内容传递管线"或简称为"管线")的至少一部分。

[0013] 通常,将同一段内容分成多个片段(例如,10个第二片段),并且每个片段都有不同的比特率。低比特率可能会有颗粒感,而高比特率通常会具有更好的图像质量。典型地,当开始播放新的一段内容时,系统不知道网络带宽的质量。结果,为了尽快开始播放,常规系统以最低的比特率开始。因此,每当用户从一个内容切换到下一个内容时,播放将以最低的比特率开始,并根据网络性能缓慢增加或改善。相反,示例性实施方案在切换到新的一段内容时保留先前的比特率。即,当用户选择新的一段内容进行播放时(例如,从前一段内容切换到新的一段内容),示例性实施方案在开始新的一段内容播放时,维持或保留(启发式确定的)用于流式传输或下载前一段内容的比特率。这使得可以尽快开始播放,同时从开始就提供更好的图像质量。

[0014] 此外,在常规系统中,内容的切换或转换通常使得先前内容的传递管线被解构(例如,先前获取的资源被释放)。随后,为新的一段内容创建新的管线(例如,获取新的资源)。相反,示例性实施方案可以保持或保留用于获得前一段内容的部分(或全部)内容传递管线(例如,包括源元件、解复用器("多路分配器")、视频解码器和音频解码器),而不是重建管线(例如,破坏内容传递管线并建立新内容传递管线)。管线的保留还使得可以尽快播放新内容。

[0015] 结果,本文所述的一种或更多种方法有助于解决优化内容更改的技术问题(例如,减少用于频道更改或新内容的加载的时间),而无论传递信道如何——内容是广播(例如,IPTV和多播)还是互联网电视(over-the-top,OTT)。所述方法包括:通过数字接收器,使得播放第一段内容,并且在第一段内容播放期间,接收对用于播放的新的一段内容的选择。响应于接收到选择,数字接收器保持用于播放第一段内容的比特率,以开始新的一段内容的播放。所述方法进一步包括:在切换到播放新的一段内容时确定是否保留播放管线的至少一部分。在一些实施方案中,保留播放管线的至少一部分包括:当切换到播放新的一段内容时,确定是否重新训练管线的音频解码器和视频解码器。因此,本文所讨论的一种或更多种方法改善了内容更改期间的延时,同时保持了图像质量。应当注意的是,内容更改包括:选择用于观看的一段内容(例如,从诸如收藏夹网格的内容访问页面或通过节目指南)以及频道更改(例如,线性频道更改)。

[0016] 参照图1,示出了示例性环境100的实施方案,该示例性环境100使得能够优化内容更改(例如,减少频道更改或选择用于观看的一段内容期间的延时)。在示例性实施方案中,用户的数字接收器102提供对数字内容的访问并管理内容更改操作。在一个实施方案中,数字接收器102是机顶盒。数字接收器102连接到用户可以在其上观看数字内容的观看设备104(例如,电视或监控器)。在一些实施方案中,数字接收器102(例如,数字接收器102的操

Pinterest Ex. 1004 Page 113 of 371

作)可以与观看设备104(例如,智能电视、平板电脑或智能手机)组合。将结合下面的图2更详细地讨论用于执行示例性实施方案的操作的数字接收器102的组件。

[0017] 在一些实施方案中,数字接收器102经由网络106从内容分发网络(CDN)服务器108访问(例如,拉取、接收、检索)内容。CDN服务器108可以从一个或更多个内容提供商110(例如,内容提供商110的服务器)获得内容。在示例性实施方案中,CDN服务器108可以与第三方服务(例如,Netflix、Hulu、YouTube、亚马逊)相关联,该第三方服务存储和提供诸如如下的内容,但不限于互联网电视(OTT)内容、视频点播(VOD)内容、互联网内容或通过网络106向数字接收器102广播的内容。该内容包括:文本、图像、音频和/或视频内容(例如,电影、电视节目、视频),并且在一些实施方案中,包括实况(例如,实时)内容。在一些实施方案中,内容提供商110通过网络106直接将内容提供给数字接收器102以在观看设备104上显示。

[0018] 网络106的一个或更多个部分可以是:自组织网络、内联网、外联网、虚拟专用网(VPN)、局域网(LAN)、无线LAN(WLAN)、广域网(WAN)、无线WAN(WWAN)、城域网(MAN)、一部分互联网、一部分公共交换电话网(PSTN)、蜂窝电话网络、无线网络、WiFi网络、WiMax网络、卫星网络、电缆网络、广播网络、另一种类型的网络,或两个或多个这种网络的组合。网络106的任何一个或更多个部分可以经由传输介质或信号介质来通信信息。如本文所使用的,"传输介质"是指能够传送(例如,传输)由机器(例如,由该机器的一个或更多个处理器)执行的指令的任何无形(例如,易失性)介质,并且包括数字或模拟通信信号或其他无形介质,以促进这种软件的通信。

[0019] 应当注意的是,图1所示的环境100仅是示例。例如,在环境100内可以实现任何数量的CDN服务器108和内容提供商110。此外,可以组合环境100的一些组件。例如,数字接收器102的功能可以在观看设备104内实现以形成单个设备,例如智能电视、平板电脑、智能电话或能够获取、渲染和显示内容的任何其他设备。此外,本文针对任何单个系统或机器描述的功能可以细分为多个系统或机器。

[0020] 图1所示或与图1相关的任何系统或机器(例如,数据库、设备、服务器)可以为、包括已经修改(例如,通过软件配置或编程,软件诸如应用程序、操作系统、固件、中间件或其他程序的一个或更多个软件模块)的专用(例如,专用或其他非通用)计算机,或以其它方式在该专用计算机中实现,以执行本文所述的该系统或机器的一个或更多个功能。例如,下面参照图5讨论能够实现本文描述的方法中的任何一种或更多种的专用计算机系统,这种专用计算机可以相应地是用于执行本文所讨论的方法中的任何一种或更多种的装置。在此类专用计算机的技术领域内,与缺少本文所述的结构或无法执行本文讨论的功能的其他专用计算机相比,已通过本文所讨论的结构进行修改以执行本文所讨论的功能的专用计算机在技术上得到了改进。因此,根据本文所讨论的系统和方法配置的专用机器对相似的专用机器的技术提供了改进。

[0021] 图2是示出根据示例性实施方案的数字接收器102内的组件的示例性实施方案的框图。在示例性实施方案中,数字接收器102管理对通过网络106流式传输的内容的访问。具体地,数字接收器102预先取得元数据,在开始新的一段内容的播放时保留用于前一段内容的播放(例如,流式传输或下载)的比特率,并保留内容传递管线的至少一部分。为了实现这些操作,数字接收器102包括:播放器202、内容传递管线204(也称为"管线")、高速缓存管理器206和高速缓存208,所有这些都可以配置为彼此通信(例如,通过总线、共享内存或交换

Pinterest Ex. 1004 Page 114 of 371

机)。数字接收器102包括与示例性实施方案的操作无关的其他组件(未示出)。

[0022] 播放器202配置为管理管线204。在示例性实施方案中,当选择第一段内容进行显示时,播放器204实例化(例如,构建)管线204。可以为每种类型的内容构建不同的管线。例如,播放器202为HLS内容构建HTTP实时流式传输(HLS)管线,并且为DASH内容构建基于HTTP的动态自适应流式传输(DASH)管线。当内容发生切换时(例如,频道更改或选择用于观看的新内容),播放器204还决定是保持管线204的至少一部分还是构建新管线。结合下面的图4进一步详细讨论用于管理管线保留的示例性方法。

[0023] 由播放器202通过获取用于获得和处理内容数据的适当资源来构建管线204,以便播放所选内容。管线204的资源包括:源元件212、解复用器("多路分配器")214、音频解码器216和视频解码器218。源元件212管理用于所选段内容的内容数据的下载。源元件212还管理数字接收器102处的比特率适配。具体地,源元件212记住用于播放当前/先前段内容的最后比特率,并且继续利用该比特率来播放新内容。这样,如果最后比特率高,则源元件212将以相同的高比特率开始用于新内容。如果新内容不能以该比特率播放,则源元件212将降低比特率。例如,如果内容的下载所花费的时间小于预期的时间,则存在多余的带宽,并且可以提高比特率。相反,如果下载所花费的时间长于预期的时间,则降低比特率。这样,示例性实施方案将以先前/最后的比特率开始新内容的播放,而不是以较低或最低的比特率开始(并缓慢增加)。

[0024] 解复用器对从CDN服务器108或内容提供商110获得的内容数据进行解复用,以获得音频信号和视频信号。音频信号被发送到音频解码器216进行处理,而视频信号被发送到视频解码器218进行处理。来自音频解码器216和视频解码器218的结果被输出(例如,发送)到观看设备104,以呈现给用户。

[0025] 高速缓存管理器206管理可能潜在地选择用于播放的内容的元数据的预先取得。在一些实施方案中,高速缓存管理器206预测用户可能感兴趣观看的内容。例如,用户可能正在沿特定方向(例如,向上或向下)浏览频道或节目的线性列表(例如,电子节目指南;"EPG")。在该实施方案中,高速缓存管理器206基于线性列表上的浏览方向来预测下一组内容。在另一个示例中,用户可能正在查看视频点播(video-on-demand,VoD)目录或用户的观看列表。如果用户请求信息或将其悬停在对一段内容的选择上,则高速缓存管理器206将其用作用户对这一段内容感兴趣的预测。或者,高速缓存管理器可以将目录或观看列表的可视部分中的所有(或某些)段内容视为感兴趣的内容。在任何这些情况下,高速缓存管理器206预先取得感兴趣内容的元数据,并将预先取得的数据存储到高速缓存208。元数据可以包括,例如,一个或更多个统一资源定位符(URL),其中大量内容可用;用于不同比特率的URL;许可证数据(例如,从何处获得许可证);以及编解码器信息。如下面将进一步讨论的,播放器202将利用编解码器信息来确定是否保留管线204的至少一部分。如果用户随后选择已经预先取得元数据的内容,则可以在选择之后从高速缓存208访问元数据,而不是必须通过网络106从CDN服务器108或内容提供商110中检索元数据。这将有助于减少播放的延迟。

[0026] 本文描述的任何一个或更多个组件(例如,模块、解码器、资源)可以利用硬件(例如,机器的一个或更多个处理器)单独地实现,或利用硬件和软件的组合来实现。例如,本文描述的任何组件可以物理地包括一个或更多个处理器的布置,或者配置处理器(例如,在机器的一个或更多个处理器之中)以执行本文描述的对于该模块的操作。因此,本文描述的不

Pinterest Ex. 1004 Page 115 of 371

同组件可以包括并配置在不同时间点的处理器的不同布置或在不同时间点的处理器的单种布置。本文描述的每个组件是用于执行本文描述的对于该组件的操作的装置的示例。而且，这些组件中的任何两个或更多个可以组合成单个组件，并且本文描述的对于单个组件的功能可以在多个组件之中进行细分。此外，根据各种示例性实施方案，本文描述为在单个机器、数据库或设备内实现的组件可以分布在多个机器、数据库或设备上。

[0027] 图3是根据示例性实施方案的用于优化内容更改的示例性方法300的流程图。在示例性实施方案中，方法300由数字接收器102的组件部分或全部执行。因此，参考数字接收器102通过示例来描述方法300。然而，应当理解的是，方法300的至少一些操作可以被部署在各种其他硬件配置上，或者可以由位于环境100中的其他地方的类似组件来执行。因此，方法300不旨在限于数字接收器102。

[0028] 在操作302，使第一段内容由观看设备104播放。在示例性实施方案中，播放器202构建用于获得和处理第一段内容的内容数据的管线204。具体地，播放器202获取源元件212、解复用器214、音频解码器216和视频解码器218以形成管线204。数据内容由管线204处理并呈现在查看设备104上。

[0029] 在操作304，预先取得用于一个或更多个感兴趣内容的集合的元数据。在示例性实施方案中，高速缓存管理器206预测用户感兴趣的内容并预先取得感兴趣的内容的元数据。然后，将预先取得的数据存储到高速缓存208。元数据可以包括但不限于：一个或更多个URL，其中大量内容可用；用于不同比特率的一个或更多个URL；许可证数据(例如，从何处获得许可证)；以及编解码器信息。

[0030] 在操作306，播放器202接收切换到用于播放的新的一段内容的指示。该指示可以从用户的控制设备(例如，遥控器)接收。在一些实施方案中，用户可以滚动浏览EPG或正在查看目录或观看列表，并选择用于观看的新的一段内容。

[0031] 在操作308，当将播放切换到新的一段内容时，数字接收器102保持比特率。在示例性实施方案中，当将播放从正在进行的播放操作转换到新的播放操作时，源元件212利用为第一段内容的播放而得到的启发式比特率来播放新的一段内容。因此，与从最低可能的比特率开始新的播放相反，源元件212尝试保持或保留用于播放的比特率。如果不能以该比特率传送新的一段内容，则源元件212将降低比特率。这样，示例性实施方案将以先前/最后的比特率开始新内容的下载，而不是以较低或最低的比特率开始(并缓慢增加)。这使得可以立即以最佳比特率播放新内容，而不必从最低可能的比特率开始启发式地重新计算最佳比特率。通常，得到最佳比特率通常需要下载内容数据的几个片段或块，从而导致图像质量的逐渐改善。然而，从新内容播放的最开始，利用先前得到的启发式比特率的示例性实施方案保持了与先前播放的图像质量水平相同的图像质量水平。

[0032] 在操作310，执行管线保留过程以确定是否保持用于播放第一段内容的管线的至少一部分，以用于播放新的一段内容。此外，如果要保持或保留管线，则确定应该保留管线的所有资源还是仅保留一部分管线(例如，仅保持一些资源，而释放其他资源)。将结合图4更详细地讨论管线保留过程。

[0033] 图4是根据示例性实施方案的用于保留内容传递管线的示例性方法400的流程图。在示例性实施方案中，方法400参照管线204的资源的一部分或全部由播放器202来执行。因此，参考播放器202和管线204，通过示例来描述方法400。然而，应当理解的是，方法400的至

Pinterest Ex. 1004 Page 116 of 371

少一些操作可以被部署在各种其他硬件配置上，或者可以由位于环境100中的其他地方的类似组件来执行。因此，方法400不旨在限于播放器202和管线204。

[0034] 在操作402，响应于接收到将播放切换到新内容的指示，高速缓存管理器206访问在高速缓存208中存储的预先取得的用于新内容的元数据。预先取得的用于新内容的元数据可以包括：一个或更多个URL，其中新内容可用；一个或更多个URL，用于与新内容相关联的不同比特率；用于新内容的许可证数据；以及用于新内容的编解码器信息。预先取得的元数据还可以指示新内容是否与第一段内容类型相同。例如，第一段内容和新内容都可以是HTTP实时流式传输(HLS)格式，或者都可以是HTTP上的动态自适应流式传输(DASH)格式。

[0035] 在操作404，播放器202确定第一段内容和新内容是否具有相同的内容类型。如果第一段内容和新内容不具有同一类型(例如，第一段内容是HLS格式，而新内容是DASH格式)，那么在操作406释放管线204的资源(例如，源元件212、解复用器214、音频解码器216和视频解码器218)。释放管线204的所有资源实质上解构了管线204。播放器202通过获取适用于新内容的内容类型的其他资源来创建新管线。

[0036] 如果在操作404播放器202确定出第一段内容和新内容具有相同的内容类型(例如，两者均为HLS格式)，则在操作408，检测用于新内容的编解码器信息。在示例性实施方案中，对于编解码器信息，播放器202检查用于新内容的预先取得的元数据。编解码器信息指示新内容所需的解码器类型。

[0037] 在操作410，由播放器202确定新内容所需的解码器的类型是否与第一段内容的管线204中当前的解码器相同。如果所需的解码器的类型相同，则在操作412，保留整个管线204。换句话说，管线204的资源被保持并继续用于播放新内容。

[0038] 然而，如果在操作410播放器202确定出新内容需要不同的解码器，则在操作414，释放解码器(例如，音频解码器216和视频解码器208)。随后在操作416，保留或保持管线204的其余部分(例如，源元件212和解复用器214)。在这些实施方案中，播放器202获取适用于新内容的新的解码器集合(例如，新的音频解码器和新的视频解码器)，并将新的解码器集合添加到管线204的保留部分。

[0039] 尽管参照可适用于DASH和HLS的管线和比特率保留讨论了示例性实施方案，但是用于保留比特率和管线的示例性实施方案可应用于本质上自适应的任何类型的内容(例如，内容比特率可以基于带宽改变)。

[0040] 图5是示出了根据一些示例性实施方案的机器500的组件的框图，机器500能够从机器存储介质522(例如，非易失性机器存储介质、机器可读存储介质、计算机可读存储介质，或它们的任何合适的组合)读取指令524，并全部或部分地执行本文所讨论的方法中的任何一种或更多种。具体地，图5以计算机设备(例如，计算机)的示例形式示出了机器500，在其中可以全部或部分地实现用于使机器500执行本文讨论的方法中的任何一种或更多种的指令524(例如，软件、程序、应用程序、小程序、应用或其他可执行代码)。

[0041] 例如，指令524可以使机器500执行图3和图4的流程图。指令524可以将通用的、未编程的机器500转换成编程为以所述的方式执行所描述和示出的功能的特定机器(例如，特殊配置的机器)。

[0042] 在替代实施方案中，机器500作为独立设备操作，或者可以连接(例如，联网)到其他机器。机器500可以是服务器计算机、客户端计算机、个人计算机(PC)、平板计算机、膝上

Pinterest Ex. 1004 Page 117 of 371

型计算机、上网本、机顶盒(例如,STB)、个人数字助理(PDA)、蜂窝电话、智能电话、Web设备、网络路由器、网络交换机、网桥、电源适配器或能够顺序或以其他方式执行指令524的任何机器500,指令524指定了该机器500要采取的动作。此外,尽管仅示出了单个机器500,但是术语"机器"也应理解为包括机器的集合,其单独地或共同地执行指令524以执行本文所讨论的方法中的任何一种或更多种。

[0043] 机器500包括:处理器502(例如,中央处理单元(CPU)、图形处理单元(GPU)、数字信号处理器(DSP)、专用集成电路(ASIC)、射频集成电路(RFIC),或其任何合适的组合)、主存储器504和静态存储器506,它们配置为通过总线508彼此通信。处理器502可以包括可由指令524的一些或全部来临时或永久配置的微电路,使得处理器502可以配置为整体或部分执行本文所述方法中的任何一种或更多种。例如,一组处理器502的一个或更多个微电路可以配置为执行本文所述的一个或更多个模块(例如,软件模块)。

[0044] 机器500可以进一步包括:图形显示器510(例如,等离子显示面板(PDP)、发光二极管(LED)显示器、液晶显示器(LCD)、投影仪、阴极射线管(CRT)或任何其他能够显示图形或视频的显示器)。机器500还可以包括:字母数字输入设备512(例如,键盘或小键盘)、光标控制设备514(例如,鼠标、触摸板、轨迹球、操纵杆、运动传感器、眼球跟踪设备或其他指向工具)、存储单元516、信号生成设备518(例如,声卡、放大器、扬声器、耳机插孔或它们的任何合适的组合)以及网络接口设备520。

[0045] 存储单元516包括机器存储介质522(例如,有形的机器可读存储介质),在其上存储了指令524,指令524实现了本文描述的方法或功能中的任何一种或更多种。在由机器500执行指令之前或期间,指令524也可以全部或至少部分地位于主存储器504内、处理器502内(例如,处理器的高速缓冲存储器内)或这两者中。因此,主存储器504和处理器502可以认为是机器存储介质522(例如,有形的和非易失性的机器存储介质)。

[0046] 在一些示例性实施方案中,机器500可以是便携式计算设备,并且具有一个或更多个附加的输入组件(例如,传感器或仪表)。这样的输入组件的示例包括:图像输入组件(例如,一个或更多个摄像机)、音频输入组件(例如,麦克风)、方向输入组件(例如,指南针)、位置输入组件(例如,全球定位系统(GPS)接收器)、方向组件(例如,陀螺仪)、运动检测组件(例如,一个或更多个加速度计)、高度检测组件(例如,高度计)和气体检测组件(例如,气体传感器)。由这些输入组件中的任何一个或更多个输入组件收集的输入可以由本文描述的任何模块访问和使用。

[0047] 可执行指令和机器存储介质

[0048] 各种存储器(即,504、506和/或处理器502的存储器)和/或存储单元516可以存储实现本文描述的方法或功能的一种或更多种、或者由本文描述的方法或功能的一种或更多种利用的一组或更多组指令和数据结构(例如,软件524)。这些指令在由处理器502执行时使得各种操作实施所公开的实施方案。

[0049] 如本文所使用的,术语"机器存储介质"、"设备存储介质"、"计算机存储介质"(统称为"机器存储介质522")表示相同的事物,并且可以在本发明中互换使用。该术语指的是存储可执行指令和/或数据的单个或多个存储设备和/或介质(例如,集中式或分布式数据库和/或关联的高速缓存和服务器),以及包括多个存储装置或设备的基于云的存储系统或存储网络。因此,应将术语理解为包括但不限于固态存储器以及光和磁介质,包括处理器内

Pinterest Ex. 1004 Page 118 of 371

部或外部的存储器。机器存储介质、计算机存储介质和/或设备存储介质522的特定示例包括：非易失性存储器，例如包括半导体存储器件，例如，可擦除可编程只读存储器(EPROM)、电可擦除可编程只读存储器(EEPROM)、FPGA和快闪存储器件；磁盘，例如内部硬盘和可移动磁盘；磁光盘；以及CD-ROM和DVD-ROM磁盘。术语机器存储介质、计算机存储介质和设备存储介质522特别排除载波、调制数据信号和其他这种介质，其中至少一些在下文讨论的术语“信号介质”中涵盖。

[0050] 信号介质

[0051] 术语“信号介质”或“传输介质”应认为包括任何形式的调制数据信号、载波等。术语“调制数据信号”是指这样的信号，该信号的一个或更多个特性设置或更改为在该信号中编码信息。

[0052] 计算机可读介质

[0053] 术语“机器可读介质”、“计算机可读介质”和“设备可读介质”表示相同的事物，并且在本发明中可以互换使用。这些术语定义为既包括机器存储介质又包括信号介质。因此，该术语既包括存储设备/介质又包括载波/调制的数据信号。

[0054] 指令524可以进一步经由网络接口设备520利用传输介质并且利用许多公知的传输协议中的任何一种(例如，HTTP)在通信网络526上发送或接收。通信网络526的示例包括：局域网(LAN)、广域网(WAN)、互联网、移动电话网络、普通老式电话服务(POTS)网络和无线数据网络(例如，WiFi、LTE和WiMAX网络)。术语“传输介质”应认为包括能够存储、编码或运载由机器500执行的指令524的任何无形介质，并且包括数字或模拟通信信号或促进这种软件的通信的其他无形介质。

[0055] 在整个说明书中，多个实例可以实现描述为单个实例的组件、操作或结构。尽管将一种或更多种方法的单独操作示出并描述为单独的操作，但是可以同时执行一个或更多个单独操作，并且不需要按照所示顺序执行操作。在示例性配置中表示为单独组件的结构和功能可以实现为组合结构或组件。类似地，呈现为单个组件的结构和功能可以实现为单独的组件。这些和其他变型、修改、添加和改进落入本文主题的范围内。

[0056] 本文将某些实施方案描述为包括逻辑或多个组件、模块或机制。模块可以构成软件模块(例如，实现在机器存储介质522上或在传输信号中的代码)或硬件模块。“硬件模块”是能够执行某些操作的有形单元，并且可以以某种物理方式进行配置或布置。在各种示例性实施方案中，一个或更多个计算机系统(例如，独立计算机系统、客户端计算机系统或服务器计算机系统)或计算机系统的一个或更多个硬件模块(例如，一个处理器502或一组处理器502)可以通过软件(例如，应用程序或应用程序部分)配置为操作以执行本文所述的某些操作的硬件模块。

[0057] 在一些实施方案中，可以机械地、电子地或其任何合适的组合来实现硬件模块。例如，硬件模块可以包括专用电路或逻辑，该专用电路或逻辑永久地配置为执行某些操作。例如，硬件模块可以是专用处理器，例如现场可编程门阵列(FPGA)或ASIC。硬件模块还可以包括可编程逻辑或电路，该可编程逻辑或电路由软件临时配置为执行某些操作。例如，硬件模块可以包括包含在通用处理器或其他可编程处理器内的软件。应当理解的是，可以由成本和时间考虑来决定在专用且永久配置的电路中或在临时配置的电路(例如，由软件配置)中机械地实现硬件模块。

Pinterest Ex. 1004 Page 119 of 371

[0058] 相应地，短语“硬件模块”应理解为包括有形实体，是物理地构建、永久地配置(例如，硬接线)，或临时地配置(例如，编程)以某种方式操作或执行本文中所述的某些操作的实体。如本文所使用的，“硬件实现的模块”是指硬件模块。考虑其中硬件模块临时配置(例如，编程)的实施方案，每个硬件模块不需要在任何一个时刻配置或实例化。例如，在硬件模块包括由软件配置成为专用处理器的通用处理器的情况下，通用处理器可以在不同时间分别配置为不同的专用处理器(例如，包括不同的硬件模块)。软件可以对处理器进行相应地配置，例如，以在一个时刻上构成特定的硬件模块，并在不同的时刻上构成不同的硬件模块。

[0059] 本文中描述的示例性方法的各种操作可以至少部分地由一个或更多个临时配置(例如，通过软件)或永久配置为执行相关操作的处理器执行。不管是临时配置还是永久配置，这种处理器都可以构成处理器实现的模块，这些模块操作以执行本文所述的一个或更多个操作或功能。如本文所使用的，“处理器实现的模块”是指使用一个或更多个处理器实现的硬件模块。

[0060] 类似地，本文中描述的方法可以至少部分地由处理器实现，处理器是硬件的示例。例如，方法的至少一些操作可以由一个或更多个处理器或处理器实现的模块执行。

[0061] 示例

[0062] 示例1是用于优化内容更改过程的方法。所述方法包括：通过数字接收器，使得播放第一段内容；在第一段内容播放期间，通过数字接收器接收对用于播放的新的一段内容的选择；响应于接收到选择，通过数字接收器的处理器保持用于播放第一段内容的比特率，以开始新的一段内容的播放。

[0063] 在示例2中，示例1的主题可以可选地包括：确定新的一段内容是否与第一段内容类型相同；基于新的一段内容与第一段内容的类型相同，确定是否保留播放管线的至少一部分。

[0064] 在示例3中，示例1-2的主题可以可选地包括：其中，确定是否保留包括：检测新的一段内容的编解码器信息，该编解码器信息指示新的一段内容所需的解码器的类型；确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

[0065] 在示例4中，示例1-3的主题可以可选地包括：响应于管线中的音频解码器和视频解码器是由编解码器信息指示的类型，保留整个管线。

[0066] 在示例5中，示例1-4的主题可以可选地包括：响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型，释放管线中的音频解码器和视频解码器；基于所述编解码器信息获得新的音频解码器和新的视频解码器。

[0067] 示例6是一种优化内容更改过程的系统。所述系统包括：一个或更多个硬件处理器；以及存储设备，其存储用于配置一个或更多个硬件处理器以执行操作的指令，所述操作包括：使得播放第一段内容；在第一段内容播放期间，接收对用于播放的新的一段内容的选择；响应于接收到选择，保持用于播放第一段内容的比特率，以开始新的一段内容的播放。

[0068] 在示例7中，示例6的主题可以可选地包括：确定新的一段内容是否与第一段内容类型相同；基于新的一段内容与第一段内容的类型相同，确定是否保留播放管线的至少一部分。

[0069] 在示例8中，示例6-7的主题可以可选地包括：其中，确定是否保留包括：检测新的

Pinterest Ex. 1004 Page 120 of 371

一段内容的编解码器信息，该编解码器信息指示新内容所需的解码器的类型；确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

[0070] 在示例9中，示例6-8的主题可以可选地包括：响应于管线中的音频解码器和视频解码器是由编解码器信息指示的类型，保留整个管线。

[0071] 在示例10中，示例6-9的主题可以可选地包括：响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型，释放管线中的音频解码器和视频解码器；基于所述编解码器信息获得新的音频解码器和新的视频解码器。

[0072] 示例11是一种机器可读介质，其存储指令，所述指令在由机器的一个或更多个硬件处理器执行时使机器执行操作，所述操作包括：使得播放第一段内容；在第一段内容播放期间，接收对用于播放的新的一段内容的选择；响应于接收到选择，保持用于播放第一段内容的比特率，以开始新的一段内容的播放。

[0073] 在示例12中，示例11的主题可以可选地包括：确定新的一段内容是否与第一段内容类型相同；基于新的一段内容与第一段内容的类型相同，确定是否保留播放管线的至少一部分。

[0074] 在示例13中，示例11-12的主题可以可选地包括：其中，确定是否保留包括：检测新的一段内容的编解码器信息，该编解码器信息指示新内容所需的解码器的类型；确定管线中的音频解码器和视频解码器是否为由编解码器信息指示的类型。

[0075] 在示例14中，示例11-13的主题可以可选地包括：响应于管线中的音频解码器和视频解码器是由编解码器信息指示的类型，保留整个管线。

[0076] 在示例15中，示例11-14的主题可以可选地包括：响应于管线中的音频解码器和视频解码器不同于由编解码器信息指示的类型，释放管线中的音频解码器和视频解码器；基于所述编解码器信息获得新的音频解码器和新的视频解码器。

[0077] 本文中讨论的主题的某些部分可以按照对以位或二进制数字信号存储在机器存储器(例如，计算机存储器)中的数据进行运算的算法或符号表示的方式来呈现。这样的算法或符号表示是数据处理领域的普通技术人员用来将其工作的实质传达给本领域其他技术人员的技术的示例。如本文所使用的，“算法”是导致期望结果的操作或类似处理的自洽序列。在这种情况下，算法和操作涉及对物理量的物理操控。通常，但不是必须，这样的量可以采取能够由机器存储、访问、传输、组合、比较或以其他方式操纵的电、磁或光信号的形式。主要出于通用目的，利用诸如“数据”、“内容”、“位”、“值”、“元素”、“符号”、“字符”、“术语”、“数”、“数字”等的词语来引用这种信号有时会很方便。但是，这些词语仅是方便的标签，并且应与适当的物理量相关联。

[0078] 除非另有明确说明，否则本文中利用诸如“处理”、“计算”、“估算”、“确定”、“呈现”、“显示”等词语进行的讨论可以指操控或转换数据的机器的动作或过程(例如，计算机)，所述数据表示为一个或更多个存储器(例如，易失性存储器、非易失性存储器或其任意合适的组合)、寄存器或者接收、存储、传输或显示信息的其他机器组件内的物理(例如，电、磁或光)量的数据。此外，除非另有明确说明，否则如专利文件中公知的，术语“一”或“一个”在本文中用于包括一个或更多个实例。最后，除非另有明确说明，否则如本文所使用的，连词“或”是指非排他性的“或”。

[0079] 尽管已经参考特定示例性实施方案描述了本发明主题的概述，但是在不脱离本发

Pinterest Ex. 1004 Page 121 of 371

明的实施方案的较宽范围的情况下，可以对这些实施方案进行各种修改和改变。例如，本领域普通技术人员可以混合和匹配各种实施方案或其特征，或者使其成为可选的。仅出于方便起见，本文中可以单独地或共同地用术语“发明”来指代发明主题的这些实施方案，并且如果实际上公开了一个以上的发明，则不希望将本申请的范围自动限制为任何单个发明或发明构思。

[0080] 相信本文足够详细地描述了本文中所示的实施方案，以使本领域技术人员能够实践所公开的教导。可以使用其他实施方案并从中得出其他实施方案，使得可以在不脱离本发明的范围的情况下进行结构和逻辑上的替换和改变。因此，不应在限制意义上理解详细描述，并且各种实施方案的范围仅由所附权利要求以及这些权利要求所享有的等同物的全部范围来限定。

[0081] 此外，可以为本文中描述为单个实例的资源、操作或结构提供多个实例。此外，各种资源、操作、模块、引擎和数据存储装置之间的边界在某种程度上是任意的，并且在特定说明性配置的上下文中示出了特定操作。可以设想功能的其他分配，并且其可以落入本发明的各种实施方案的范围内。通常，在示例性配置中呈现为单独资源的结构和功能可以实现为组合结构或资源。类似地，呈现为单个资源的结构和功能可以实现为单独的资源。这些和其他变型、修改、添加和改进落入如所附权利要求所表示的本发明的实施方案的范围内。因此，说明书和附图应认为是说明性的而不是限制性的。

Pinterest Ex. 1004 Page 122 of 371

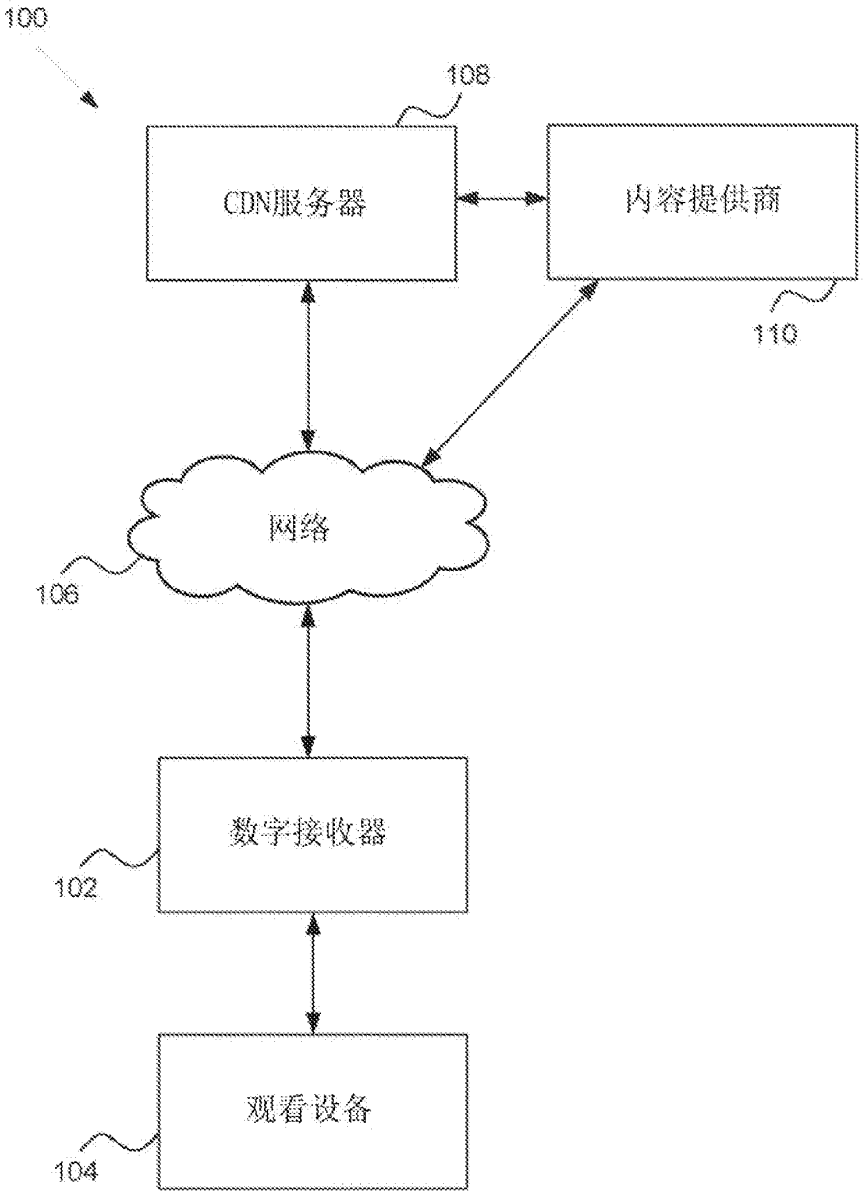


图1

Pinterest Ex. 1004 Page 123 of 371

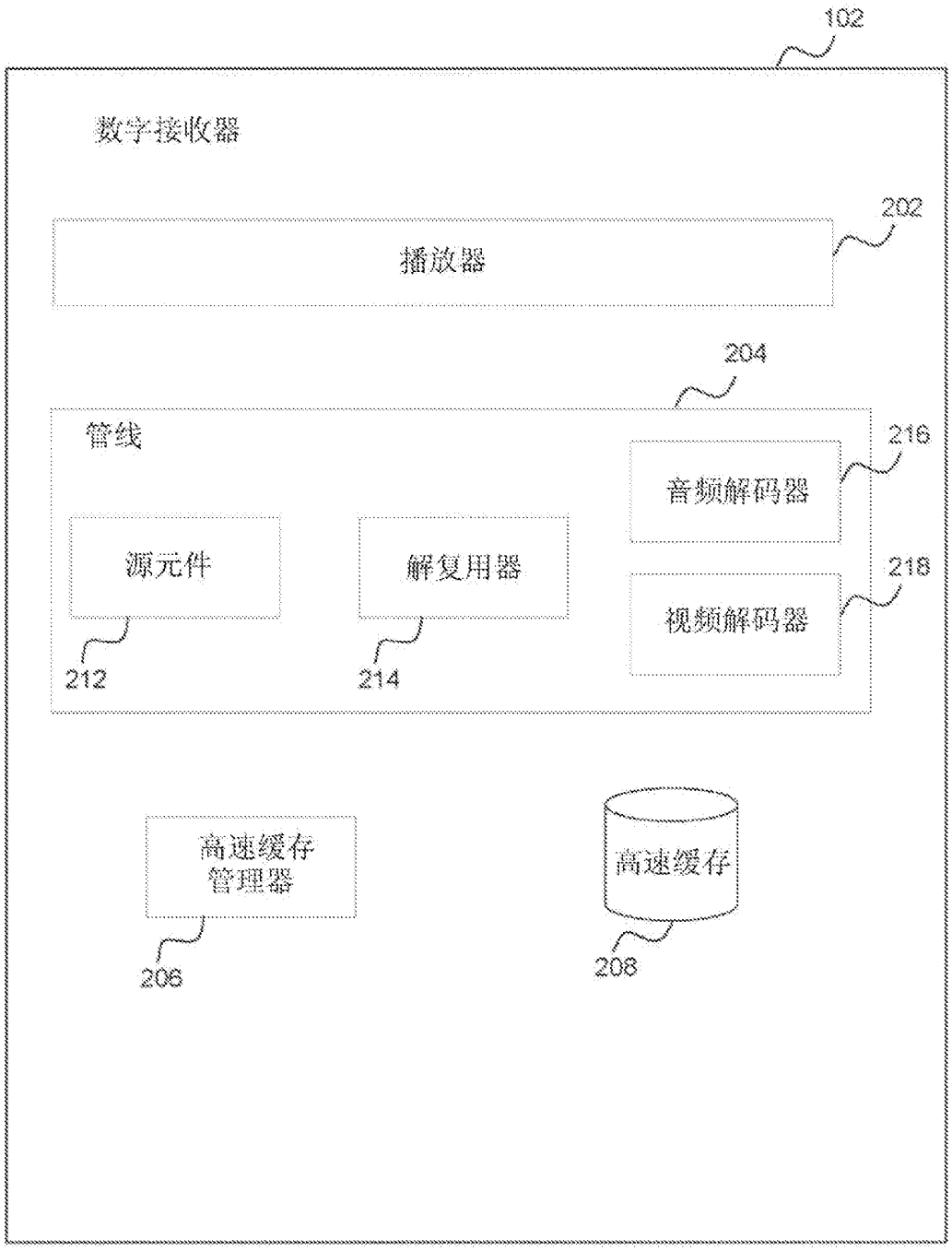


图2

Pinterest Ex. 1004 Page 124 of 371

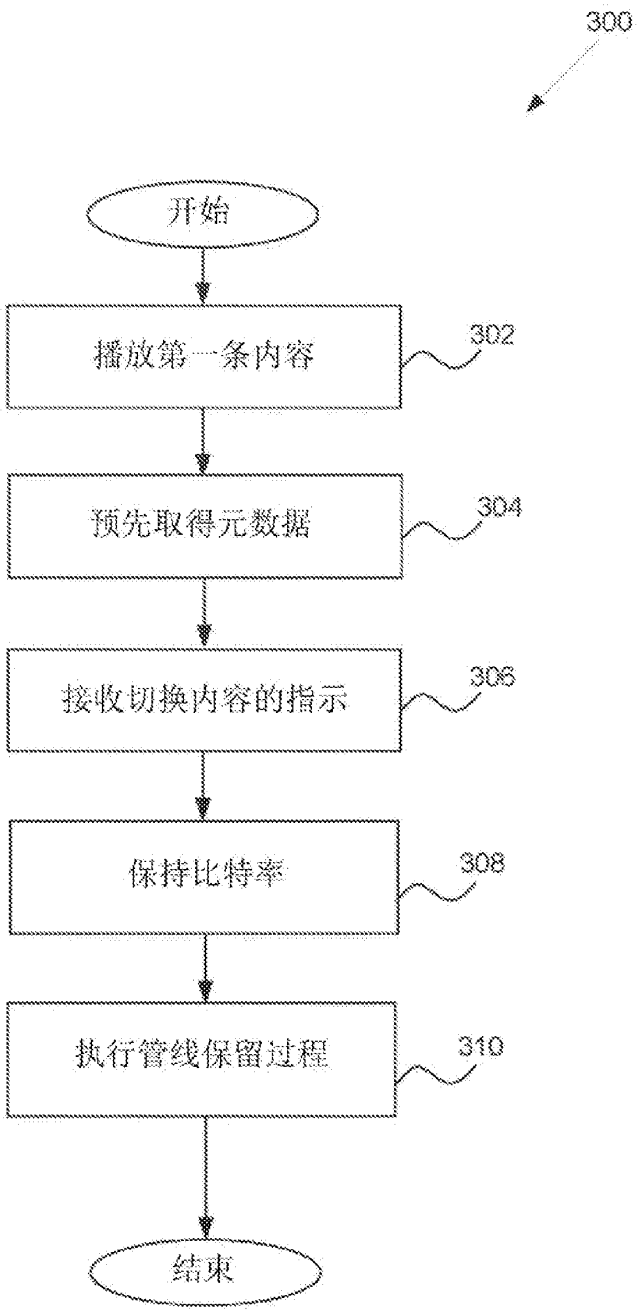


图3

Pinterest Ex. 1004 Page 125 of 371

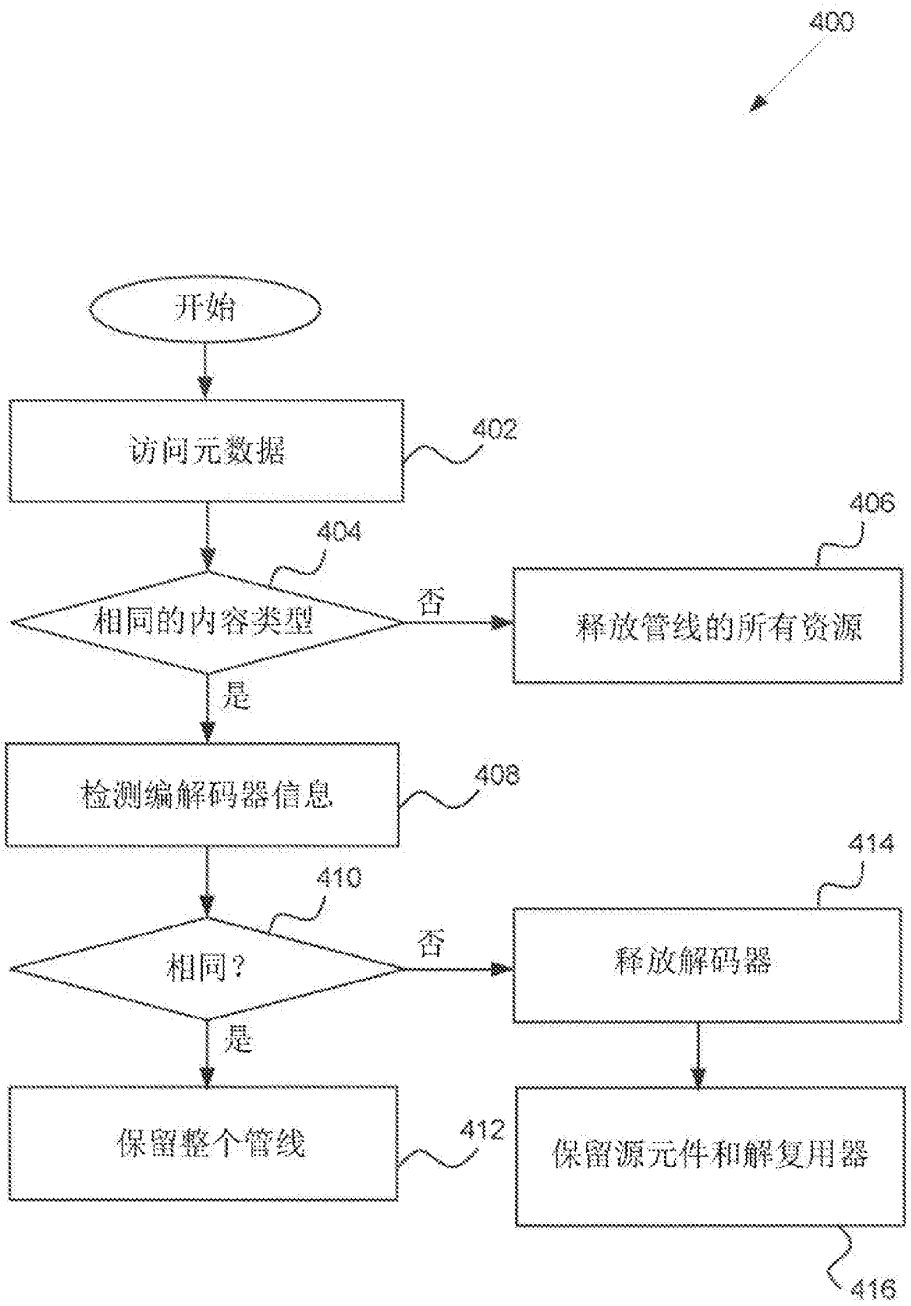


图1

Pinterest Ex. 1004 Page 126 of 371

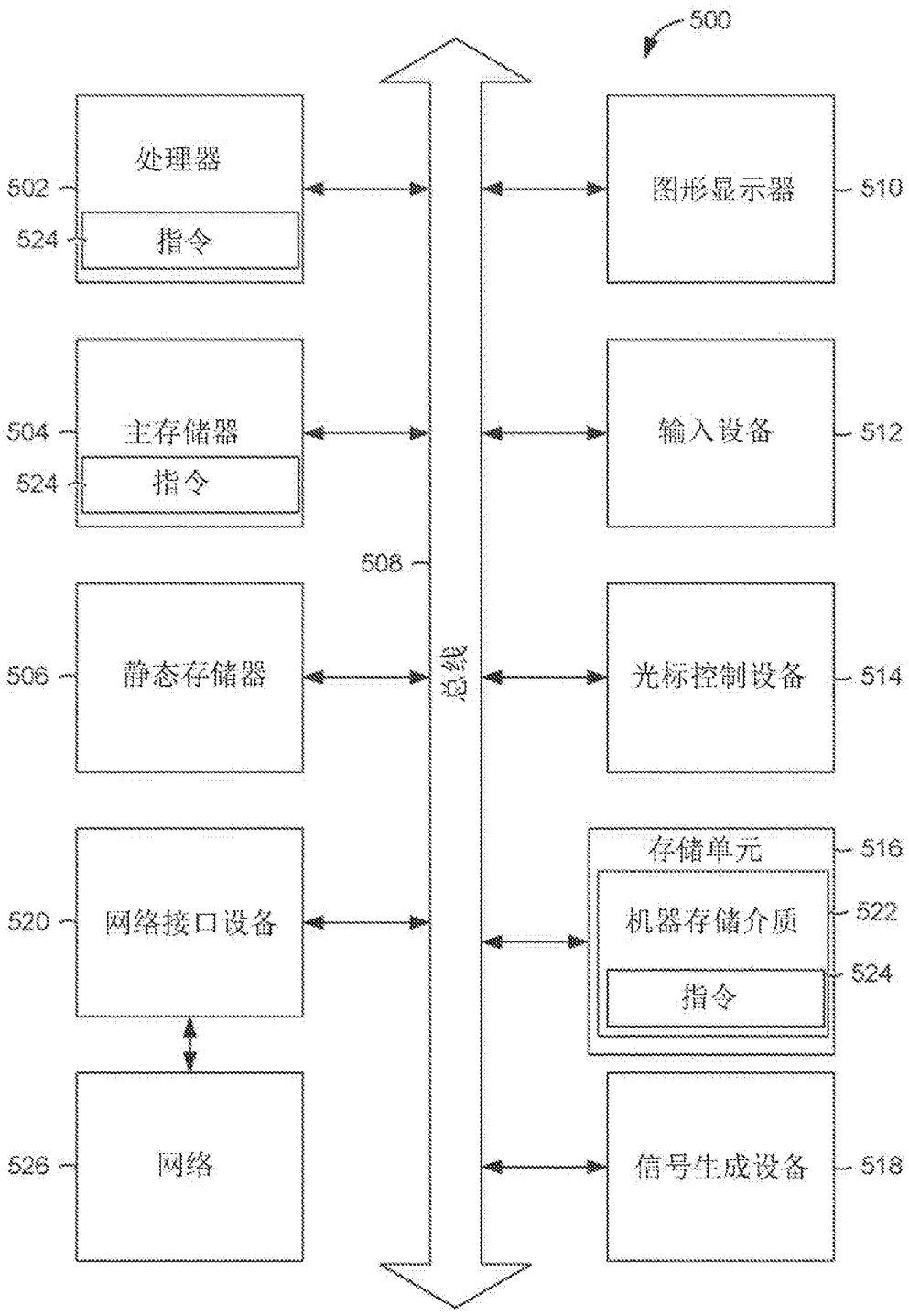


图5

Pinterest Ex. 1004 Page 127 of 371

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 050 307 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
06.11.2019 Bulletin 2019/45

(21) Application number: **14849294.5**

(22) Date of filing: **23.09.2014**

(51) Int Cl.:
H04N 21/61 *(2011.01)* ***H04N 21/238*** *(2011.01)*
H04N 21/236 *(2011.01)* ***H04L 29/06*** *(2006.01)*
H04N 21/433 *(2011.01)* ***H04N 21/438*** *(2011.01)*
H04N 21/442 *(2011.01)* ***H04N 21/466*** *(2011.01)*

(86) International application number:
PCT/IB2014/064783

(87) International publication number:
WO 2015/044870 (02.04.2015 Gazette 2015/13)

(54) SYSTEM AND METHOD FOR MANAGING ADJACENT CHANNELS IN AN ADAPTIVE STREAMING ENVIRONMENT

SYSTEM UND VERFAHREN ZUR VERWALTUNG VON NACHBARKANÄLEN IN EINER ADAPTIVEN STREAMING-UMGEBUNG

SYSTÈME ET PROCÉDÉ DE GESTION DE CANAUX ADJACENTS DANS UN ENVIRONNEMENT DE DIFFUSION ADAPTATIVE EN CONTINU

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **25.09.2013 US 201314037078**

(43) Date of publication of application:
03.08.2016 Bulletin 2016/31

(73) Proprietor: **Ericsson AB**
164 80 Stockholm (SE)

(72) Inventors:
- **PHILLIPS, Chris**
  Hartwell, Georgia 30643 (US)
- **DASHER, Charles Hammett**
  Lawrenceville, Georgia 30044 (US)
- **FORSMAN, Robert Hammond**
  Sugar Hill, Georgia 30518 (US)
- **REYNOLDS, Jennifer Ann**
  Duluth, Georgia 30097 (US)

(74) Representative: **Haseltine Lake Kempner LLP**
Redcliff Quay
120 Redcliff Street
Bristol BS1 6HU (GB)

(56) References cited:
KR-A- 20090 089 300
US-A1- 2009 217 339
US-A1- 2009 292 819
US-A1- 2013 195 205
US-B1- 6 848 004

- **CHAE YOUNG LEE ET AL: "Reducing Channel Zapping Time in IPTV Based on User's Channel Selection Behaviors", IEEE TRANSACTIONS ON BROADCASTING, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 56, no. 3, 1 September 2010 (2010-09-01), pages 321-330, XP011312107, ISSN: 0018-9316**
- **RGB NETWORKS: 'Comparing Adaptive HTTP Streaming Technologies' November 2011, XP055316468 Retrieved from the Internet: <URL:http://www.rgbnetworks.com/pdfs/RGB_Ad aptive_HTTP_Streaming_Comparison_1211-01.pdf>**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 75001 PARIS (FR)

EP 3 050 307 B1

Description

FIELD OF THE DISCLOSURE

[0001] The present disclosure generally relates to communication networks. More particularly, and not by way of any limitation, the present disclosure is directed to a system and method for managing adjacent channels in an adaptive streaming environment.

BACKGROUND

[0002] Adaptive streaming is a popular means of non-traditional video delivery. Although there have been several advances, changing adaptively streamed content (e.g., from one stream or channel to another stream or channel) remains a cumbersome process in current implementations. As such, typical adaptive streaming techniques do not provide for a realistic or user-friendly "channel surfing" experience, thereby negatively impacting the quality of user enjoyment.

[0003] Lee et al., "Reducing Channel Zapping Time in IPTV Based on User's Channel Selection Behaviors", IEEE TRANSACTIONS ON BROADCASTING, describes a predictive tuning method, which reduces channel zapping time by prejoining channels that are likely to be selected next, in addition to the currently watched channel.

SUMMARY

[0004] The present patent disclosure is broadly directed to systems, methods, devices, apparatuses and associated computer-readable media for managing and effectuating fast channel changes (e.g., user-initiated "channel surfing" requests) in an adaptive streaming environment. One or more adjacent channels are adaptively defined relative to a current streaming channel that a client device is engaged on. The client device is configured to pre-fetch metadata and initialization information for the defined adjacent channels based on bandwidth conditions, buffer conditions, etc. When a channel is changed, the client device is operative to use the pre-fetched data to quickly obtain encoded media content for rendering.

[0005] In one aspect, an embodiment of a method operative in a streaming client device disposed in an adaptive streaming environment is disclosed. The claimed embodiment comprises, *inter alia,* monitoring at least a bandwidth condition relative to a network connection or a content distribution pipe between the streaming client device and a content delivery network and associated streaming server system. Based on the monitored conditions, one or more adjacent channels may be determined relative to a current streaming channel of the streaming client device. Responsive to the determination of the one or more adjacent channels, metadata information relative to the one or more adjacent channels is pre-fetched. Responsive to the pre-fetched metadata information, initialization information for the one or more adjacent channels is pre-fetched and stored locally on the streaming client device. If the current streaming channel is changed to a new streaming channel belonging to the one or more adjacent channels, the pre-fetched initialization information may be used to fetch encoded media content pertaining to the new streaming channel. In one variation, the claimed method further includes monitoring at least one of video buffer conditions and decoder processing conditions of the streaming client device, as well as determining the number of available decoders. In another variation, the pre-fetched metadata information of the adjacent channels comprises one or more manifest files generated in effectuating adaptive bit rate (ABR) streaming. The adjacent channels may be determined in a number of ways including, but not limited to, as a configurable number of consecutive channels above and/or below the current channel, based on users' favorite lists, and the like. In a still further variation, the claimed embodiment may comprise pre-fetching media content and immediately decoding the pre-fetched media content. If the current streaming channel is changed to a new streaming channel belong to one of the adjacent channels, the decoded media content of the adjacent channel is rendered promptly for display.

[0006] In another aspect, an embodiment of a client device is disclosed that comprises one or more processors, a bandwidth monitor and a streaming client module coupled to the one or more processors. The streaming client module may be configured to perform an embodiment of a method described hereinabove at least for purposes of managing adjacent channels in an adaptive streaming environment. In still further aspects, an embodiment of a non-transitory computer-readable medium containing instructions stored thereon is disclosed for performing one or more embodiments of the methods set forth above.

[0007] Advantages of the present invention include, but not limited to, facilitating a user-friendly channel surfing experience in an adaptive streaming environment that is similar to what is commonly encountered in existing TV broadcast environments. As one or more embodiments set forth herein allow rapid changing of adaptive streaming channels without bandwidth waste, unsatisactory viewing conditions that can result from changing streaming channels are mitigated. Further features of the various embodiments are as claimed in the dependent claims. Additional benefits and advantages of the embodiments will be apparent in view of the following description and accompanying Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Embodiments of the present disclosure are illustrated by way of example, and not by way of limitation, in the Figures of the accompanying drawings in which like references indicate similar elements. It should be not-

Pinterest Ex. 1004 Page 129 of 371

ed that different references to "an" or "one" embodiment in this disclosure are not necessarily to the same embodiment, and such references may mean at least one. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to effect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0009] The accompanying drawings are incorporated into and form a part of the specification to illustrate one or more exemplary embodiments of the present disclosure. Various advantages and features of the disclosure will be understood from the following Detailed Description taken in connection with the appended claims and with reference to the attached drawing Figures in which:

FIG. 1 depicts an example streaming network environment including a content delivery network wherein one or more embodiments of the present patent application may be practiced:

FIG. 2 depicts a diagram of example stages involved in an illustrative acquisition and rendering process for streaming video content for purposes of the present patent disclosure;

FIGS. 3A-3C depict examples of various types of channel adjacencies according to one or more embodiments of the present patent disclosure;

FIG. 3D depicts a block diagram of an example streaming client device according to one embodiment;

FIGS. 4-6 depict flowcharts with blocks relative to various steps and acts that may take place at a client device according to one or more embodiments of the present patent application;

FIG. 7 depicts a flowchart with blocks relative to various steps and acts that may take place at an adaptive streaming server system according to one or more embodiments of the present patent application;

FIGS. 8-10 depicts flowcharts with blocks relative to various steps and acts that may take place at a client device according to one or more embodiments of the present patent application; and

FIG. 11 depicts another embodiment of an example streaming client device for purposes of the present patent application.

DETAILED DESCRIPTION OF THE DRAWINGS

[0010] In the following description, numerous specific details are set forth with respect to one or more embodiments of the present patent disclosure. However, it should be understood that one or more embodiments may be practiced without such specific details. In other instances, well-known circuits, subsystems, components, structures and techniques have not been shown in detail in order not to obscure the understanding of the example embodiments. Accordingly, it will be appreciated by one skilled in the art that the embodiments of the present disclosure may be practiced without such specific components-based details. It should be further recognized that those of ordinary skill in the art, with the aid of the Detailed Description set forth herein and taking reference to the accompanying drawings, will be able to make and use one or more embodiments without undue experimentation.

[0011] Additionally, terms such as "coupled" and "connected," along with their derivatives, may be used in the following description, claims, or both. It should be understood that these terms are not necessarily intended as synonyms for each other. "Coupled" may be used to indicate that two or more elements, which may or may not be in direct physical or electrical contact with each other, co-operate or interact with each other. "Connected" may be used to indicate the establishment of communication, i.e., a communicative relationship, between two or more elements that are coupled with each other. Further, in one or more example embodiments set forth herein, generally speaking, an element, component or module may be configured to perform a function if the element is capable of performing or otherwise structurally arranged to perform that function.

[0012] As used herein, a network element or node may be comprised of one or more pieces of service network equipment, including hardware and software that communicatively interconnects other equipment on a network (e.g., other network elements, end stations, etc.), and is adapted to host one or more applications or services with respect to a plurality of subscribers. Some network elements may comprise "multiple services network elements" that provide support for multiple network-based functions (e.g., A/V media management, session control, QoS policy enforcement, bandwidth scheduling management, subscriber/device policy and profile management, content provider priority policy management, streaming policy management, and the like), in addition to providing support for multiple application services (e.g., data and multimedia applications). Subscriber end stations or client devices may comprise any device configured to execute, *inter alia,* at least one streaming client application (e.g., an ABR streaming client application) for receiving content from a streaming server or content provider. Accordingly, such client devices may include set-top boxes, PVR/DVRs, workstations, laptops, netbooks, palm tops, mobile phones, smartphones, multimedia phones, Voice Over Internet Protocol (VOIP) phones, mobile/wireless user equipment, high definition TV terminals, portable media players, location-aware subscriber equipment gaming systems or consoles (such as the Wii®, Play Station 3®, Xbox 360®), etc.. that may access or consume content/services provided over a content delivery network in accordance with one or more embodiments set forth herein. Further, the client devices may also access or consume content/services provided over broadcast networks (e.g., cable and satellite networks) as well as a packet-switched wide area public network such as the

Pinterest Ex. 1004 Page 130 of 371

Internet via suitable service provider access networks. In a still further variation, the client devices or subscriber end stations may also access or consume content/services provided on virtual private networks (VPNs) overlaid on (e.g., tunneled through) the Internet.

[0013] One or more embodiments of the present patent disclosure may be implemented using different combinations of software, firmware, and/or hardware. Thus, one or more of the techniques shown in the Figures (e.g., flowcharts) may be implemented using code and data stored and executed on one or more electronic devices or nodes (e.g., a subscriber client device or end station, a network element, etc.). Such electronic devices may store and communicate (internally and/or with other electronic devices over a network) code and data using computer-readable media, such as non-transitory computer-readable storage media (e.g., magnetic disks, optical disks, random access memory, read-only memory, flash memory devices, phase-change memory, etc.), transitory computer-readable transmission media (e.g., electrical, optical, acoustical or other form of propagated signals - such as carrier waves, infrared signals, digital signals), etc. In addition, such network elements may typically include a set of one or more processors coupled to one or more other components, such as one or more storage devices (e.g., non-transitory machine-readable storage media) as well as storage database(s), user input/output devices (e.g., a keyboard, a touch screen, a pointing device, and/or a display), and network connections for effectuating signaling and/or bearer media transmission. The coupling of the set of processors and other components may be typically through one or more buses and bridges (also termed as bus controllers), arranged in any known (e.g., symmetric/shared multiprocessing) or heretofore unknown architectures. Thus, the storage device or component of a given electronic device or network element may be configured to store code and/or data for execution on one or more processors of that element, node or electronic device for purposes of implementing one or more techniques of the present disclosure.

[0014] Referring now to the drawings and more particularly to FIG. 1, depicted therein is an example streaming network environment 100 including a content delivery network or content distribution network (CDN) 122 coupled to an adaptive streaming server system 102 wherein one or more embodiments of the present patent application may be practiced. For purposes of the present patent application. CDN 122 may comprise an overlay network architected for high-performance streaming of a variety of digital assets or program assets as well as services (hereinafter referred to as "media content") to subscribers using one or more Internet-based infrastructures, private/dedicated infrastructures or a combination thereof. In general, the terms "media content" or "content file" (or, simply "content") as used in reference to at least some embodiments of the present patent disclosure may include digital assets and program assets such as any type of audio/video content or program segment, streaming or static (e.g., recorded over-the-air free network television (TV) shows or programs, pay TV broadcast programs via cable networks or satellite networks, free-to-air satellite TV shows, IPTV programs, etc.), Over-The-Top (OTT) and video-on-demand (VOD) or movie-on-demand (MOD) shows or programs, time-shifted TV (TSTV) content, as well as other content assets provided by content publishers, owners or providers, including but not limited to software files, executable computer code or programs, online electronic games, Internet radio shows/programs, entertainment programs, educational programs, movies, music video programs, and the like, that may be delivered using any known or heretofore unknown streaming technologies. Further, various programs or content files provided via streaming may be arranged as a collection or assembly of channels that are specific to different subscribers, wherein different channels may comprise media content from one or more content sources or originators.

[0015] By way of illustration, content may be delivered via CDN 122 using adaptive bit rate (ABR) streaming techniques and may be encoded to support Microsoft® Silverlight® Smooth Streaming, HTTP streaming (for instance, Dynamic Adaptive Streaming over HTTP or DASH, HTTP Live Streaming or HLS. HTTP Dynamic Streaming or HDS, etc.), Icecast, and so on. In general, the overlay architecture of CDN 122 may include a multi-level, hierarchically-organized interconnected assembly of network servers for providing media pathways or "pipes" from one or more central distribution nodes to one or more levels of regional distribution nodes that are connected to one or more local edge servers configured to serve a plurality of end users or subscribers in respective serving location areas. In addition to such "distribution servers" (sometimes also referred to as "surrogates"). CDN 122 may also include and/or interoperate with various network elements configured to effectuate request redirection or rerouting mechanisms as well as related back office systems such as subscriber management systems, bandwidth scheduling systems, account/billing systems and the like, that may be deployed as part of a streaming network back office (not specifically shown).

[0016] The streaming network environment 100 includes one or more subscriber end stations, as illustrated by an example client device or user equipment (UE) device 124 associated with a subscriber/customer for consuming content delivered via CDN 122 in any type or number of access technologies including broadband access via wired and/or wireless (radio) communications. For purposes of the present patent application, the terms "streaming client device" and "client device" may be used synonymously and may comprise any UE device or appliance that in one implementation not only receives program assets for live viewing, playback and/or decoding the content, but also operates as a command console or terminal that can accept user inputs, commands or re-

Pinterest Ex. 1004 Page 131 of 371

quests to interact with a network element disposed in CDN 122 and/or the associated streaming server systems 102 for requesting content that may be selectively rendered at an internal display screen 126 and/or one or more external audio/visual (A/V) devices (not specifically shown). As such, the example client device 124 may include one or more streaming client modules 128 (e.g.. an ABR streaming client) and associated decoding functionalities 134 depending on the streaming technologies implemented, each operating in association with a processor module 130 and video buffer memory 132 for effectuating acquisition, decoding and rendering of the streamed media content. Although not specifically shown, the client device 124 also includes appropriate user interfaces for viewing one or more electronic program guides that list, identify or otherwise show the various streaming channels the subscriber is able to receive. Such user interfaces may also be configured to allow the user to scroll through an electronic program guide (i.e.. channel surfing), select or otherwise change a particular streaming channel, and the like. Further, as will be described in additional detail hereinbelow, the client device 124 includes appropriate structures and modules for facilitating such functionalities as channel surfing and channel selection within an adaptive streaming network environment.

[0017] Continuing to refer to FIG. 1, the example adaptive streaming server system 102 may be configured to accept media content from live sources 104A and/or static file sources 104B. In general operation, the example streaming server system 102 may be configured, under the control of one or more processors 108 executing appropriate program code stored in a persistent memory module 109, to effectuate adaptive streaming of content as follows. Initially, source media content is transcoded or otherwise encoded with different bit rates (e.g.. multi-rate transcoding) using applicable encoder(s) 106. For example, a particular program content may be transcoded into five video files using variable bit rates, ranging from low to high bit rates (500 Kbps to 10 Mbps, by way of illustration). The particular content is therefore encoded as five different "versions" or "formats", wherein each bit rate is called a profile or representation. Reference numeral 110 refers to a collection of media streams encoded at different bit rates by the encoder 106. A segmentation server or segmenter 112 is operative to divide each version of the encoded media content into fixed duration segments or chunks, which are typically between two and ten seconds in duration, thereby generating a plurality of chunk streams 114. One skilled in the art will recognize that shorter segments may reduce coding efficiency whereas larger segments may impact the adaptability to changes in network throughput and/or fast changing client behavior. Regardless of the chunk size, the segments may be Group-of-Pictures (GOP)-aligned such that all encoding profiles have the same segments. One or more suitable Manifest Files are then created that describes the encoding rates and Universal Resource Locator (URL) pointers the various segments of encoded content. In one implementation, the Manifest File (MF), a Delivery Format (DF) and means for conversion from/to existing File Formats (FF) and Transport Streams (TS) may be provided by an origin server 116 as part of adaptive streams 120 to the client device 124 over CDN 122, which uses HTTP to fetch the encoded segments based on the URLs. Additionally, an error correction mechanism 118 may also be implemented, either as part of the streaming server system 102 or as a separate network element, in order to reduce transmission errors in the end-to-end streaming of the encoded media content. It should be apparent that the error correction mechanism 118 may be protocol-specific (e.g., Transmission Control Protocol or TCP), although other error correction schemes may also be used additionally or alternatively.

[0018] Still continuing to refer to FIG. 1, the media stream segments received by the client device 124 may be buffered, as needed, and decoded and played back (i.e., rendered) in sequence, either at the local display 126 or at an external A/V device associated with the client device 124. The ABR streaming client module 128 may be designed to select an optimum profile of each segment so as to maximize quality without risking buffer underflow and stalling (i.e., rebuffering) of the play-out. Each time the client device 124 fetches a segment, it may choose the profile based on the measured time to download the previous one or several segments.

[0019] It will be recognized that changing media content (i.e., from one streaming channel to another streaming channel) in an adaptive streaming environment such as the example network arrangement 100 shown in FIG. 1 can be a cumbersome process, especially in fast channel changing conditions. That is because adaptive streaming typically requires that appropriate video buffers be filled to certain levels before rendering, in addition to content segments encoded in high bit rates (i.e., "high bit rate content") being preferred to the same content segments encoded in low bit rates (i.e., "low bit rate content"), etc. Further, as several processing events or stages need to take place in a sequential order before the received media content can be properly rendered (i.e., played back), changing channels can yield an unacceptable viewing experience (e.g., stuttering, jitter, pixelation, etc.) because of the delays and/or interruptions introduced in the overall receive-decode-rendering process. Several embodiments will be set forth in detail hereinbelow, which relate to server-side processes and structures, client-side processes and structures, or both, that address the foregoing issues.

[0020] FIG. 2 depicts a diagram of example stages involved in an illustrative streaming media acquisition and rendering process 200 according to an embodiment of the present patent disclosure. As described above, a client device first obtains, receives or otherwise acquires certain metadata, e.g., manifest files, with respect to media transport streams (block 202). Based on the information contained in the manifest files, various pieces of in-

Pinterest Ex. 1004 Page 132 of 371

itialization information are obtained or otherwise acquired (block 204). Such initialization information may comprise, *inter alia,* Sequence Parameters Set (SPS), Picture Parameters Set (PPS), one or more codec headers such as, e.g., MPEG-2 sequence headers, or High Efficiency Video Coding (HEVC) headers, or AC3 (audio) headers, and any data necessary to decode at least one or more frames, or depending on the granularity of prediction, one or more slices (which are spatially distinct regions of a frame that are encoded separately from other regions of that frame), and/or any combination thereof. Such encoded frames may comprise I-frames (Intra-coded pictures). B-frames (Bi-predictive pictures), or P-frames (Predictive pictures). Likewise, slices may comprise I-slices, B-slices or P-slices, Using the initialization information, encoded media content or data is then obtained or retrieved (block 206) and buffered (208). As appropriate levels of buffer data become available, such data is decoded (210) and then provided to a display screen for rendering (212), using suitable decoder/rendering engines.

[0021] In accordance with the teachings of the present patent disclosure, at least one or more stages of the process flow 200 set forth above may be performed in an anticipatory manner such that those process stages may be "pre-performed". Accordingly, certain basic information necessary to decode streaming media content is made readily available to an adaptive streaming client by virtue of pre-performing some of the early process stages. As a consequence, the adaptive streaming client can promptly utilize the already available information (i.e., "pre-fetched" information) to quickly adjust to a new channel when a user decides to scroll through the channels and/or select a particular channel thereafter. In further accordance with the teachings of the present patent disclosure, anticipatory pre-performance of certain process stages as set forth in the foregoing may be implemented for a select number of streaming channels that are determined to be "adjacent" with respect to a current streaming channel based on predictive channel surfing behavior, channel categorization, adaptive learning, pattern recognition, and other criteria.

[0022] FIGS. 3A-3C depict examples of various types of channel adjacencies according to one or more embodiments of the present patent disclosure. In example 300A shown in FIG. 3A, one or more adjacent channels may be determined as a configurable number of consecutive channels that are above the current streaming channel (i) (e.g., (i+2) channels), or as a configurable number of consecutive channels that are below the current streaming channel (i) (e.g., (i-3) channels), or both. In another embodiment, example 300B shown in FIG. 3B illustrates a scenario where channels may be grouped based on content categorization. Such categories may be defined as user-based "favorites lists", for example. Accordingly, all channels belonging to category "x" may be deemed to be adjacent with respect to one another. FIG. 3C illustrates a scenario where a user's surfing behavior pattern (e.g., over a period of time) may be used to identify whether the user is likely to surf in one direction or the other direction and then selecting adjacent channels in the direction.

[0023] Those skilled in the art should appreciate that the foregoing examples of channel adjacencies merely represent a non-exhaustive list, as there can be numerous variations, methodologies, determinations and schemes by which adjacency may be implemented. Channel adjacencies may also be dynamically changed from default settings and may be configured to vary from one scheme to another based on users' viewing habits, etc. It should also be recognized that certain channel adjacency implementations may depend on how electronic program guides are organized and presented to the users. Accordingly, for purposes of at least some embodiments of the present patent disclosure, an adjacent channel is a streaming channel for which certain process stages shown in FIG. 2 are preemptively performed. Moreover, the number of adjacent channels for which metadata is pre-fetched may be dependent on certain performance/resource constraints pertaining to the client device itself, e.g., current bandwidth conditions, the number of available decoders, buffer conditions, decode processing conditions, and the like.

[0024] Referring now to FIG. 3D, depicted therein is a block diagram of an example streaming client device 350 according to one embodiment wherein one or more aspects of the present patent disclosure may be practiced. It should be appreciated that the streaming client device 350 is a UE device that is generally representative of the subscriber/client device 124 illustrated in FIG. 1, and may include appropriate hardware/software components and subsystems that may augment or otherwise rearrange the blocks shown as part of the client device 124. Broadly, such hardware/software components and subsystems may be configured for performing any of the device-side processes (either individually or in any combination thereof) described hereinabove, which may be rearranged when taken in view of one or more processes described below. A processor module 302 including one or more microcontrollers/processors is provided for the overall control of the client UE device 350 and for the execution of various stored program instructions embodied in a persistent memory 315 that may be part of a memory subsystem 311 of the device 350. Also, one or more video buffers 319 may be included in the memory subsystem 311 for storing video streaming data. Controller/processor complex referred to by reference numeral 302 may also be representative of other specialty processing modules such as graphic processors, video processors, digital signal processors (DSPs), and the like, operating in association with suitable video and audio interfaces 314, 316 for receiving/transmitting content data, which interfaces may include or operate in conjunction with appropriate tuners, demodulators, descramblers, MPEG decoders/demuxes. For example, the client device 350 may be configured to operate with a number

Pinterest Ex. 1004 Page 133 of 371

of known audio formats (e.g., MP3. AAC, AAC+, eAAC+, FLAC WMA, WAV, AMR, OGG, DTS, AC3, LPCM and MIDI) as well as video formats such as, e.g., MPEG4, H.263, H.264, DivX, XviD, WMV, AVI, 3GO, Flash Video, etc. A location-based and/or satellite communications interface 306 may be provided in certain embodiments for effectuating satellite-based communications. Other I/O or interfaces may include one or more user interfaces 320 generally illustrative of a graphic user interface (GUI), touch-sensitive screen, keyboard, microphone, etc., that may be used for inputting commands to effectuate, *inter alia,* channel surfing, channel selection, program guide manipulation, and the like. Additionally, one or more USB/HDMI/DVI/FireWire ports 318 may be provided for effectuating connections to one or more external A/V devices whereby the decoded media content may be rendered externally. Broadband network connectivity may be achieved via interfaces such as Ethernet I/F 308 as well as short-range and wide area wireless connectivity interfaces 312. In one implementation of the client device 350, a hard disk drive (HDD) system (not specifically shown) may be provided for mass storage of program assets such as A/V media, TV shows, movie titles, multimedia games, etc. Also included in the client/UE, device 350 is a suitable power supply 322, which may include AC/DC power conversion to provide power for the device 350. It should be appreciated that the actual power architecture for the client/US device 350 may vary by the hardware platform used, e.g., depending upon the core SoC (System on Chip), memory, analog front-end, analog signal chain components and interfaces used in the specific platform, and the like.

[0025] For purposes of the present patent application, the stored program instructions embodied in the persistent memory 315 (e.g., Flash memory) of the client device 350 may include computer-readable instructions configured to perform one or more device-side processes, selectively in conjunction with other subsystems or logic blocks such as one or more ABR streaming client and decode logic modules 310 and ether subsystems such as a channel change controller, bandwidth and other performance monitors, as well as view mode and channel adjacency determination mechanisms, all collectively referred to by reference numeral 304. Further, an optional local or included display 313 may also be provided as part the client device 350 for rendering received content locally (for example, in a number of resolutions such as Standard Definition, Enhanced Definition or High Definition) in addition to operating as a touch-sensitive screen.

[0026] In one aspect of the present patent disclosure, the various modules, blocks and subsystems set forth above may be configured to effectuate efficient display of adjacent channels through pre-fetched metadata in an adaptive streaming environment. In general, the client device 350 may be configured to operate in two functional modes: (i) a "viewing" mode in which certain data may be pre-fetched in addition to delivering high quality video; and (ii) a "channel changing" or "channel surfing" mode in which fetching low quality or "good enough" quality video to display rapidly changing channels is the main concern. The client device 350 may be in "viewing" mode if no channel is changed after or within a configurable period of time (e.g., 30 seconds). On the other hand, the client device 350 may be in "channel changing" mode if the channel has recently been changed (e.g., less than 30 seconds).

[0027] At least a portion of the modules, blocks and subsystems of the client device 350 are operable to effectuate one or more of the following processes and subprocesses under the control of processor 302 for purposes of facilitating efficient display of adjacent streaming channels according to one or more embodiments of the present patent application. Referring to an embodiment of process 400 shown in FIG. 4, the client device 350 may be configured to monitor current bandwidth conditions (e.g., relative to the network connection such as connection 136 shown in FIG. 1 as well as any other distributions pipes involved in the end-to-end distribution path through the CDN) and other performance conditions, as set forth at block 402. Responsive to the monitored conditions, a determination may be made as to how many adjacent channels for which certain metadata information is to be pre-fetched. In an illustrative example, if 2 Mb of bandwidth is currently available (after accounting for whatever bandwidth is being utilized for the current streaming session), assuming that each channel requires 400 Kb of bandwidth to fetch its metadata, a determination could be made that the client device is capable of fetching metadata for five adjacent channels. As described previously, various constructs of channel adjacencies may be implemented, including, e.g., user-specific or user-defined lists, operator-defined lists, based on program guide implementations, content categories, language-based definitions, static or fixed configurations, etc. In a predictive behavior modeling approach, if the user has pressed up three channels (i.e., scrolled up three times) within a specified period of time, a probabilistic determination can be made that the user is likely to scroll up again rather than down, for example. Accordingly, a certain number of channels above the current channel may be deemed to be the adjacent channels for which metadata will be pre-fetched. The foregoing operations are illustrative of the acts and functions set forth at block 404 of the process flow 400.

[0028] After determining one or more adjacent channels (e.g., relative to a current streaming channel), metadata information for the adjacent channels is obtained, requested, retrieved, or otherwise pre-fetched from the associated server system(s) (block 406). In one adaptive streaming implementation, such metadata may comprise appropriate manifest files relative to the encoded media content streaming on the adjacent channels. The streaming client logic executing on the client device 350 is operable to parse the pre-fetched metadata information, and responsive thereto, determine where to go to obtain initialization information for the adjacent channels (block

Pinterest Ex. 1004 Page 134 of 371

408). As previously described, such initialization information may comprise at least one of SPS/PPS information, one or more codec headers, and the minimum amount of metadata necessary to decode slices/frames. Accordingly, based on the pre-fetched metadata information, the client device 350 is further operable to pre-fetch or pre-download the adjacent channels" initialization information, which may be locally stored in memory (block 408). If the current streaming channel is changed to a new streaming channel belonging to the group of adjacent channels (decision block 410), the initialization information for the new streaming channel (which is readily/locally available because it was pre-fetched) is used by the client device 350 to quickly fetch the required media content from appropriate locations (block 414). In one implementation, the streaming client logic executing on the client device 350 may be configured to request for only the media content that is encoded at a select bit rate, e.g., the lowest bit rate, by the streaming server's encoder. Additionally or alternatively, the client device 350 may also request for the encoded media content that is segmented into shorter segments.

[0029] If there is no channel changing, the client device 350 may continue to monitor the bandwidth conditions, buffer resources, and processing conditions so that new or modified channel adjacencies may continue to be (re)established or otherwise (re)determined (blocks 412, 402, 404). If the user settles into a particular channel (i.e., "viewing" mode) as set forth at decision block 416, the streaming client logic executing on the client device 350 may be configured to request for the media content that is encoded at higher bit rates, potentially going all way to the highest bit rate profiles possible (i.e., ramping up). Additionally or alternatively, the client device 350 may also request for the encoded media content that is segmented into larger segments. Accordingly, it should be appreciated that once the client device 350 is in "viewing" mode, media content with highest QoS may be presented to the user relatively quickly. These operations are illustratively set forth at block 418. Thereafter, the client device 350 may (re)establish or otherwise (re)determine newer channel adjacencies based on the monitored conditions as described previously.

[0030] One skilled in the art will recognize upon reference hereto that by executing the above-described pre-fetching operations, at least process stages 202 and 204 illustrated in FIG. 2 may be advantageously circumvented at the time of channel changing, thereby gaining a "head start" when the channel is changed. As the media content for the new channel is more readily available, albeit at low bit rate profiles and/or shorter segments (at least initially), the decoder/renderer engine of the client device can quickly process the media content so that at least some of the image rendering issues that can arise in a typical channel-changing streaming environment may be alleviated.

[0031] Referring now to FIG. 5, shown therein is another embodiment of a process flow 500 that may be implemented by a streaming client device (e.g., client device 350) having multiple streaming client applications and corresponding decoders for achieving additional efficiencies in a channel changing environment. Similar to the process flow 400 described above, the process flow 500 includes blocks 502-506 where the client device 350 may continue to monitor the bandwidth conditions, buffer resources, processing conditions, etc., so that appropriate channel adjacencies may be determined and metadata and initialization data may be pre-fetched. Using the pre-fetched initialization information, the client device 350 proceeds to fetch the adjacent channels' media content and begins to decode immediately (block 508). In other words, the client device 350 is operative to decode multiple streams from the adjacent channels in parallel (by virtue of separate streaming clients/decoders) (i.e., pre-decoding), thereby gaining an additional head start with respect to the process stage of 210 shown in FIG. 2. It should be realized that early parts of media segments may comprise a "moof" atom (e.g., in Fragmented MP4 coding) that informs where all the video samples in the segments are and an IDR (Instantaneous Decoding Refresh) slice of the frames. At this point, the rendering engine of the client device 350 has enough information to put some pixels on the display screen. Accordingly, if the current streaming channel is changed to one of the adjacent channels, the rendering engine of the client device 510 can begin rendering immediately (because the pre-decoded media content is already available in appropriate video buffers) as set forth at block 510. Thereafter, the client device 350 may (re)establish or otherwise (re)determine newer channel adjacencies based on the monitored conditions as described previously with respect to FIG. 4.

[0032] FIG. 6 depicts a flowchart of a high-level channel buildup process 600 that may be executed by the example client device 350 at least relative to certain aspects of the present patent disclosure. At block 602. one or more lists of adjacent channels may be built, which in some embodiments may be prioritized based on user preferences, content provider policies, etc. As discussed above, various pieces of data (up to and including encoded media segments, in certain implementations) may be pre-fetched for each adjacent channel. At decision block 604, a determination may be made as to whether adjacent channel buildup is complete, i.e., if all the necessary pre-fetching operations for the channels determined to be adjacent have been concluded. If so, the process flow stops (block 606). Otherwise, pre-fetching/downloading operations may continue to be performed relative to the remaining adjacent channels (block 608).

[0033] Turning now to FIG. 7, depicted therein is a flowchart with blocks relative to various steps and acts that may take place at an adaptive streaming server system (e.g., server system 102 shown in FIG. 1) according to one or more embodiments of the present patent applica-

Pinterest Ex. 1004 Page 135 of 371

tion with respect to facilitating fast channel changes in an adaptive streaming environment. In particular, process flow 700 of FIG. 7 illustrates various functionalities that may be effectuated - independently or in some combination or sub-combination thereof - by the processor complex 108 upon executing appropriate service logic stored in the persistent memory 109 and operating in conjunction with other subsystems (e.g., encoder 106, segmenter 112, error correction 118, etc.) of the server system 102. When a new stream of media content is started at the server system 102 (e.g., because of a user's channel change request), the service logic embodied in the persistent memory 109 may be configured to always commence streaming of the requested media content at a specific point (block 702) such as a Stream Access Point (SAP), which is a GOP random access point in the content stream guaranteed that all frames in the GOP are decodable. Additionally or alternatively, the service logic of the server system 102 may be configured to disable error correction mechanisms 118 for the transmission of the new stream to the client device 350 for a select period of time (block 704). It will be recognized that disabling a protocol-specific error correction mechanism may yield a non-standard protocol transmission of streaming data, but one without the error correction overhead, thereby facilitating a faster transmission rate to the client device 350. It should further be apparent that the timing windows during which an error correction mechanism is relaxed may be configurable or otherwise customizable, e.g., responsive to requests, commands, signals, etc. from the network and/or client device 350. In an additional or alternative variation, the service logic of the server system 102 may be configured to facilitate, at least initially, only transmission of the media content encoded at a select bit rate (e.g., lowest bit rate possible) and/or segmented into shortest segments by the segmenter 112, as set forth at block 706. Again, the initial period during which the streaming server's functionalities are conditionally modulated (e.g., a ramping up period) may be configurable responsive to requests from the client device 350 and/or other control signals from network management nodes. For instance, in one implementation, the error correction relaxation period and initial ramp up period may be provided to be the same. In another implementation, the two time periods may be different. In a still further implementation, responsive to receiving one or more requests from the client device 350 (e.g., messages, alarms, status indicators, etc.), the error correction mechanism may be enabled or re-enabled regardless of the entity or event that initially disabled the error correction mechanism when the new media stream was started. Additionally or alternatively, one or more requests from the client device 350 (e.g., URLs, pointers, indicators, etc.) may selectively instruct the server system 102 to begin transmitting the media content encoded at higher bit rates and/or in larger segments. By way of illustration, the client device 350 may send one URL (operative as a first URL, for example) *http://www.purple-frog.com/vid/665/r1/0000311.m4s* for low bit rate media content and another URL (operative as a second URL, for example) *http://www.purple-frog.com/vid/665/r2/0000311.m4s* for high bit rate media content. It should be realized that such requests may be generated by the client device in response to various conditions, *inter alia,* bandwidth conditions, quality of the rendered video, buffer conditions, decode processing conditions, and the like. Accordingly, the streaming functionality effectuated by the server system 102 may be conditionally modulated responsive to the various requests as set forth at block 708.

[0034] To facilitate fast channel changes in concert with the foregoing functionalities of the streaming server system 102, the client device 350 may also be configured accordingly to effectuate a number of processes - independently or in some combination or sub-combination thereof. FIG. 8 depicts a process flow 800 with blocks relative to various steps and acts that may take place at the client device 350. When a media content stream is newly started (e.g., due to a channel change request), the client device 350 is operative to initiate a request for only media content that is encoded in the lowest bit rate possible and/or in shortest segments (block 802). As the encoded media content is being received, the client device 350 may be configured to commence immediate decoding and rendering of the received media content, regardless of the buffer state. As described previously with respect to the embodiment of FIG. 5, such immediate decoding/rendering is possible upon receiving at least a minimum amount of information. Additionally or alternatively, the video buffer memory 319 may be prevented from being flushed during a ramp up period. The foregoing functionalities, illustratively set forth at block 804, may be effectuated by the channel change controller and buffer monitor 304, preferably operating in concert with the appropriate streaming client 310 under the control of the processor complex 302. Depending on the bandwidth conditions, video quality, etc., the client device 350 may gradually ramp up the requested bit rates and/or segment sizes (potentially requesting media content encoded at the highest bit rates possible and segmented into largest segments) by generating appropriate signals to the streaming server system 102. The client device 350 is also operative to send a signal or request to enable or re-enable error correction at the streaming server system 102 if the error correction was disabled initially. After the client device 350 has achieved a bit rate suitable for acceptable quality video (e.g., high quality), the client device 350 behaves normally in "viewing" mode until a new media content stream is requested. The foregoing functionalities are illustratively set forth at block 806. It should be appreciated that the various requests/signals described above may be generated by the client device 350 at different times (i.e., asynchronous with respect to one another), and after expiration of select/customizable time periods from the time when the new stream is started.

[0035] FIG. 9 depicts an example user viewing expe-

Pinterest Ex. 1004 Page 136 of 371

rience 900 that may be achieved by implementing an embodiment of the streaming server system 102 and client device 350 as set forth above. At block 902, the client device 350 (e.g., a streaming A/V player) is turned on and a select channel media content is requested. At block 904, the requested media content begins playing with video and audio in sync, although the rendered content may be at a low quality. At block 906, the user changes the channel, whereupon the new media content is played with video and audio in sync (block 908). Again, the overall quality of the new media content may be low, as there may be audio and/or visual glitches in the rendering. When the user settles on a channel, the media content of that channel gradually ramps up to the highest bit rate possible (potentially within in a few seconds), with the video buffer filling up accordingly (block 912).

[0036] FIG. 10 depicts a flowchart of a high-level channel changing process 1000 that may be executed by the example client device 350 at least relative to certain aspects of the present patent disclosure. At block 1002, a channel change is started, whereupon the client device 350 initially receives a lowest quality stream (1004). The received low quality stream is decoded and rendered as immediately as possible (block 1006). The bit rates, segment sizes and quality in general are ramped up until normal/acceptable quality is achieved, as set forth at blocks 1008, 1010. Thereafter, the client device 350 behaves normally in "viewing" mode until a new media content stream is requested, as described above.

[0037] FIG. 11 depicts anther embodiment of an example streaming client device 1100, which is representative of a portion of the client device 350, for purposes of the present patent application. A channel change controller 1106 is provided with communication paths 1105, 1107 to intercept, interrupt, or otherwise control the operations relative to a video buffer 1104 that is operative to store an incoming video stream and a decoder/renderer 1108, respectively. The decoder/renderer 1108 is coupled to the video buffer 1104 via a communication path 1109 and to a display screen 116 via a communication path 1114. In normal viewing operations, the decoder/renderer 1108 is operative to decode the buffered data when certain levels are achieved/maintained. Example decoded data is illustratively shown as header data 1110 and I/B/P frames or slices 1112 that may be provided to the display screen 1116 for forming images thereon. In channel changing conditions, on the other hand, the decoder/renderer 1108 is forced to process the video buffer data even if there is only a minimum amount of data.

[0038] Based upon the foregoing Detailed Description, it should be appreciated that the embodiments of the present disclosure can be advantageously implemented to facilitate channel changing in streaming environments. By pre-fetching certain initialization data in a predictive manner, a head start may be achieved in the overall media acquisition-decode-rendering process, thereby reducing the switching-induced delays that typically give rise to an unacceptable viewing experience. Accordingly, a channel surfing experience similar to one that is commonly expected in existing TV broadcast environments may be provided in an adaptive streaming network.

[0039] In the above-description of various embodiments of the present disclosure, it is to be understood that the terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of this specification and the relevant art and may not be interpreted in an idealized or overly formal sense expressly so defined herein.

[0040] At least some example embodiments are described herein with reference to block diagrams and/or flowchart illustrations of computer-implemented methods, apparatus (systems and/or devices) and/or computer program products. It is understood that a block of the block diagrams and/or flowchart illustrations, and combinations of blocks in the block diagrams and/or flowchart illustrations, can be implemented by computer program instructions that are performed by one or more computer circuits. Such computer program instructions may be provided to a processor circuit of a general purpose computer circuit, special purpose computer circuit, and/or other programmable data processing circuit to produce a machine, so that the instructions, which execute via the processor of the computer and/or other programmable data processing apparatus, transform and control transistors, values stored in memory locations, and other hardware components within such circuitry to implement the functions/acts specified in the block diagrams and/or flowchart block or blocks, and thereby create means (functionality) and/or structure for implementing the functions/acts specified in the block diagrams and/or flowchart block(s). Additionally, the computer program instructions may also be stored in a tangible computer-readable medium that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable medium produce an article of manufacture including instructions which implement the functions/acts specified in the block diagrams and/or flowchart block or blocks.

[0041] As alluded to previously, tangible, non-transitory computer-readable medium may include an electronic, magnetic, optical, electromagnetic, or semiconductor data storage system, apparatus, or device. More specific examples of the computer-readable medium would include the following: a portable computer diskette, a random access memory (RAM) circuit, a read-only memory (ROM) circuit, an erasable programmable read-only

Pinterest Ex. 1004 Page 137 of 371

memory (EPROM or Flash memory) circuit, a portable compact disc read-only memory (CD-ROM), and a portable digital video disc read-only memory (DVD/Blu-ray). The computer program instructions may also be loaded onto or otherwise downloaded to a computer and/or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer and/or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide steps for implementing the functions/acts specified in the block diagrams and/or flowchart block or blocks. Accordingly, embodiments of the present invention may be embodied in hardware and/or in software (including firmware, resident software, microcode, etc.) that runs on a processor such as a digital signal processor, which may collectively be referred to as "circuitry," "a module" or variants thereof.

[0042] Further, in at least some additional or alternative implementations, the functions/acts described in the blocks may occur out of the order shown in the flowcharts. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved. Moreover, the functionality of a given block of the flowcharts and/or block diagrams may be separated into multiple blocks and/or the functionality of two or more blocks of the flowcharts and/or block diagrams may be at least partially integrated. Finally, other blocks may be added/inserted between the blocks that are illustrated. Moreover, although some of the diagrams include arrows on communication paths to show a primary direction of communication, it is to be understood that communication may occur in the opposite direction relative to the depicted arrows.

[0043] Although various embodiments have been shown and described in detail, the claims are not limited to any particular embodiment or example. None of the above Detailed Description should be read as implying that any particular component, element, step, act, or function is essential such that it must be included in the scope of the claims. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." Accordingly, those skilled in the art will recognize that the exemplary embodiments described herein can be practiced with various modifications and alterations within the scope of the claims appended below.

Claims

1. A method (400, 500) operative in a streaming client device (124, 350) disposed in an adaptive streaming environment (100), the method (400, 500) comprising:

   monitoring (402) at least a bandwidth condition relative to a network connection (136) between the streaming client device (124, 350) and a content delivery network (122);

   determining (404, 502) one or more adjacent channels relative to a current streaming channel of the streaming client device (124, 350);

   pre-fetching (406, 504) metadata information associated with the one or more adjacent channels;

   responsive to the pre-fetched metadata information, pre-fetching and storing (408, 506) initialization information for the one or more adjacent channels; and

   if the current streaming channel is changed (410) to a new streaming channel belonging to the one or more adjacent channels, using (414) the pre-fetched initialization information to fetch encoded media content pertaining to the new streaming channel.

2. The method (400, 500) as recited in claim 1, wherein the monitoring (402) further comprises monitoring at least one of video buffer conditions and decoder processing conditions of the streaming client device (124, 350).

3. The method (400, 500) as recited in claim 1, wherein the metadata information comprises manifest information associated with the respective one or more adjacent channels.

4. The method (400, 500) as recited in claim 1, wherein the initialization information corresponding to the one or more adjacent channels comprises at least one of a Sequence Parameters Set (SPS), a Picture Parameters Set (PPS), one or more codec headers, and data necessary to decode slices of frames.

5. The method (400, 500) as recited in claim 4, wherein the one or more codec headers comprise at least one of MPEG-2 sequence headers, High Efficiency Video Coding (HEVC) headers, and AC3 (audio) headers.

6. The method (400, 500) as recited in claim 1, wherein the one or more adjacent channels are determined as at least one of a first number of consecutive channels above the current streaming channel and a second number of consecutive channels below the current streaming channel, and further wherein the first number and the second number respectively range from 0 to a quantity based on the network bandwidth condition.

7. The method (400, 500) as recited in claim 1, wherein the one or more adjacent channels are determined as a group of streaming channels that belong to a content category to which the current streaming

Pinterest Ex. 1004 Page 138 of 371

channel also belongs.

8. The method (400, 500) as recited in claim 1, wherein the one or more adjacent channels are determined based on predicting a user's behavioral patterns in a "channel surfing" mode when using the streaming client device (124, 350).

9. The method (400, 500) as recited in claim 8, wherein the "channel surfing" mode is ascertained responsive to detecting that the user has changed a plurality of channels within a select time period.

10. The method (400, 500) as recited in claim 1, further comprising:

using the pre-fetched initialization information, pre-fetching (508) encoded media content of the respective one or more adjacent channels ;
pre-decoding (508) the encoded media content; and
if the current streaming channel is changed to a new streaming channel belonging to the one or more adjacent channels, rendering (510) the pre-decoded media content to be displayed immediately.

11. The method (400, 500) as recited in claim 10, wherein the pre-fetched media content of the respective one or more adjacent channels comprises media content segments encoded at a low bit rate.

12. The method (400, 500) as recited in claim 11, further comprising:

after determining that a user has remained on the new streaming channel for a select time period, ascertaining (416) that the user is in a "viewing" mode;
sending (418) a request for streaming media content encoded at higher bit rates; and
continuing to monitor (402) at least one of the bandwidth conditions of the network connection (136), video buffer conditions and decoder processing conditions, to determine (404) one or more additional adjacent channels relative to the new streaming channel.

13. The method (400, 500) as recited in claim 12, further comprising sending (418) a request for streaming media content for the new streaming channel in larger segments.

14. A client device (124, 350) configured to perform the method of any of the preceding claims.

Patentansprüche

1. Verfahren (400, 500), das in einer Streaming-Client-Vorrichtung (124, 350) wirksam ist, die in einer adaptiven Streaming-Umgebung (100) angeordnet ist, wobei das Verfahren (400, 500) umfasst:

Überwachen (402) mindestens einer Bandbreitenbedingung in Bezug auf eine Netzwerkverbindung (136) zwischen der Streaming-Client-Vorrichtung (124, 350) und einem Content Delivery Network (122);
Bestimmen (404, 502) eines oder mehrerer benachbarter Kanäle relativ zu einem aktuellen Streaming-Kanal der Streaming-Client-Vorrichtung (124, 350);
Vorababrufen (406, 504) von Metadateninformationen, die einem oder mehreren Nachbarkanälen zugeordnet sind;
Vorababrufen und Speichern (408, 506) von Initialisierungsinformationen für einen oder mehrere Nachbarkanäle als Reaktion auf die vorab abgerufenen Metadateninformationen; und
Verwenden (414) der vorab abgerufenen Initialisierungsinformationen, um codierte Medieninhalte, die sich auf den neuen Streaming-Kanal beziehen, abzurufen, wenn der aktuelle Streaming-Kanal in einen neuen Streaming-Kanal geändert (410) wird, der zu einem oder mehreren Nachbarkanälen gehört.

2. Verfahren (400, 500) nach Anspruch 1, wobei das Überwachen (402) ferner ein Überwachen mindestens eines von den Videopufferbedingungen und den Decoder-Verarbeitungsbedingungen der Streaming-Client-Vorrichtung (124, 350) umfasst.

3. Verfahren (400, 500) nach Anspruch 1, wobei die Metadateninformationen Manifestinformationen umfassen, die dem entsprechenden einen oder den mehreren Nachbarkanälen zugeordnet sind.

4. Verfahren (400, 500) nach Anspruch 1, wobei die Initialisierungsinformationen, die dem einem oder den mehreren Nachbarkanälen entsprechen, mindestens eines von einem Sequenzparametersatz (Sequence Parameters Set, SPS), einem Bildparametersatz (Picture Parameters Set, PPS), einem oder mehreren Codec-Kopfsätzen und von Daten umfassen, die zum Decodieren von Rahmenscheiben erforderlich sind.

5. Verfahren (400, 500) nach Anspruch 4, wobei die einen oder mehreren Codec-Kopfsätze mindestens eines von MPEG-2-Sequenzkopfsätzen, High Efficiency Video Coding (HEVC)-Kopfsätzen und AC3 (Audio)-Kopfsätzen umfassen.

Pinterest Ex. 1004 Page 139 of 371

6. Verfahren (400, 500) nach Anspruch 1, wobei der eine oder die mehreren Nachbarkanäle als mindestens eines von einer ersten Anzahl von aufeinanderfolgenden Kanälen oberhalb des aktuellen Streaming-Kanal und einer zweiten Anzahl von aufeinanderfolgenden Kanälen unterhalb des aktuellen Streaming-Kanals bestimmt werden, und wobei ferner die erste Anzahl und die zweite Anzahl jeweils im Bereich von 0 bis zu einer Menge liegt, die auf der Netzwerkbandbreitenbedingung begründet ist.

7. Verfahren (400, 500) nach Anspruch 1, wobei der eine oder die mehreren Nachbarkanäle als eine Gruppe von Streaming-Kanälen bestimmt werden, die zu einer Inhaltskategorie gehören, zu der auch der aktuelle Streaming-Kanal gehört.

8. Verfahren (400, 500) nach Anspruch 1, wobei der eine oder die mehreren Nachbarkanäle basierend auf einem Vorhersagen von Verhaltensmustern eines Benutzers in einem "Kanal-Surf"-Modus bei Verwendung der Streaming-Client-Vorrichtung (124, 350) bestimmt werden.

9. Verfahren (400, 500) nach Anspruch 8, wobei der "Kanal-Surf"-Modus als Reaktion auf ein Erfassen festgestellt wird, dass der Benutzer eine Vielzahl von Kanälen innerhalb eines ausgewählten Zeitraums geändert hat.

10. Verfahren (400, 500) nach Anspruch 1, ferner umfassend:

    Vorababrufen (508) eines codierten Medieninhalts des jeweiligen einen oder der mehreren Nachbarkanäle unter Verwendung der vorab abgerufenen Initialisierungsinformationen;
    Vordecodieren (508) des codierten Medieninhalts; und
    wenn der aktuelle Streaming-Kanal in einen neuen Streaming-Kanal geändert wird, der zu einem oder mehreren Nachbarkanälen gehört, Rendern (510) des vordecodierten Medieninhalts, der unmittelbar anzuzeigen ist.

11. Verfahren (400, 500) nach Anspruch 10, wobei der vorab abgerufene Medieninhalt des jeweiligen einen oder der mehreren Nachbarkanäle Medieninhaltssegmente umfasst, die mit einer niedrigen Bitrate codiert sind.

12. Verfahren (400, 500) nach Anspruch 11, ferner umfassend:

    nachdem bestimmt ist, dass ein Benutzer für einen ausgewählten Zeitraum auf dem neuen Streaming-Kanal verweilt ist, Feststellen (416), dass sich der Benutzer in einem "Betrachtungsmodus" befindet;
    Senden (418) einer Anforderung zum Streamen von Medieninhalten, die mit höheren Bitraten codiert sind; und
    Fortsetzen des Überwachens (402) mindestens einer von den Bandbreitenbedingungen der Netzwerkverbindung (136), den Videopufferbedingungen und den Decoder-Verarbeitungsbedingungen, um einen oder mehrere zusätzliche Nachbarkanäle in Bezug auf den neuen Streaming-Kanal zu bestimmen (404).

13. Verfahren (400, 500) nach Anspruch 12, ferner mit dem Schritt des Sendens (418) einer Anforderung zum Streamen von Medieninhalten für den neuen Streaming-Kanal in größeren Segmenten.

14. Client-Vorrichtung (124, 350), die konfiguriert ist, um das Verfahren eines der vorhergehenden Ansprüche auszuführen.

Revendications

1. Procédé (400, 500) opérationnel dans un dispositif client de transmission en continu (124, 350) disposé dans un environnement de transmission en continu adaptatif (100), le procédé (400, 500) comprenant :

    la surveillance (402) d'au moins une condition de bande passante relative à une connexion réseau (136) entre le dispositif client de transmission en continu (124, 350) et un réseau de diffusion de contenu (122) ;
    la détermination (404, 502) d'un ou de plusieurs canaux adjacents relatifs à un canal de transmission en continu actuel du dispositif client de transmission en continu (124, 350) ;
    la pré-extraction (406, 504) d'informations de métadonnées associées aux un ou plusieurs canaux adjacents ;
    en réponse aux informations de métadonnées pré-extraites, pré-extraction et stockage (408, 506) d'informations d'initialisation pour les un ou plusieurs canaux adjacents ; et
    si le canal de transmission en continu actuel est remplacé (410) par un nouveau canal de transmission en continu appartenant aux un ou plusieurs canaux adjacents, l'utilisation (414) des informations d'initialisation pré-extraites pour extraire du contenu multimédia codé relatif au nouveau canal de transmission en continu.

2. Procédé (400, 500) selon la revendication 1, dans lequel la surveillance (402) comprend en outre la surveillance de l'une au moins parmi des conditions de tampon vidéo et des conditions de traitement de décodeur du dispositif client de transmission en con-

Pinterest Ex. 1004 Page 140 of 371

tinu (124, 350).

3. Procédé (400, 500) selon la revendication 1, dans lequel les informations de métadonnées comprennent des informations manifestes associées aux un ou plusieurs canaux adjacents respectifs.

4. Procédé (400, 500) selon la revendication 1, dans lequel les informations d'initialisation correspondant aux un ou plusieurs canaux adjacents comprennent au moins l'un parmi un ensemble de paramètres de séquence (SPS), un ensemble de paramètres d'image (PPS), un ou plusieurs en-têtes de codec, et des données nécessaires pour décodes des tranches de trames.

5. Procédé (400, 500) selon la revendication 4, dans lequel les un ou plusieurs en-têtes de codec comprennent au moins l'un parmi des en-têtes de séquence MPEG-2, des en-têtes de codage vidéo à haute efficacité (HEVC), et des en-têtes AC3 (audio).

6. Procédé (400, 500) selon la revendication 1, dans lequel les un ou plusieurs canaux adjacents sont déterminés comme l'un au moins parmi un premier nombre de canaux consécutifs au-dessus du canal de transmission en continu actuel et un deuxième nombre de canaux consécutifs en dessous du canal de transmission en continu actuel, et dans lequel le premier nombre et le deuxième nombre sont en outre respectivement compris entre 0 et une quantité basée sur la condition de bande passante de réseau.

7. Procédé (400, 500) selon la revendication 1, dans lequel les un ou plusieurs canaux adjacents sont déterminés comme un groupe de canaux de transmission en continu appartenant à une catégorie de contenu à laquelle appartient également le canal de transmission en continu actuel.

8. Procédé (400, 500) selon la revendication 1, dans lequel les un ou plusieurs canaux adjacents sont déterminés sur la base de modèles comportementaux d'utilisateur dans un mode de « navigation sur les canaux » lors de l'utilisation du dispositif client de transmission en continu (124, 350).

9. Procédé (400, 500) selon la revendication 8, dans lequel le mode de « navigation sur les canaux » est établi en réponse à la détection de la modification d'une pluralité de canaux par un utilisateur dans une période de temps sélectionnée.

10. Procédé (400, 500) selon la revendication 1, comprenant en outre :

l'utilisation des informations d'initialisation pré-extraites, la pré-extraction (508) de contenu multimédia codé des un ou plusieurs canaux adjacents respectifs ;
pré-décodage (508) du contenu multimédia codé; et
si le canal de transmission en continu actuel est remplacé par un nouveau canal de transmission en continu appartenant aux un ou plusieurs canaux adjacents, la restitution (510) du contenu multimédia pré-décodé pour un affichage immédiat.

11. Procédé (400, 500) selon la revendication 10, dans lequel le contenu multimédia pré-extrait des un ou plusieurs canaux adjacents respectifs comprend des segments de contenu multimédia codés à un débit binaire faible.

12. Procédé (400, 500) selon la revendication 11, comprenant en outre :

après avoir déterminé qu'un utilisateur est resté sur le nouveau canal de transmission en continu pour une période de temps sélectionnée, établissement (416) que l'utilisateur est dans un mode « visionnage » ;
l'envoi (418) d'une requête pour la transmission en continu de contenu multimédia codé à des taux binaires plus élevés ; et
la poursuite de la surveillance (402) de l'une au moins parmi les conditions de bande passante de la connexion réseau (136), les conditions de tampon vidéo et les conditions de traitement de décodeur, pour déterminer (404) un ou plusieurs canaux adjacents supplémentaires relatifs au nouveau canal de transmission en continu.

13. Procédé (400, 500) selon la revendication 12, comprenant en outre l'envoi (418) d'une requête pour la transmission en continu de contenu multimédia pour le nouveau canal de transmission en continu dans des segments plus grands.

14. Dispositif client (124, 350) configuré pour exécuter le procédé selon l'une quelconque des revendications précédentes.

Pinterest Ex. 1004 Page 141 of 371

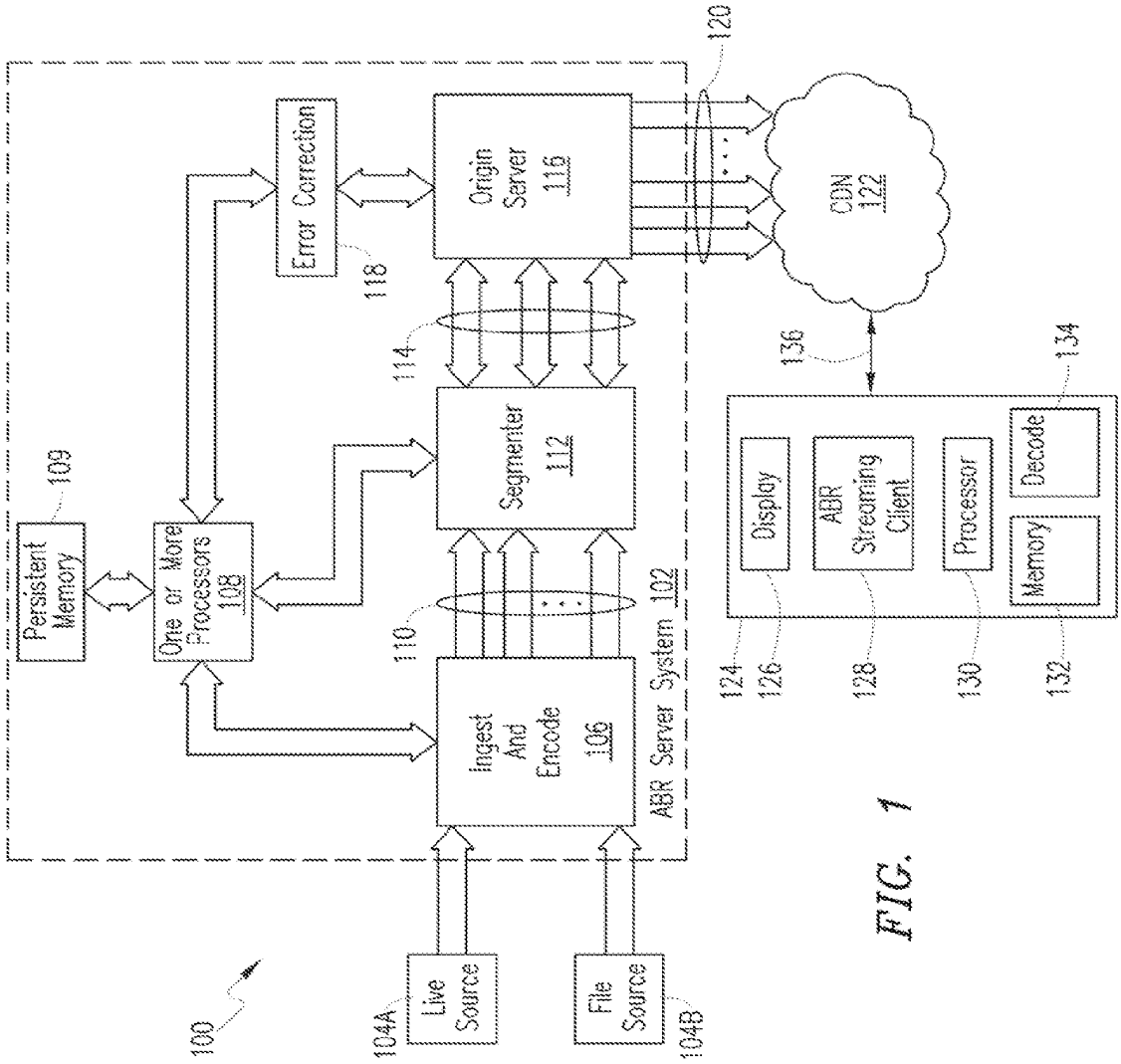


FIG. 1

Pinterest Ex. 1004 Page 142 of 371

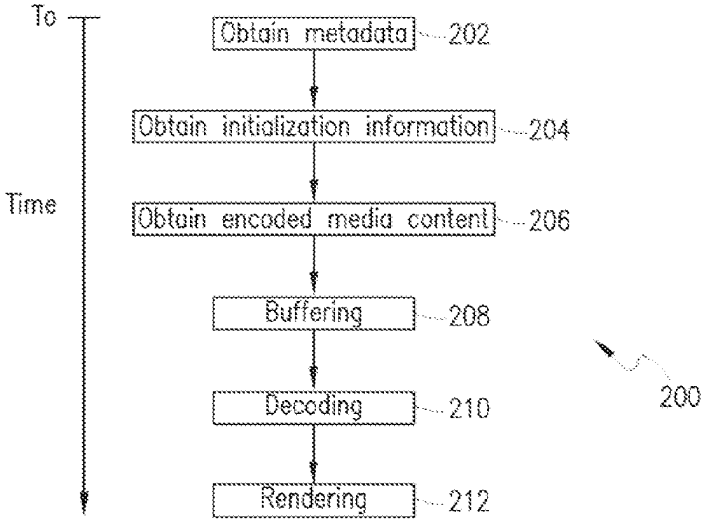


FIG. 2

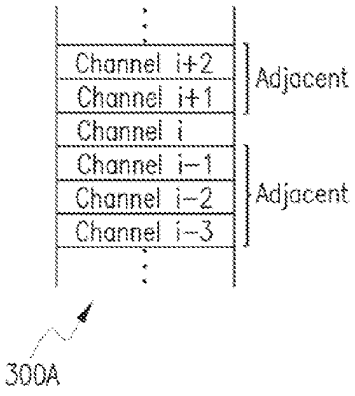


FIG. 3A

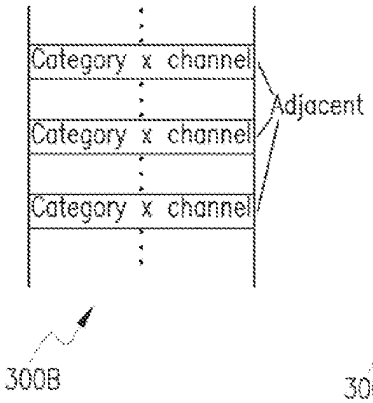


FIG. 3B

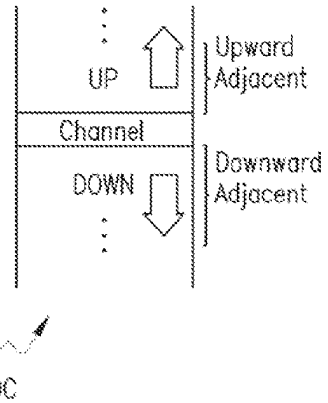


FIG. 3C

Pinterest Ex. 1004 Page 143 of 371

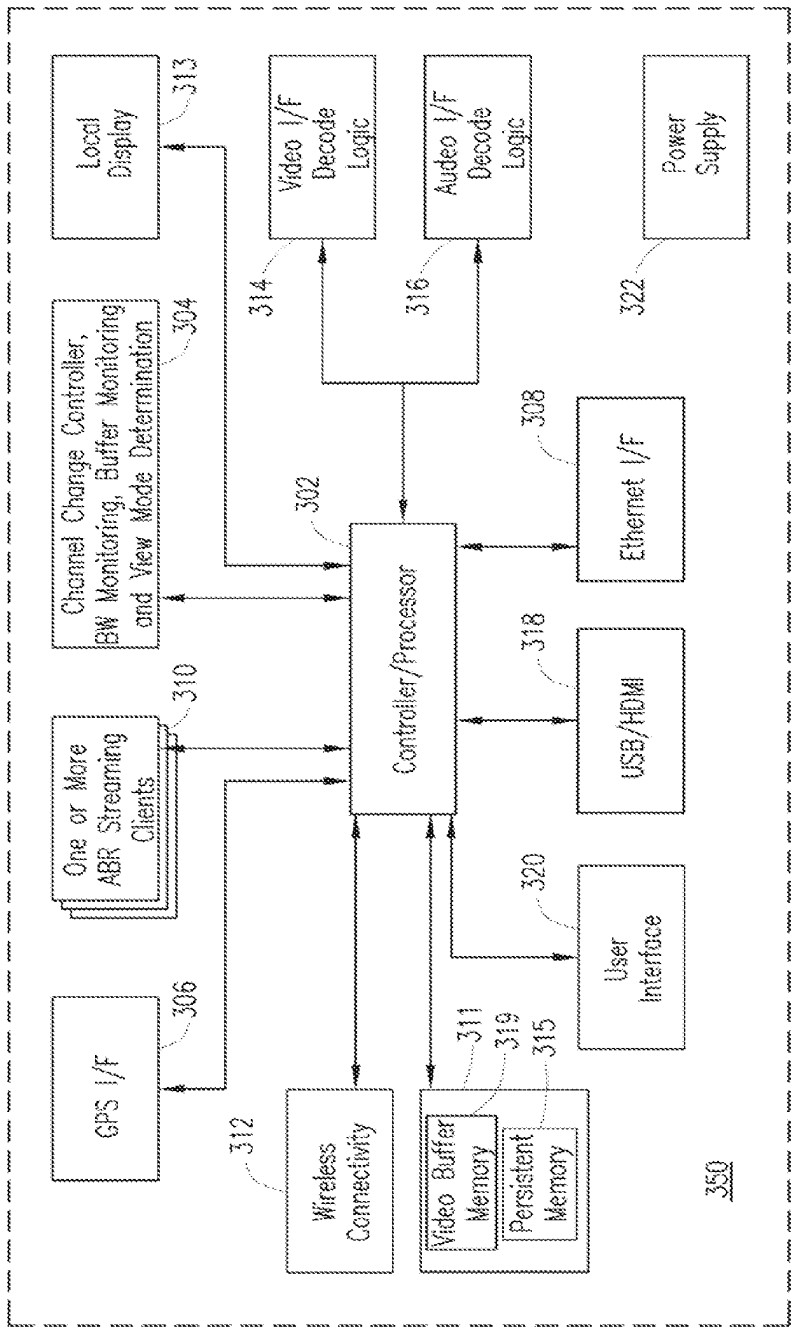


FIG. 3D

Pinterest Ex. 1004 Page 144 of 371

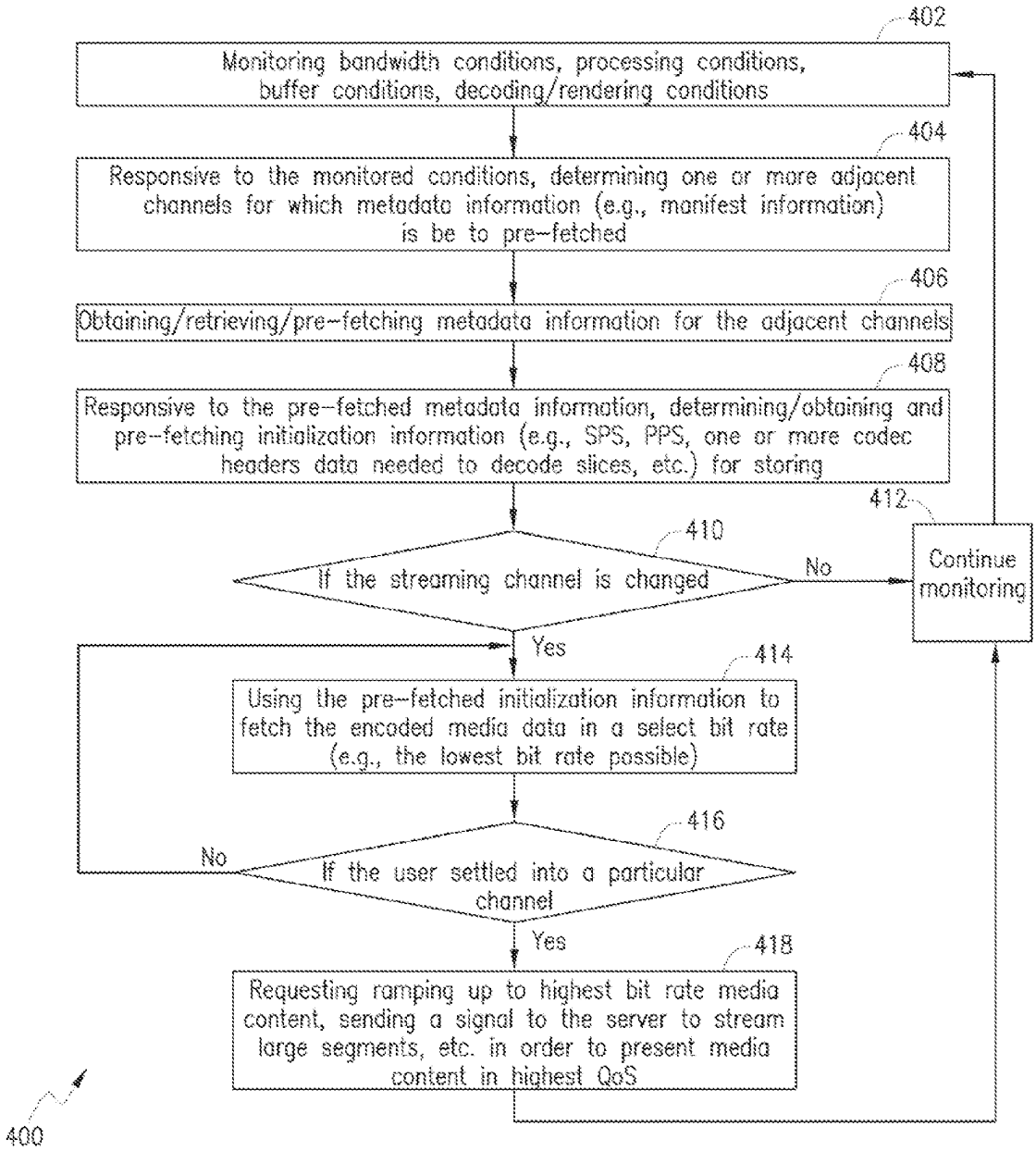


FIG. 4

Pinterest Ex. 1004 Page 145 of 371

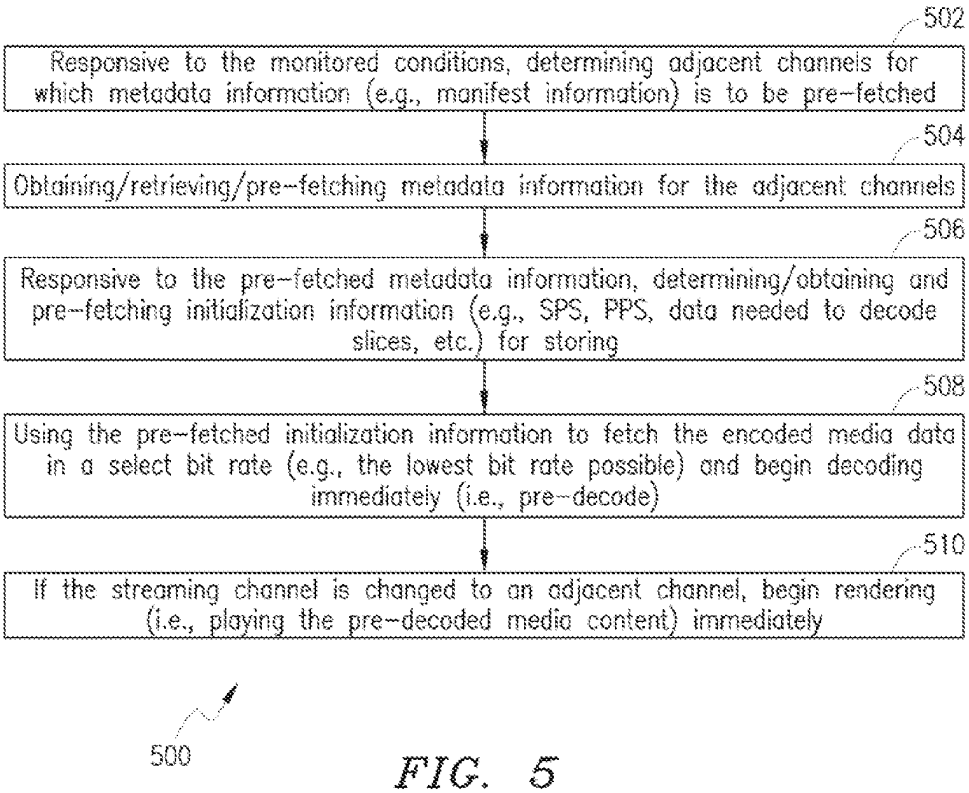


FIG. 5

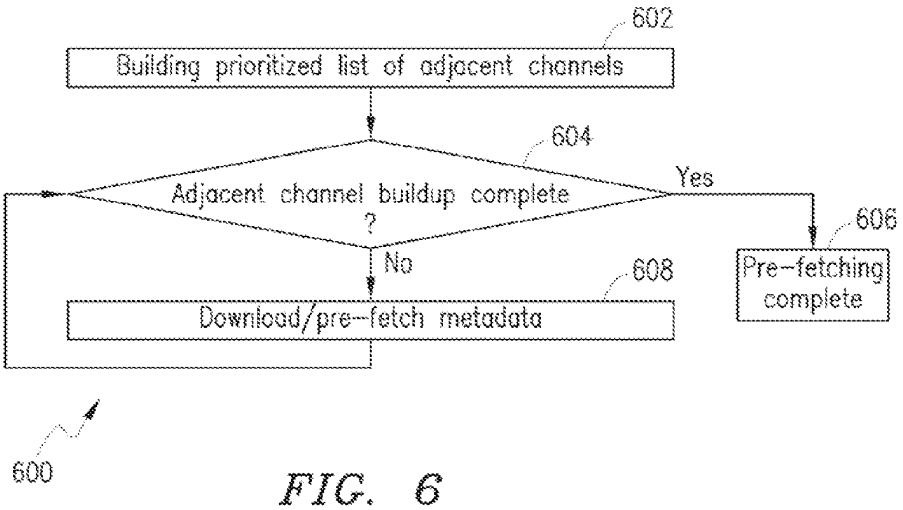


FIG. 6

Pinterest Ex. 1004 Page 146 of 371

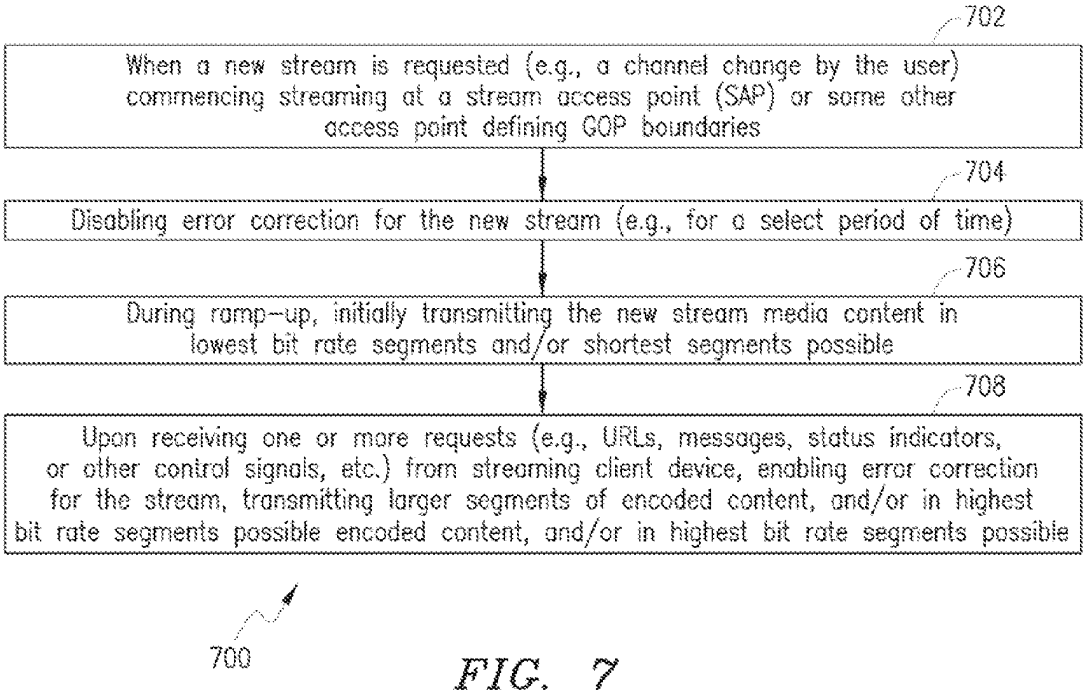


FIG. 7

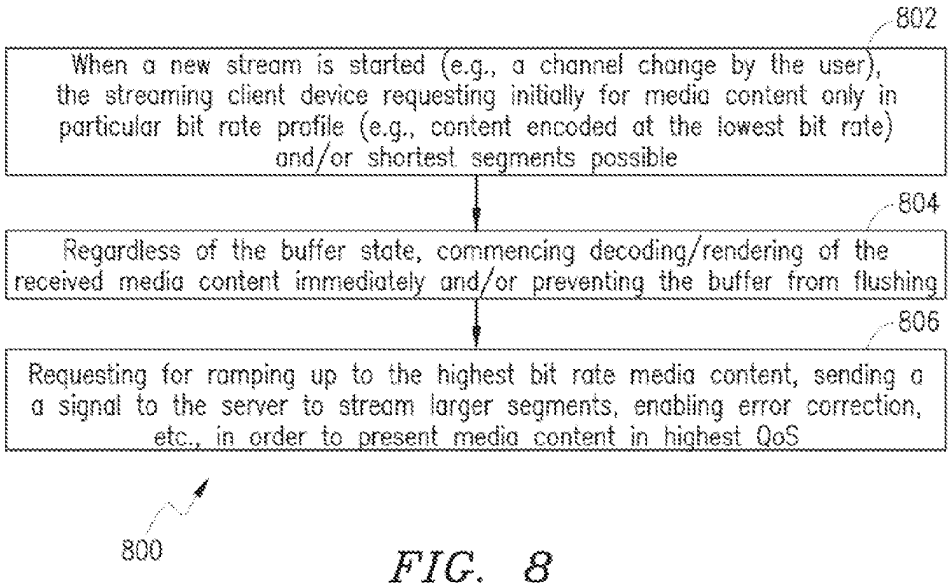


FIG. 8

Pinterest Ex. 1004 Page 147 of 371

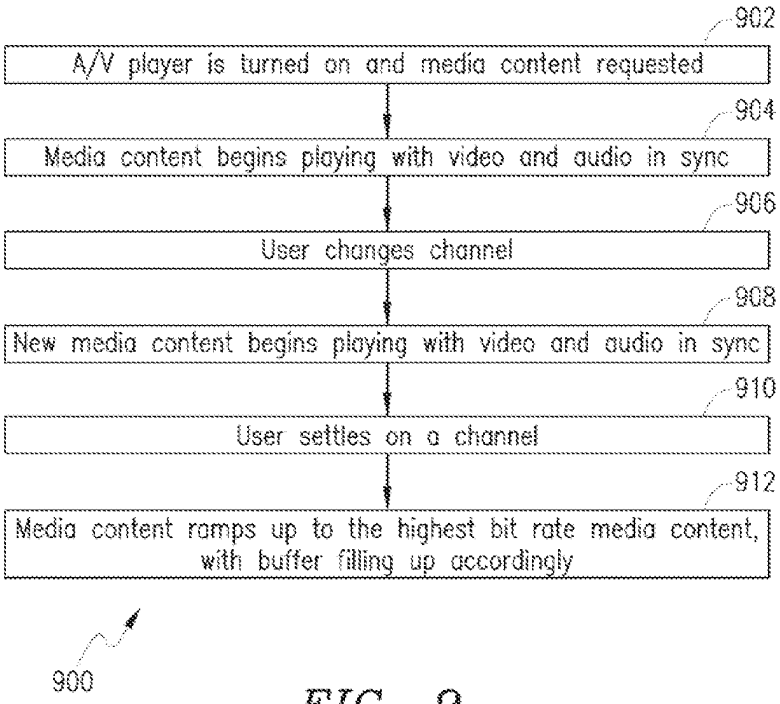


FIG. 9

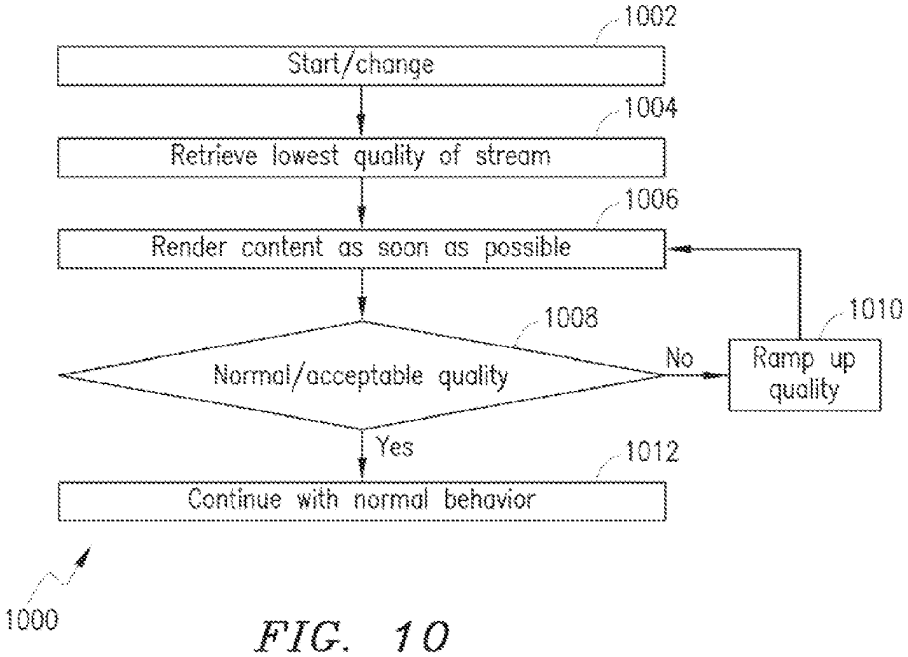


FIG. 10

Pinterest Ex. 1004 Page 148 of 371

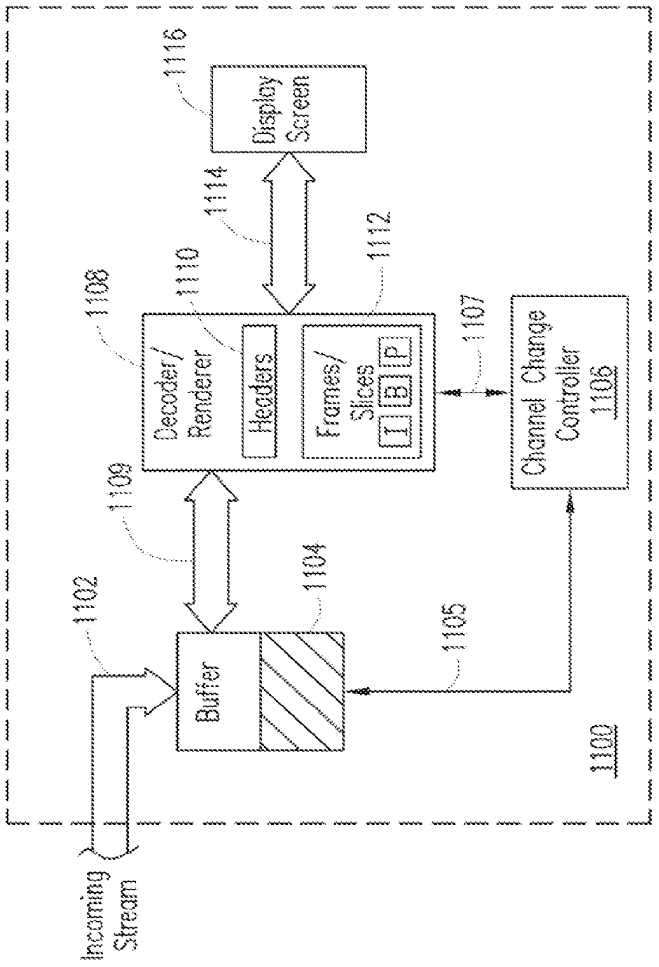


FIG. 11

Pinterest Ex. 1004 Page 149 of 371

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Non-patent literature cited in the description

- **LEE et al.** Reducing Channel Zapping Time in IPTV Based on User's Channel Selection Behaviors. *IEEE TRANSACTIONS ON BROADCASTING* **[0003]**

Pinterest Ex. 1004 Page 150 of 371

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 775 953 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.04.2007 Bulletin 2007/16

(51) Int Cl.:
H04N 7/24 *(2006.01)* ***H04N 5/00*** *(2006.01)*
H04N 5/44 *(2006.01)* ***H04N 5/50*** *(2006.01)*

(21) Application number: **05022486.4**

(22) Date of filing: **14.10.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(71) Applicants:
- **UNIVERSITEIT GENT**
  9000 Gent (BE)
- **IBBT vzw**
  9000 GENT (BE)

(72) Inventors:
- **Van Quickenborne, Frederic**
  8500 Kortrijk (BE)
- **De Neve, Philippe**
  9040 Sint-Amandsberg (BE)
- **Strobbe, Matthias**
  8870 Izegem (BE)
- **Verstraete, Vincent**
  8870 Izegem (BE)
- **De Turck, Filip**
  9550 Steenhuize-Wijnhuize (BE)

(74) Representative: **Bird, William Edward et al**
Bird Goen & Co.,
Klein Dalenstraat 42A
3020 Winksele (BE)

(54) Switching between digital video streams using buffering of second digital video stream

(57) A method (200, 300) for handling a plurality of digital video streams, each of the digital video streams being encoded in sequences of frames. Each of the sequences of frames comprising a key frame, at least one reference frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames. The method comprises displaying (204) at least a first digital video stream to be displayed and buffering (206) at least one of said key frame or said at least one reference frame for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered key frame or reference frame(s) when the second digital video stream is selected to be displayed. The invention also relates to a controller for controlling buffering of video information of a digital video stream not-displayed at that moment.

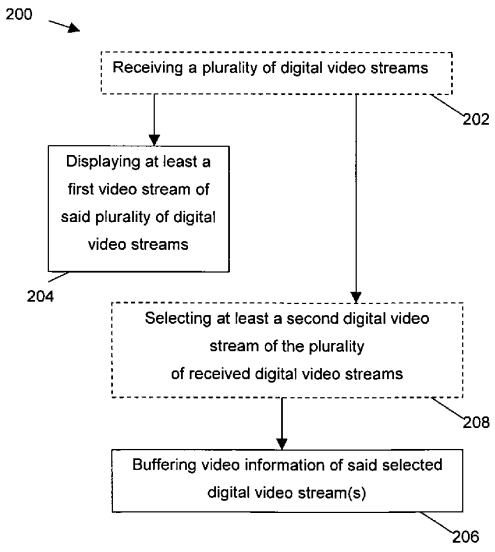


Fig. 3

EP 1 775 953 A1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical field of the invention

[0001] The present invention relates to display of digital video streams such as e.g. digital television. More particularly, the present invention relates to methods and devices for display of digital video streams capable of switching between digital video streams.

Background of the invention

[0002] The use of digital video streams, such as e.g. in digital television, becomes a widely spread method for distributing information, especially as they allow the provision of high quality video and enable flexible use of the information provided. As digitisation of video content requires a large amount of data and as the bandwidth for transporting this data between a server and a client is limited, compression is needed. Such compression, also referred to as a type of encoding, is done at the server side, for instance at the video broadcaster-side. At the client side, a decompression process, also referred to as decoding, reconstructs the video pictures from the compressed video data. Typically, video specific compression and decompression processes profit from the digital video sequence structure to reduce the file size of the video. Two characteristics of video sequences are exploited to compress video data: as in still pictures, pixels correlate with their neighbouring pixels enabling so-called spatial compression and successive pictures also correlate with each other enabling temporal compression. Using this compression technique leads to the image content of different pictures or video frames being dependent upon each other. Hence, to decode a certain picture in a video stream, information from previous and/or next pictures may be needed. Because this dependency cannot be unlimited, every number of pictures a key frame is inserted in the digital video stream, this key frame being independent of every other frame. The other frames typically are dependent on this key frame. A digital video stream typically comprises sequences of frames comprising a key frame and other frames which may be directly or indirectly dependent on the key frame. In the different Motion Picture Experts Group (MPEG) standards, which are often used compression/decompression standards, such sequences of frames are also referred to as Groups Of Pictures (GOP).

[0003] The need for compression and decompression of digital video stream data typically results in a delay when an observer wants to switch between two video streams, as a newly selected video stream can only be displayed after a key frame is received and decoded. The moment the key frame is received, it is possible to decode all the further frames of the video stream. The time needed to receive a key frame and corresponding dependent frames may cause the largest delay. Transmission of digital video streams typically is done in spaced sequences. The time between receipt of two subsequent key frames may be up to a few seconds, depending on the length of the sequence of frames used in the compression/decompression (CODEC) system and on the moment switching between digital video streams is performed. The switching process between digital video streams thus may take significantly longer than the time needed for switching between analogue video streams. This may be disturbing and annoying for an observer who wants to switch quickly between real-time digital video streams, i.e. to "zap" between different real-time digital video streams.

[0004] The above described problem of delay in presented video stream during switching is known and a number of methods for solving this problem have already been described.

[0005] A number of methods is focused on influencing the data streams in the transport stream in order to obtain improved switching. E.g. in US 2003/0048808 A1 a method is described wherein, in order to obtain faster switching, the data stream for a newly selected content channel is temporarily sent at a higher rate, such that the data stream is received quicker and consequently, displaying of the data stream can be performed quicker. In order to obtain faster switching, the method requires communication about the switching between the client terminal and the server and adaptations for the transmission at the server side. In WO 2004/019530, a method is described for allowing seamless switching between data streams, whereby the data rate of the data streams may be adjusted to synchronise start and end points in the data streams. In this way a seamless transition between the data streams can be provided. Nevertheless, the latter results in a delay in switching from the old data stream to the new data stream, i.e. upon the act of initiating switching, the old data stream is still shown for a while, and requires changes in the creation of transport streams which may be CODEC dependent.

[0006] Alternatively, other methods operate on the client side, making e.g. use of additional components. In US 2004/0194134 A1 a method for fast switching between channels in a digital television transport stream is described, whereby a first tuner/decoder is used for displaying a first channel of a digital television transport stream and whereby a second tuner/decoder is used for storing a recent full-frame video still image from other channels of a digital television transport stream. When switching to a second channel, a stored video still image for the second channel is displayed using the second tuner/decoder, until sufficient data is received to generate real-time video for the second channel. The method requires at least two tuner/decoders and provides a still image during the switching time. Similar thereto, US 2004/0181813 A1 also describes a method for fast switching between channels in a digital television transport stream using a second tuner/decoder, e.g. a tuner/decoder present in the system to allow picture-in-picture imaging. In one embodiment, the document describes that additional video streams can be selected and de-

Pinterest Ex. 1004 Page 152 of 371

coded using spare tuner/decoders. The system therefor requires a spare tuner/decoder system for each video stream to which fast switching is to be obtained. In another embodiment, the document describes a method comprising the storage of program identifying information to allow, upon zapping, extracting the necessary video stream as soon as it is available. Nevertheless, a delay still will occur, determined by the time needed to provide the necessary video stream data. In order to further fasten the display of a newly selected video stream, an I-frame may be cached. The latter allows providing a still image during the delay time.

[0007] None of the above prior art systems allows fast switching between digital video streams whereby a video stream is nearly immediately displayed, without the need for a large number of additional components or communication between the client and the server.

Summary of the invention

[0008] It is an object of the present invention to provide apparatus and methods allowing fast and qualitative switching between digital video streams. It is an advantage of embodiments of the present invention that fast switching between digital video streams can be performed without the need for communication between the receiver and the server side. It is furthermore an advantage of embodiments of the present invention that fast switching can be performed by introducing only minor changes to the equipment at the receiver side, i.e. for example without the need for a second set-top box. It is also an advantage of specific embodiments of the present invention that there is no need for additional decoders to obtain the fast and qualitative switching. It is an advantage of embodiments of the present invention that switching is substantially as fast and as good as can be obtained for switching between channels on an analogue television system.

[0009] The above objective is accomplished by a method and device according to the present invention.

[0010] The present invention relates to a method for handling a plurality of digital video streams, the method comprising displaying at least a first digital video stream to be displayed and buffering video information for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed. A moving window may be a window that comprises most recently received information about the digital video stream. The window may be frequently refreshed in order to comprise most recently received information. The updating may be done on a frame-by-frame basis or on a sequence of frames basis, e.g. a buffer is refreshed every time a reference frame is received. Allowing extraction of moving images from the buffered video information may be allowing extraction of moving images from the buffered video information for displaying the second digital video information substantially in a real-time manner. Substantially in a real-time manner may be with a small delay compared to receipt of the corresponding information in the second digital video stream. Substantially in a real-time manner may be with a delay of maximal the showing time for one sequence of frames. Said buffering may be buffering video information of a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information as to combine the moving images with further received video information of the second digital video stream when the second digital video stream is selected to be displayed.

[0011] Each of the digital video streams may be encoded in sequences of frames, each of the sequences of frames comprising a key frame, at least one reference frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames, wherein buffering video information may comprise buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream. It is an advantage of embodiments of the present invention that for at least a second digital video stream, but preferably for a plurality of further digital video streams, frame information is buffered that allows reducing the delay when switching from a first digital video stream to any of these further digital video streams. Digital video streams may refer to any type of framed information transferred in a sequence of sequences of frames. The latter may e.g. include 3D video images.

[0012] The method may comprise not buffering all of said further frames for a window of at least a second digital video stream. It is an advantage of embodiments of the present invention that not all frame information needs to be buffered. In this way a smart buffering is performed. The method may comprise not buffering any of said further frames for at least a second digital video stream

[0013] Said buffering video information may comprise buffering video information in an encoded format. It is an advantage of embodiments of the present invention that buffering of encoded frames is performed reducing the needed memory space and avoiding the need for first decoding the frames to be buffered. Consequently less decoding time may be needed which is advantageous as the major part of the buffered frames will not be used anyway.

[0014] Buffering said at least one of said key frame or said at least one reference frame may comprise buffering the key frame and all reference frames of a sequence of frames for said window of at least a second digital video stream. Buffering the key frame and all reference frames may allow extraction of moving images with a sufficient high quality.

[0015] With a moving window of at least a second digital video stream there may be a number of most recently received sequences of frames, e.g. a few most recently received sequences of frames, e.g. three most recently

Pinterest Ex. 1004 Page 153 of 371

received sequences of frames or the most recently received sequence of frames or the most recently received sequence of frames and the last but one most recently received sequence of frames

[0016] Buffering said at least one of said key frame or said at least one reference frame furthermore may comprise buffering no further frames in a first half of a sequence of frames and buffering all further frames in a second half of a sequence of frames. The latter may allow synchronising the display and the receipt of sequences of frames of a second digital video stream once selecting of the second digital video stream is performed.

[0017] Said buffering may comprise buffering said frames of the most recently received sequence of frames for said at least a second digital video stream. The latter may allow, upon selection, to display digital video streams in "real time". The buffering also may comprise buffering at least one of a key frame or reference frame (s) from a last but one received sequence of frames for said at least a second digital video stream. The buffering also may consist of buffering said frames of the most recently received sequence of frames for said at least a second digital video stream.

[0018] The method may comprise refreshing said buffering when a new most recently received sequence of frames for said at least a second digital video stream is received. Refreshing said buffering may be reapplying the buffering step wherein buffering at least one of said key frame or said at least one reference frame of the most recently received sequence of frames for at least a second digital video stream is performed. Refreshing said buffering also may be applied after part of a new most recently received sequence of frames has already been buffered, the refreshing then referring to removal of the last but one received sequence of frames.

[0019] Buffering for at least a second digital video stream may comprise buffering for a plurality of further digital video streams. It is an advantage of embodiments of the present invention that a plurality of further digital video streams can be made available for fast switching without the need for decoding all of the plurality of further digital video streams.

[0020] The method furthermore may comprise decoding at least part of said buffered video information, e.g. key frame or reference frames, for at least one of said at least a second digital video stream. The decoding may be performed using spare time of the decoder used for displaying the at least one first digital video stream. The decoding may be performed using a spare decoder. The spare decoder may be a decoder typically used for picture-in-picture displaying. It may be an advantage of some embodiments of the present invention that part of the buffered video information, e.g. key frame or reference frames, are already decoded allowing a further decrease of the delay during switching between digital video streams. It may be an advantage that not all frames in a sequence of frames for a digital video stream need to be decoded but that only key frames and/or reference frames are decoded.

[0021] At least one of the digital video streams may comprise a number of video layers, e.g. encoded in sequences of frames, wherein buffering may be performed for at least one layer of said at least a second digital video stream. Either all layers can be buffered or a selection of the video layers may be buffered. The different video layers may comprise different levels of detail, whereby the buffering may be buffering of the video layer having the lowest image detail. Buffering also may be performed on a plurality of video layers comprising less image detail then the non-buffered video layers

[0022] The method furthermore may comprise, prior to said buffering, selecting said at least a second digital video stream based on a context of said plurality of digital video streams. Selecting based on context of said plurality of digital video streams may be based on statistical information of a client's viewing behaviour or may be based on another analysis of a client's viewing behaviour, such as e.g. by a neural network. Alternatively, said selecting at least a second digital video stream may be based on which at least one digital video stream is displayed. The plurality of digital video streams may be ranked and selecting at least a second digital video stream may be based on said ranking.

[0023] The method furthermore may comprise, providing to the viewer an indication of the digital video streams for which video information, e.g. at least one of said key frame or said at least one reference frame, are buffered. The latter provides a user friendly interface for clients that which to fastly switch between different digital video streams.

[0024] The buffering may comprise buffering said video information, e.g. said at least one of said key frame or said reference frame(s), with a resolution or size lower than a resolution or size of the received video information, e.g. key frame or reference frame(s).

[0025] The invention also relates to a method for switching between a plurality of digital video streams, the method comprising displaying at least a first digital video stream to be displayed and buffering video information for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed, and

upon selection of said digital second video stream for displaying,

extracting and displaying moving images from the buffered video information and after said extracting and displaying, displaying newly received sequences of frames for said second digital video stream.

[0026] Said displaying newly received sequences of frames may comprise receiving each frame of said sequence of frames in a buffer, decoding said frames and displaying said frames.

[0027] Each of the digital video streams may be encoded in sequences of frames, each of the sequences of frames comprising a key frame, at least one reference

Pinterest Ex. 1004 Page 154 of 371

frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames, wherein buffering video information may comprise buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream.

[0028] The method furthermore may comprise, upon selection of said second digital video stream for displaying, adjusting the number of frames displayed in order to synchronise receiving sequences of frames for said second digital video stream and displaying newly received sequences of frames for said second digital video stream. The method for switching may comprise any of the features as described above for the method for handling a plurality of digital video streams.

[0029] The invention also relates to a controller for handling a plurality of digital video streams, the controller comprises means for controlling the display of at least a first digital video stream characterised in that the controller furthermore comprises means for controlling buffering video information for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed.

[0030] Each of said digital video streams may comprise sequences of frames, each of said sequences of frames comprising at least a key frame, at least one reference frame and further frames, said at least one key frame and said at least one reference frame suitable for deriving frame information for said further frames, wherein said means for controlling buffering video information may comprise a means for controlling buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream.

[0031] Said means for controlling buffering may be adapted so as to not buffer all of said further frames.

[0032] Said means for controlling buffering may be adapted so as to said buffer video information, e.g. at least one of said key frame or said at least one reference frame, in an encoded format.

[0033] The controller may be adapted for, upon selection of a second digital video stream to be displayed, controlling extraction and display of moving images from said buffered video information, e.g. buffered key frame or reference frames, for said second digital video stream and said controller may be adapted for, after said extraction and display, controlling display of newly received video information, e.g. newly received sequences of frames, for said second digital video stream. The controller may be adapted for, upon the display of moving images for said second digital video stream, synchronising the receipt of video information, e.g. sequences of frames, and the display thereof.

[0034] The invention also relates to a device for handling a plurality of digital video streams, the device comprising a buffer for buffering frames from a plurality of video images and a controller for controlling the display of at least a first digital video stream and for controlling buffering of video information for a moving window of at least a second video stream to said buffer, said buffering allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed.

[0035] Each of said digital video streams may comprise sequences of frames, each of said sequences of frames comprising at least a key frame, at least one reference frame and further frames, said at least one key frame and said at least one reference frame suitable for deriving frame information for said further frames. Said buffered video information may comprise at least one of a key frame or at least one reference frame of said at least second digital video stream.

[0036] The device furthermore may comprise a decoder for decoding of frames of said at least a first digital video stream and for decoding of said buffered video information, e.g. key frame or reference frame(s). The controller may be adapted for controlling said decoding of the buffered video information, e.g. key frame or reference frame(s), when the second digital video stream is selected to be displayed. The buffer for buffering frames from a plurality of video images may comprise a first sub-buffer for buffering frames of a first video stream and at least one second sub-buffer for buffering video information, e.g. at least one of said key frame or said at least one reference frame, for at least a second digital video stream. Such sub-buffers may be virtually separate buffers or such buffers may be physically separate buffers. The controller may have any of the above described features

[0037] The invention also relates to a display system for displaying at least one digital video stream from a plurality of video streams, the display system comprising a controller as described above or a device for handling a plurality of digital video frames as described above.

[0038] The invention furthermore relates to a computer program product for executing the method of handling a plurality of digital video streams and/or for executing part of the method for switching between digital video streams. The invention also relates to a machine readable data storage device for storing the computer program or to the transmission of such a computer program product over a local or wide area telecommunications network.

[0039] Particular and preferred aspects of the invention are set out in the accompanying independent and dependent claims. Features from the dependent claims may be combined with features of the independent claims and with features of other dependent claims as appropriate and not merely as explicitly set out in the claims.

[0040] The above and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The ref-

Pinterest Ex. 1004 Page 155 of 371

erence figures quoted below refer to the attached drawings.

Brief description of the drawings

[0041]

Fig. 1 is a schematic overview of an exemplary environment including devices according to the first and/or second embodiment of the present invention.
Fig. 2 is a schematic overview of a controller for handling a plurality of digital video streams according an embodiment of to the present invention.
Fig. 3 is a schematic overview of an exemplary method for handling a plurality of digital video streams according to the third embodiment of the present invention.
Fig. 4 is a schematic overview of an exemplary method for switching between digital video streams according to the third embodiment of the present invention.
Fig. 5 is a schematic overview of the frames that are buffered and the frames that are displayed for a first decoding and displaying scenario according to the third embodiment of the present invention.
Fig. 6 is a schematic overview of the frames that are buffered and the frames that are displayed for a second decoding and displaying scenario according to the third embodiment of the present invention.
Fig. 7 is a schematic overview of the frames that are buffered and the frames that are displayed for a third decoding and displaying scenario according to the third embodiment of the present invention.
Fig. 8 is a schematic overview of an exemplary trajectory for video streams in a method for handling a plurality of digital video streams according to the third embodiment of the present invention.
Fig. 9 is a schematic overview of an exemplary computing system suitable for running a method according to the third embodiment of the present invention.

[0042] In the different figures, the same reference signs refer to the same or analogous elements.

Definitions

[0043] The following terms are provided solely to aid in the understanding of the invention. These definitions should not be construed to have a scope less than understood by a person of ordinary skill in the art. In the present invention with digital video stream may be meant any type of framed information transferred in a sequence of sequences of frames. The latter also may e.g. include data streams, audio streams, video streams as such or a combination thereof. Furthermore 3D video images may be meant. It is possible that one video stream is split into different layers, e.g. in a layered, hierarchical structure. Each of these layers describes the video stream with a certain degree of details, e.g. starting with the basic layer which describes the pictures with a low quality. Each following layer depends on the previous layers and gives more details of the pictures, e.g. a better resolution. The present invention applies to both unlayered video streams, i.e. video stream with only one basic layer, and layered video streams. Therefore, in the following, with the terminology "video stream" the set of different layers of a stream of framed data such as a video stream are meant, or in case the set contains only one element, the only layer of framed data such as a single video stream is meant.

Description of illustrative embodiments

[0044] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

[0045] Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

[0046] It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated features, integers, steps or components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. Thus, the scope of the expression "a device comprising means A and B" should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

[0047] The invention will now be described by a detailed description of several embodiments of the invention. It is clear that other embodiments of the invention can be configured according to the knowledge of persons skilled in the art without departing from the true spirit or technical teaching of the invention, the invention being limited only by the terms of the appended claims. The present invention relates to a method and system for handling video streams, e.g. for switching between different video streams. Typically, for transfer reasons, such video streams are received by the client as a sequence of encoded slices. The video streams in the present invention

Pinterest Ex. 1004 Page 156 of 371

may be encoded in any type of CODEC dividing the video stream in sequences, each sequence comprising a key-frame. Typical examples of such CODECs, the invention not being limited thereto, are the standards provided by the Motion Picture Experts Group (MPEG), such as e.g. MPEG-1 referring to ISO/IEC standard 11172, MPEG-2 referring to ISO/IEC standard 13818, MPEG-4 referring to ISO/IEC 14496 and the standards H.263 and H.264, being International Telecommunications Union standards. MPEG-4 Part 10 and H.264 are technically identical CODECs, written by the Joint Video Team. The technology used is known as Advanced Video Coding. It is possible that one video stream consists of multiple video layers. Each video layer describes the video stream in a certain degree of detail. The first layer, holding the less detailed information is called the basic layer and all the following layers will be dependent of the previous one(s). Typically the structure of the sequence of frames of different layers will be all the same. Depending on the CODEC used, the sequence of encoded slices may be a sequence of encoded frames, or, in more advanced CODECs, such as e.g. H.264/MPEG-4 Part 10, the sequence of encoded slices may be a sequence of encoded video objects, being an area of the video scene that may occupy an arbitrarily-shaped region and may exist for an arbitrary length of time and corresponding with a sequence of a part of frames. For the ease of explanation, the following description will be based on a CODEC using encoded frames, but it will be obvious for the person skilled in the art, that a sequence of encoded video objects can be used, whereby the different video objects are treated as a set of part of frames, each set of part of frames being independent of each other. In other words, each video object could be interpreted as a video stream, whereby putting all video objects together reults in the resulting video stream wanted. It is to be noted that video objects can have different structures for the sequences of frames, such that e.g. the key frames of the different video objects are not sent all at the same time. It is to be noted that the specific CODEC used is not limiting for the present invention. In other words, it is an advantage of embodiments of the present invention that the corresponding methods and systems can be used with any of the known CODECs.

[0048] Not all frames in a sequence of encoded frames, also referred to as pictures, are treated in the same way during encoding and decoding. In the present application, the following terminology will be used in general for each encoding/decoding system. By way of example, the corresponding terminology for the often used MPEG-2 standard will be indicated.

- α-frames, also referred to as a key frames, are those frames that are independent of other frames, i.e. those frames without any reference to other frames. In MPEG-2 standard, such frames may be referred to as Intra Coded frames or I-frames, in MPEG-4 Part 2, such frames may be referred to as I-VOP and in H.264/MPEG-4 part 10 such frames are referred to as instantaneous decoder refresh pictures (IDRP). Typically α-frames are used as a starting point for prediction after a video stream change and to recover from errors. All current CODECs and future CODECs have a key frame in the video sequence because a key frame is needed as a starting point when the television is switched on, for instance.
- β-frames are those frames that are only dependent on α-frames and β-frames and that can be used as a reference frame for all other frames except α-frames. In the MPEG-2 standard, predicted frames or P-frames are obtained by forward prediction from I-frames and P-frames. Such P-frames thus are examples of β-frames.

In the present patent application β-frames and optionally δ-frames will also be referred to as reference frames as they function as a reference frame for a plurality of other types of frames, i.e. β-frames, γ-frames, δ-frames and ε-frames.

- γ-frames are those frames that are dependent on other α- and β-frames but that cannot be used as a reference frame for other frames in the video stream. In the MPEG-2 standard Bi-directionally predicted frames or B-frames are obtained by forward prediction and/or backward prediction and/or interpolation from I-frames and P-frames. Such B-frames are not used as reference frames for other frames.
- δ-frames are those frames that are dependent on other α- and β-frames but, contrary to the γ-frames, they can be used as a reference frame but only for other δ-frames.
- ε-frames : frames that do no follow one of the mentioned classifications, e.g. such as D-frames in the MPEG-2 standard, being frames encoded like I-frames but whereto no reference may be made. These frames thus are not used for further decoding.

It is to be noted that during encoding and transferring of the digital video stream, some frames may be skipped and thus may not be sent at all. In the encoding, transferring and decoding process of video streams, each video stream is handled as a sequence of sequences of frames. Each sequence of frames comprises a key frame and additional basic reference frames and furthermore typically may allow a number of additional frames. Except for the key frame, the frames of a sequence of frames will depend on other frames of the sequence of frames. No references to frames outside the sequence of frames will be present, except maybe at the end of a sequence of frames where the last frames can be dependent on the first frame of the next sequence of frames. Typically such a sequence of frames corresponds with image data allowing generation of a few seconds of video stream. Therefor, when in the present application the term 'real-time' video stream is used, this might also refer to a video

Pinterest Ex. 1004 Page 157 of 371

stream transferred in blocks corresponding with a few seconds of video. A sequence of frames is in the MPEG-1 and MPEG-2 standard referred to as a GOP. An example of such a sequence of frames in the MPEG-2 standard is the sequence IBBPBBPBBPBB. This format allows for a satisfactory video quality with an acceptable random access time (<0.5s) within a bit-rate of 1.15 Mbps, which is considered as low bit-rate. So: 1/12 I-pictures (no temporal compression); 3/12 P-pictures (+/- 75% temporal compression); 8/12 B-pictures (+/- 95% temporal compression) for a total compression ratio of +/- 82%, without taking into account spatial compression. It is to be noted that the methods and systems of the embodiments of the present patent application are not limited by the specific type of frames in the sequence of frames or by the number of frames present in the sequence of frames. The above example illustrated the use of temporal compression. In the present invention, furthermore also spatial compression may be used.

[0049] In a first embodiment, the present invention relates to a controller for controlling the handling of a plurality of digital video streams at a client side, also referred to as receiver side or user side or possibly in the network near the client side. Such a controller 100 typically may be used in a network between a server and a client, also referred to as user, an example thereof being shown in Fig. 1. Digital video typically is transferred between a server side 102, typically being a digital video broadcaster, and a client side 104 over a network 106. At the server side 102 encoding and streaming of the different video streams is done, while at the client side 104 decoding is done. The main purpose of encoding the video streams is the reduction of the needed bandwidth for streaming the video data, because bandwidth capacity typically is the main restriction of a network 106. The network 106 is responsible for the transportation of the video streams from the server 102 to the clients 104 and may be a network according to any suitable network technology such as, but not limited to digital describer line technologies xDSL, cable, satellite, digital video broadcasting - terrestrial (DVB-T) transmitting the digital signal through air, wireless WiFi technology or WiMAX technology or other wireless connections like 3G and 4G technologies (UMTS, etc.). Digital video typically is transferred over the network 106 using a transport stream 108. One such a transport stream 108 may comprise different digital video streams 110 corresponding with image content for different digital video streams. The transfer of different digital video streams 110 may be done, amongst other depending on the type of network 106 used and the number of video streams 110 to be sent, via different frequency bands, in broadband, and/or in a multiplexed way, such that typically a tuner and/or demultiplexer 112 may be used to extract different separate video streams 110. Such a tuner and/or demultiplexer may be incorporated or separate to a device 114 for handling a plurality of digital video streams (in Fig. 1 the tuner/demultiplexer is shown incorporated in device 114). Such a device 114 typically is referred to as a set-top box (STB). The device 114 furthermore comprises a buffer 116 for buffering image frames of the received digital video streams and also may comprise a decoder 118 for decoding the encoded digital video streams 110 received at the client side 104. Typically a client 104 selects at least one digital video stream to be displayed, the displaying done on any suitable type of display 120. It is to be noted that the controller and possibly the set-top box may be a network device, placed in the network rather than at the client side, such that the controller and possibly the set-top box may be used for different displays in one or multiple viewing places such as homes.

[0050] The controller 100 according to the first embodiment of the present invention is shown in more detail in Fig. 2. It comprises means for controlling the display 150 of at least a first digital video stream. The means for controlling the display 150 of at least a first digital video stream allows to display at least a first digital video stream that is selected for viewing by the client 104. Such controlling typically may comprise controlling the usual tasks performed for displaying a digital video stream 110. Such controlling may e.g. comprise selecting the at least first digital video stream from the plurality of encoded digital video streams 110 that are received, decoding the incoming frames of the at least a first digital video stream and displaying the decoded frames of the at least a first digital video stream. In order to take into account inertia of the decoder 118 or inertia of the display 120, both encoded frames, i.e. in advance of the decoding, and/or decoded frames may be buffered. This typically is limited to the most recent frames, e.g. the three most recent frames to be displayed and typically is completely independent of the sequence of frames structure of the received digital video stream 110. In systems where additional tuner/multiplexers and decoders are present, at least a first digital video stream may comprise more than one video stream, e.g. as obtained in picture-in-picture (PIP) systems. The means for controlling the display 150 of at least a first digital video stream then allows to display different digital video streams 110 simultaneously. The means for controlling the display 150 of at least a first digital video stream consequently directly or indirectly interacts with the tuner/multiplexer 112, the decoder 118 and the display 120. Besides these means 150 that allow to handle the selected video streams, the controller furthermore also comprises a means for controlling buffering 152 video information of a moving window of at least a second digital video stream that is not displayed at that time, but that might be selected in the near future. The buffered video information of a moving window of the at least a second video stream is such that it allows extraction of moving images from this buffered video information when the second digital video stream is selected. In other words, the buffered video information of a moving window of the at least a second video stream may be such that extraction of moving images can be done, based only on the buffered video information, i.e. without

Pinterest Ex. 1004 Page 158 of 371

the need for other received frames. With a moving window of a digital video stream, typically there a window comprising most recently received information of the digital video stream. In other words, a moving window is refreshed such that it comprises most recently received information of the digital video stream. As described above, digital video streams 110 typically are built as a sequence of sequences of frames, whereby each sequence comprises a key frame, reference frames and further frames. Typically a few to a few hundreds frames may be present in a sequence of frames, such as e.g. between 6 and 300 frames. An often used number of frames at present is 15 frames per sequence. The reference frames are those frames that are, in combination with the key frame, used as reference frames to obtain full image information about other reference frames and further frames. In order to allow fast switching between digital video streams, typically information of the most recently received sequence of frames is buffered, as this will allow to display, upon selection of the corresponding digital video stream, at least part of the most recently received sequence of frames followed by further sequences received after switching. In other words, providing moving images nearly immediately after switching to a second digital video stream is obtained by buffering a moving window of the digital video stream, whereby the moving window typically comprises a number of most recently received sequences of frames, for example but not limited to the three most recently received sequences of frames, the most recently received sequence of frames and the last but one recently received sequence of frames, the most recently received sequence of frames and part of the last but one recently received sequence of frames or the most recently received sequence of frames. The buffering thus may be systematically refreshed, it is at regular moments, whereby the previously buffered frames or at least part thereof may be removed. Upon refreshment of the buffer 116, some frames of the next received sequence of frames might be buffered first before the frames of the previously received sequence of frames are removed. Thus, the means for controlling buffering 152 is adapted for, after or upon receipt of a new sequence of frames for the at least a second digital video stream, removing the frames buffered from previous sequences of frames. The means for controlling buffering 152 will be adapted for buffering at least one of a key frame or reference frames, whereby the buffered information allows to generate moving images based on the buffered frames. It may be adapted for controlling the buffering of the key frame and all reference frames of a sequence of frames for at least a second digital video stream. The latter guarantees a relatively high quality for displaying the digital video steam. If not all reference frames are buffered, a loss of quality will occur. The means for buffering also may allow the buffering of a number of further frames. Whereas in principle all frames of a sequence of frames could be buffered - e.g. in case buffer space is not an issue - the latter may be detrimental for the amount of buffer used and thus not preferable. It therefor may be advantageous to not buffer all further frames of the sequence of frames or even not to buffer any of the further frames. If a digital video stream 110 consists of different video layers, there is a choice of buffering all, some or none of the layers. If a video stream consists of different video layers, typically a basic layer, being the layer with the lowest detail, and enhancement layers will be present in the respective order. Each further enhancement layer, also referred to as higher enhancement layer, builds on the previous enhancement layers, also referred to as lower enhancement layer, providing enhanced information of the previous layers. If not all layers of a video stream are buffered, the means for buffering is adapted for controlling the buffering of at least the basic layer and possibly the lower enhancement layers are buffered. Furthermore, the controller may be adapted for controlling the buffering of layers on a frame by frame base. Once a layer of a frame has been dropped, all the higher enhancement layers above the dropped enhancement layer of that frame are useless, as they are building on the lower layers. Consequently, also on a frame by frame basis, only the basic layer and possibly the lowest enhancement layers may be buffered. Selection of layers to be buffered on a frame by frame basis may be for example such that only the basic layer and possibly the lowest enhancement layers of the further frames are buffered, while all layers are buffered of the key frame and the reference frame. In the present invention, the frames may be buffered in an encoded format, having the advantage of not needing to be decoded first. Only those encoded frames that really will be needed for display upon selection of that video stream then may be decoded, thus avoiding unnecessary use of decoder capacity. It thus is an advantage that no additional decoders are necessary for the buffering, while still providing fast switching between different video streams. Alternatively if spare decoders are present, the controller may be adapted for using spare time of these decoders to decode frames buffered from the at least a second digital video stream, this way further reducing the time needed for switching. Nevertheless, no substantial change is needed in order for the system to operate.

[0051] The at least a second digital video streams may be a plurality of video streams. Depending on the size of the buffer 116, either all digital video streams may be buffered, or a selection thereof may be buffered. Which video streams are buffered may change during operation. Such a selection may be based on heuristic results, based on the most popular video streams, based on the specific preferred video streams by the client or based on other video streams that are likely to be switched to, such as e.g. video streams having a position on the channel list being next to or close to currently displayed video streams, or a combination of any of these. The controller 100 may be adapted to perform any of the above analysis for which digital video streams are likely to be switched to.

[0052] The controller furthermore may comprise

Pinterest Ex. 1004 Page 159 of 371

means for controlling extraction and display 154, upon selection of a second digital video stream, moving images based on the buffered frames for the second digital video stream. The means therefor may control the selecting of those buffered frames appropriate to be displayed, control the decoding of the frames necessary to generate the moving images and control the display thereof. Which buffered frames need to be extracted and displayed depends on the moment at which the selection of the second digital video stream is performed. If the latter is done at the start of a sequence of frames, the time to be bridged in order to receive a new sequence of frames for the second digital video stream will be longer than if this switching is performed at the end of a sequence of frames and preferably more buffered images will be used for providing moving images in that bridging time. Which buffered frames need to be extracted and displayed also depends on the type of decoding scenario that is used, which will be discussed further in this application. Control of the decoding of the frames and control of the display thereof also may be performed by the means for controlling the display 150 of at least a first digital video stream.

[0053] The controller 100 also may be adapted for displaying newly received sequences of frames, received after switching to the second digital video stream. Such sequences of frames will be displayed after the moving images are extracted and displayed based on the buffered frames. In principle, the further handling of the second digital video stream can be performed using the means for controlling 150 the display of at least a first digital video stream. The controller also may comprise a means for synchronising 156 the receipt of sequences of frames of the second digital video stream and the actual display of sequences of frames. The latter may e.g. be done by dropping frames in the moving images to be displayed, by allowing a standard delay between receipt and display or by changing the display rate of the frames.

[0054] The controller 100 may be made as software and installed on a host computer, which may be any suitable programmable computing device such as personal computer with a Pentium IV microprocessor supplied by Intel Corp. USA, for instance, with memory and a graphical interface such as Windows 2000 as supplied by Microsoft Corp. USA. Alternatively the controller may include a computing device, e.g. microprocessor, for instance it may a micro-controller. In particular, it may include a programmable controller, for instance a programmable digital logic device such as a Programmable Array Logic (PAL), a Programmable Logic Array, a Programmable Gate Array, especially a Field Programmable Gate Array (FPGA). The use of an FPGA allows subsequent programming of the controller, e.g. by downloading the required settings of the FPGA.

[0055] In a second embodiment, the present invention relates to a device for handling 114 a plurality of digital video streams 110 comprising the controller 100 as described in the first embodiment. Such a device for handling 114 a plurality of digital video streams 110 typically is referred to as a set-top box (STB) and is illustrated by way of example in Fig. 1. The device for handling 114 a plurality of digital video streams 110 typically comprises at least a buffer 116 for buffering frames from a plurality of video images and a controller 100 as described in detail in the first embodiment. The specific features and advantages of the controller 100 as described in the first embodiment apply to the controller 100 incorporated in the device for handling 114 a plurality of digital video streams 110 according to the second embodiment of the present invention. The amount of available storage space in the buffer 116 to buffer the different video streams 110 is restricted to the physical constraints of the device. Such physical constraints typically are the available amount of read/write memory, such as e.g. random access memory (RAM). The amount of memory of the buffer typically depends on the functionality of the device for handling 114 a plurality of digital video streams. If only decoding and displaying capability is present, typically a memory of 56MB, 128MB or 256MB is used, although the embodiments of the present invention are not limited thereto. Typically, these buffers may be fast memory modules based on RAM memory or flash memory. When recording capability is present in the device for handling 114 a plurality of digital video streams, a larger storage capacity typically is present such as e.g. 40GB, 80GB or 160GB, the embodiments of the present invention not being limited thereto. The buffer 116 fo the device for handling 114 a plurality of digital video streams preferably comprises RAM or flash memory to support the fast switching actions according to embodiments of the present invention. The buffer 116 may be considered as a first sub-buffer, wherein the buffering for the video stream displayed at the moment is performed, and a number of additional sub-buffers, each sub-buffer suitable for buffering video information for one of the at least one second digital video stream. The different sub-buffers may be virtual sub-buffers or also may be physically separated. Because the buffering of the different video streams 110 requires fast writing of big amounts of data to the memory of the device, a good memory management may be needed. Different possible memory structures may be used and some examples thereof are provided hereafter by way of illustration. If e.g. a linear memory structure is used, the buffer 116 may be regarded as one large single buffer, wherein all different frames of different video streams 110 are stored in a linear way. The different frames of one video stream are connected to each other by using a linked list. So every frame holds a pointer to the next frames of the video stream. Furthermore pointers are needed to the first frame of every video stream. This leads to a very flexible and efficient memory management, but the management of the pointers is quite complex. An alternative memory management may be based on circular buffers. In a system using circular buffers each video stream has a dedicated amount of memory. A key frame from the video stream is the first frame

Pinterest Ex. 1004 Page 160 of 371

in the buffer. The following frames of the video stream are stored after this key frame. For this system, one or two pointers per video stream are needed, as there always needs to be a write pointer and in case the video stream is being displayed, also a read pointer is needed. Because, for this system, a dedicated amount of memory must be assigned to every video stream, this approach requires relatively much buffer capacity, but the management of the pointers are easier in comparison to the linear buffer approach. The system for handling 114 the plurality of digital video streams 110 is positioned at the client side 104. It may be incorporated in a display system, it may be part of a computing means or it may be a separate set-top box positioned between a central receiving point at the client side 104 and at least one display system.

[0056] In a third embodiment, the present invention relates to a method for handling a plurality of digital video streams. The method is suitable for handling a plurality of digital video streams received in an encoded format in sequences of frames. By way of illustration, basic and optional steps are shown in Fig. 3 for an exemplary method 200 according to the present embodiment. The method 200 is adapted for allowing fast switching between digital video streams 110. It typically may comprise receiving a plurality of digital video streams 110, transferred over a network 106, as described above and illustrated in step 202. The method according to the present embodiment comprises displaying at least a first digital video stream to be displayed, i.e. for example the video stream of a video channel that a user is watching, shown by step 204. E.g. for a picture-in-picture system or for a multi-view system having a number of displays, multiple video streams may be displayed at the same time. In order to allow fast switching, the method furthermore comprises buffering video information for a moving window of at least a second digital video stream, that is not displayed at that moment, as shown in step 206. The buffering allows extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed, i.e. when a user decides to switch from a first video stream to the second video stream, also referred to as zapping to the second video stream. For a sequence of frames comprising a key frame, at least one reference frame and further frames, whereby the reference frames are suitable for deriving frame information for the further frames, the buffered video information may comprise at least one of a key frame or a reference frame of a recently received sequence of frames of the second video stream, e.g. the last received sequence of frames. Typically, not all of the further frames are buffered, but a smart buffering system may be applied. In an alternative embodiment no further frames are buffered. Buffering at least one of a key frame or a reference frame may e.g. comprise buffering the key frame and may e.g. comprise buffering the key frame and all reference frames. The frames typically may be buffered in an encoded format, thus allowing to reduce the needed memory space and avoiding the need for first decoding the frames. Consequently less decoding time may be needed which is advantageous as the major part of the buffered frames will not be used anyway.

[0057] The at least a second video stream for which video information is buffered may be one video stream, but preferably is a number of video streams. The video streams for which video information is buffered could either be predetermined or could be variably selected, e.g. based on a context of the received video streams, e.g. based on statistical information of a client's viewing behaviour, e.g. based on user-inputted information or e.g. based on another analysis of a client's viewing behaviour, such as e.g. by using a neural network. Alternatively, or in combination therewith, the video streams for which video information is buffered could be based on the digital video stream that is displayed at that moment. The plurality of digital video streams may e.g. be ranked and selecting a video stream wherefore video information is buffered may be based on the ranking, e.g. it may be those video streams which have a number close to the number of the video stream that is displayed at that moment. In other words, the at least a second digital video stream of the plurality of received digital video streams may optionally be explicitly selected, as shown in optional step 208. The method also may comprise indicating to the client, e.g. by LED indications or by indications on the screen, which video streams are available for fast switching. Also an advanced remote controller can be used for indicating the video streams that are available for fast switching. The list of these video streams can be used as the dynamically adapted order of the available video streams. The latter could e.g. be commercially exploited, e.g. by making a digital video stream of an advertiser always available for fast switching upon payment of a fee. In the present invention, buffering video information typically may consist of buffering video information about a moving window of a video stream. With a moving window of a digital video stream, typically there a window comprising most recently received information of the digital video stream. In other words, a moving window is refreshed such that it comprises most recently received information of the digital video stream. Such a moving window may comprise frames of one sequence of frames or possibly of a few sequences of frames. This buffering typically is done to allow fast switching between digital video streams. An advantage of buffering only such a small window of a video stream is that in principle a plurality of digital video streams may be buffered, such that switching to any of this plurality of digital video streams can be done relatively fast. Typically frames of the most recently received sequence of frames or of a few of the most recently received sequences of frames for the at least a second digital video stream may be buffered. This allows to display digital video streams in "real time" or almost "real time", i.e. with a delay of less than a few sequences of frames, e.g. a delay of less than the showing time of one sequence of frames. The buffering also may comprise buffering at least one of a key

Pinterest Ex. 1004 Page 161 of 371

frame or reference frame(s) from a last but one received sequence of frames for said at least a second digital video stream. In other words, such a moving window may comprise - although the invention is not limited thereto - a number of most recently received sequences of frames, such as e.g. the three most recently received sequences of frames, the two most recently received sequences of frames, the most recently received sequence of frames and part of the last but one most recently received sequence of frames or the most recently received sequence of frames. In order to reduce the necessary buffer capacity, frames may be buffered with a resolution or size lower than a resolution or size of the received frames, in general, frames may be buffered at a lower quality. It is also possible that the received frames already have a lower quality.

[0058] With buffering video information about a window of a video stream, there also may be meant that upon receipt of a new most recently received sequence of frames, the buffering may be refreshed. This refreshing may be reapplying the buffering step either immediately upon receipt of a new most recently received sequence of frames or after part of a new most recently received sequence of frames has already been buffered. The refreshing comprises removing the frames received during the last but one received sequence of frames or received earlier. In other words systematically buffering of video information about the most recently received part of the video stream may be performed. If sufficiently buffer memory is present, more information may be buffered and refreshing may be done less frequently.

[0059] In order to further save time, decoding of at least part of the buffered frames, e.g. part of the buffered key frame or reference frames, for at least one of the digital video streams for which video information is buffered, may be applied. Such decoding may for example be performed using spare time of a decoder used for displaying the digital video stream selected for display by the client or e.g. using a spare decoder, e.g. present for allowing picture-in-picture display.

[0060] When a client wishes to switch from a first digital video stream to a second digital video stream, typically a first digital video stream is displayed. According to the present method, video information of a moving window of the second digital video stream may also be buffered at that moment. Upon switching to a video stream that is part of the video streams for which video information is buffered, moving images may be extracted from the buffered video information and may be displayed nearly immediately. Switching may be performed by a method 300 as shown in Fig. 4, illustrating basic and optional steps for such a method 300. As mentioned, before switching, according to the present embodiment a first digital video stream is displayed, as shown in step 204 and video information for a window of at least a second digital video stream is buffered, as shown in step 206. When a client selects a new digital video stream to be displayed, i.e. when the client zaps between two digital video streams, shown in step 302, it is checked whether video information about a moving window of the newly selected digital video stream is buffered. The latter is performed in step 304. If this is not the case, switching to and displaying of the newly selected digital video stream occurs in a conventional way, as shown in step 306, typically requiring a large delay time. If video information about the newly selected digital video stream is buffered - which information might be available from actions in step 206 - the corresponding buffered video information may be selected or extracted from the buffer. The latter is performed in step 308, based on the buffering performed in step 206. The selected buffered video information then is decoded, if not already done using spare decoders, and displayed, which is performed in step 310. Meanwhile, further sequences of frames for the digital video streams will be received, shown in step 312, allowing to seamless or nearly seamless switch from the display of the moving images based on the buffered video information to display of newly received digital video stream, which is shown in step 314. In other words, during the display of the decoded frames, typically a new sequence of frames will be received for the newly selected digital video stream, which allows initiation of the standard display of the newly selected digital video stream providing a seamless transition between display of the buffered video information and the standard display. Typically for standard display, only the most recent frames to be displayed are buffered, decoded and displayed. Furthermore, buffering video information of a moving window of at least one other digital video stream typically will be performed, the at least one other digital video stream being selected e.g. based on content, client preferences or ranking of the different video streams, as shown in step 316. Additional buffers may be provided, e.g. before the decoder in order to solve for the inertia of the decoder, or after the decoder, e.g. to solve the inertia of the network, e.g. if packets sent over a network suffer from network delay, this still allows displaying video information during a period of time when no video data is received.

[0061] In order to provide a seamless transition between the frames derived from the buffered video information and the newly received sequences of frames, synchronisation might be necessary. The latter can be done by installing a fixed delay or by dropping some frames. The need for synchronisation and the type thereof typically is correlated with the way of decoding and displaying. Different scenarios are possible, three of them shown, by way of illustration in Fig. 5 to Fig. 7. In these examples, by way of illustration, the first video stream VS1 and the second video stream VS2 both consist of sequences of frames having a $\alpha/\gamma/\beta/\gamma/\beta$ structure.

[0062] In a first scenario, the buffered video information is used for generating moving images, i.e. the frames of the buffered video information may be decoded, as these typically are stored in an encoded format, whereby if zapping occurred during the Nth frame 402 of a sequence of frames for a first video stream VS1, the $N+1^{th}$

Pinterest Ex. 1004 Page 162 of 371

frame 406 of a sequence of frames of the second video stream VS2 is shown. In this scenario, the sequences of frames for both video streams preferably may be equal in length. Fig. 5 illustrates this principle, whereby the frames displayed prior switching and the frames buffered after switching 404 are indicated for the first video stream VS1, the frames buffered before switching and the frames displayed after switching 408 are indicated for the second video stream VS2 and the frames displayed to the client are illustrated by frame set 410. A small zapping time may exist as decoding the first frame-to-be-displayed from the second video stream 408 typically requires decoding information from previous not-displayed frames, such as e.g. the key frame and other reference frames. It is to be noted that in this scenario it is not necessary to store all the video frames of a second video stream, as some frames are not needed for decoding other frames.

[0063] In a second scenario, shown in Fig. 6, the buffered video information is used for generating moving images, i.e. frames of the buffered video information may be decoded, as these typically are stored in an encoded format, whereby upon zapping, all frames that can be derived from the buffered video information from the second video stream are shown. The moment the user zaps to a second video stream VS2, the stored key frame 412 is shown immediately after the frame 402 of the first video stream VS1 wherein zapping occurred, while in the mean time further decoding of further frames of the second video stream VS2 can be done, leading to an almost nihil zapping time. A disadvantage may be that the user is not looking real-time to the second video stream VS2 but that a delay 414 occurs. The displayed frames have a fixed delay 414 with respect to their receipt. The amount of delay 414 depends on the time whereon zapping is performed, with respect to the sequence of frames. This delay will however be smaller than the showing time of one sequence of frames. In order to take this delay into account and to be sure that the frames are shown at the right moment in time, the timestamps of the frames need to be changed or the clock of the decoder needs to be adapted.

[0064] In a third exemplary scenario, the buffered video information is used for generating moving images, i.e. frames of the buffered video information may be decoded, as these typically are stored in an encoded format, whereby upon zapping, different frames of the sequence of frames of the second video stream, including frames at the start of the sequence 416, are displayed upon zapping. As frames at the start of the sequence, e.g. the key frame 412, are shown after zapping, the time needed for zapping is almost nihil. In the present example, resynchronisation between the display and the receipt of frames is obtained by dropping some frames 418, e.g. 1 picture per second or, if present, γ frames. The latter also requires adaptation of the timestamps of the frames or of the clock of the decoder, albeit temporarily. In order to resynchronise, it is also possible to show the frames for a shorter time, e.g. if normally each frame is displayed for 25 milliseconds this could be reduced to 20 milliseconds. The latter is shown, by way of illustration in Fig. 7.

[0065] In a fourth scenario, a guaranteed minimum zapping time is obtained by combining scenario 1 with scenarios 2 or 3. The first frames of the sequence of frames then are decoded as described in scenario 1, as long as not all buffered pictures are decoded or as long as the given minimum zapping time is not exceeded. If the given minimum zapping time is exceeded, the remaining buffered frames are decoded and displayed, resp. with a fixed delay or with a decreasing delay. The latter may be advantageously used in the buffer strategy applied, e.g. by buffering only the key-frame and reference frames in the first half of the sequence of frames, and by buffering all frames in the second half of the sequence of frames.

[0066] Alternatively, also reference frames could be dropped, although this will lead to loss of quality. After switching, the displayed frames will become better and better and at the moment the next key-frame is displayed, full quality will be achieved again.

[0067] By way of illustration, the video data flow for a method according to the present invention is illustrated for the case of video streams in MPEG video standard in Fig. 8. At the top, the encoded video files 502 are shown. Next, these video files are streamed 504 to the clients. Dependent on the network capacity, different video streams are buffered, resulting in buffered video information 506 of the displayed video stream 508 and buffered video information 510 of the video stream 512 not displayed at the moment, in the set-top box of the clients. The video stream 508 that is watched by the user will be decoded and sent to the display, as shown by the full line. When the user switches to another previously non-displayed video stream, as shown by the dashed line, buffered data of the new video stream 512, will be used to generate moving images thus reducing the zapping time. Depending on the buffered video data of the other video streams, multiple scenarios are possible for decoding and displaying leading to a seamless transition between moving images based on the buffered video information and moving images based on newly received sequences of frames and standard display thereof.

[0068] In a further embodiment, the invention relates to a processing system wherein the method embodiments according to the present invention are implemented, or in other words, wherein the method for handling a plurality of digital video streams according to the present invention, whereby buffering video information about a moving window of a non-displayed digital video stream is performed such that moving images can be derived from the buffered video information. An exemplary processing system 600 is shown in Fig. 9. Fig. 9 shows one configuration of processing system 600 that includes at least one programmable processor 603 coupled to a memory subsystem 605 that includes at least one form of memory, e.g., RAM, ROM, and so forth. A storage

Pinterest Ex. 1004 Page 163 of 371

subsystem 607 may be included that has at least one disk drive and/or CD-ROM drive and/or DVD drive. In some implementations, a display system, a keyboard, and a pointing device may be included as part of a user interface subsystem 609 to provide for a user to manually input information. Ports for inputting and outputting data also may be included. More elements such as network connections, interfaces to various devices, and so forth, may be included, but are not illustrated in Fig. 9. The various elements of the processing system 600 may be coupled in various ways, including via a bus subsystem 613 shown in Fig. 9 for simplicity as a single bus, but will be understood to those in the art to include a system of at least one bus. The memory of the memory subsystem 605 may at some time hold part or all (in either case shown as 611) of a set of instructions that when executed on the processing system 600 implement the step(s) of the method embodiments described herein. Thus, while a processing system 600 such as shown in Fig. 9 is prior art, a system that includes the instructions to implement aspects of the present invention is not prior art, and therefore Fig. 4 is not labelled as

prior art.

[0069] It is to be noted that the processor 603 or processors may be a general purpose, or a special purpose processor, and may be for inclusion in a device, e.g., a chip that has other components that perform other functions. Thus, one or more aspects of the present invention can be implemented in digital electronic circuitry, or in computer hardware, firmware, software, or in combinations of them. Furthermore, aspects of the invention can be implemented in a computer program product tangibly embodied in a carrier medium carrying machine-readable code for execution by a programmable processor. Method steps of aspects of the invention may be performed by a programmable processor executing instructions to perform functions of those aspects of the invention, e.g., by operating on input data and generating output data. Accordingly, the present invention includes a computer program product which provides the functionality of any of the methods according to the present invention when executed on a computing device. Further, the present invention includes a data carrier such as for example a CD-ROM or a diskette which stores the computer product in a machine-readable form and which executes at least one of the methods of the invention when executed on a computing device. Nowadays, such software is often offered on the Internet or a company Intranet for download, hence the present invention includes transmitting the computer product according to the present invention over a local or wide area network.

[0070] It is an advantage that for the present invention only the buffer and more particularly the controlling thereof needs to be changed in a system for handling digital video streams, i.e. no changes are needed to e.g. the decoder.

[0071] It is to be noted that the system also works for dynamic sequences of frames, i.e. whereby the length of the sequences of frames used varies within a single video stream or between video streams. As information about the length of the sequence of frames may be provided together with the video information buffered for a second digital video stream, the latter could be handled using methods and systems according to the present invention, without substantial additional problems.

[0072] It is to be noted that the frame transmission order and the frame decoding order is not necessarily the same as the frame display order.

[0073] By applying a smart buffering strategy of the different video streams, this delay can be reduced to times similar to zapping on the analogue television. It is an advantage of embodiments of the present invention that the delay in displaying digital video stream in real-time or nearly real-time for embodiments of the present invention may be up to 10 times smaller than for existing digital systems.

[0074] It is an advantage of the present invention that no changes are needed at the server side of the network, nor in intermediate active nodes of the network, i.e. only changes at the client side of the network are needed.

[0075] It is to be understood that although preferred embodiments, specific constructions and configurations, as well as materials, have been discussed herein for devices according to the present invention, various changes or modifications in form and detail may be made without departing from the scope and spirit of this invention.

Claims

1. A method (200) for handling a plurality of digital video streams (110), the method comprising

   - displaying at least a first digital video stream to be displayed and
   - buffering video information for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed

2. A method (200) according to claim 1, each of the digital video streams (110) being encoded in sequences of frames, each of the sequences of frames comprising a key frame, at least one reference frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames,
   wherein buffering video information comprises buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream.

3. A method (200) according to claim 2, the method

Pinterest Ex. 1004 Page 164 of 371

comprising not buffering all of said further frames for a moving window of at least a second digital video stream.

4. A method (200) according to any of claims 2 to 3, wherein buffering said at least one of said key frame or said at least one reference frame comprises buffering the key frame and all reference frames of a sequence of frames for said moving window of at least a second digital video stream.

5. A method (200) according to any of claims 2 to 4, wherein buffering said at least one of said key frame or said at least one reference frame furthermore comprises buffering no further frames in a first half of a sequence of frames and buffering all further frames in a second half of a sequence of frames.

6. A method (200) according to any of claims 2 to 5, wherein said buffering comprises buffering said frames of the most recently received sequence of frames for said at least a second digital video stream.

7. A method (200) according to any of claims 2 to 6, the method comprising refreshing said buffering when a new most recently received sequence of frames for said at least a second digital video stream is received.

8. A method (200) according to any of the previous claims, wherein said buffering video information for a moving window of at least a second digital video stream comprises buffering video information in an encoded format.

9. A method (200) according to any of the previous claims wherein buffering for at least a second digital video stream comprises buffering for a plurality of further digital video streams.

10. A method (200) according to any of the previous claims, the method furthermore comprising, decoding video information for at least one of said at least a second digital video stream.

11. A method (200) according to any of the previous claims, said digital video streams comprising a number of video layers, wherein said buffering is performed for at least one layer of said at least a second digital video stream.

12. A method (200) according to any of the previous claims, the method furthermore comprising, prior to said buffering, selecting said at least a second digital video stream based on a context of said plurality of digital video streams.

13. A method (200) according to any of the previous claims, the method furthermore comprising, providing to the viewer an indication of the digital video streams for which video information is buffered.

14. A method (200) according to any of the previous claims, wherein the buffering comprises buffering video information with a resolution or size lower than a resolution or size of the received video information.

15. A method (300) for switching between a plurality of digital video streams, the method comprising

- displaying at least a first digital video stream to be displayed and
- buffering video information for a moving window of at least a second video stream allowing extraction of moving images from the buffered video information when the second video stream is selected to be displayed, and upon selection of said digital second video stream for displaying,
- extracting and displaying moving images from the buffered video information and

after said extracting and displaying,

displaying newly received video information for said second digital video stream.

16. A method (300) according to the previous claim, each of the digital video streams being encoded in sequences of frames, each of the sequences of frames comprising a key frame, at least one reference frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames, wherein buffering video information comprises buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream.

17. A method (300) according to claim 16, the method furthermore comprising, upon selection of said second digital video stream for displaying, adjusting the number of frames displayed in order to synchronise receiving sequences of frames for said second digital video stream and displaying newly received sequences of frames for said second digital video stream.

18. A controller (100) for handling a plurality of digital video streams (110), wherein the controller (100) comprises means for controlling the display (150) of at least a first digital video stream
characterised in that
the controller (100) furthermore comprises means for controlling buffering (152) of video information for a moving window of at least a second digital video stream allowing extraction of moving images from the buffered video information when the second dig-

Pinterest Ex. 1004 Page 165 of 371

ital video stream is selected to be displayed.

19. A controller (100) according to the previous claim, each of the digital video streams (110) being encoded in sequences of frames, each of the sequences of frames comprising a key frame, at least one reference frame and further frames, said key frame and at least one reference frame suitable for deriving frame information for said further frames, wherein said means for controlling buffering of video information comprises means for controlling buffering at least one of said key frame or said at least one reference frame of at least a second digital video stream.

20. A controller (100) according to claim 19, wherein said means for controlling buffering (152) is adapted so as to not buffer all of said further frames.

21. A controller (100) according to any of claims 18 to 20, wherein said means for controlling buffering (152) is adapted so as to buffer video information in an encoded format.

22. A controller (100) according to any of claims 18 to 21, the controller being adapted for, upon selection of a second digital video stream to be displayed, controlling extraction and display of moving images from said buffered video information and said controller being adapted for, after said extraction and display, controlling display of newly received video information for said second digital video stream.

23. A controller (100) according to claim 22, the controller being adapted for, upon the display of moving images for said second digital video stream, synchronising the receipt of newly received video information and the display thereof.

24. A device for handling (114) a plurality of digital video streams (110), the device comprising

- a buffer (116) for buffering frames from a plurality of video images and
- a controller (100) for controlling the display of at least a first digital video stream and for controlling buffering of video information for a moving window of at least a second video stream to said buffer, said buffering allowing extraction of moving images from the buffered video information when the second digital video stream is selected to be displayed.

25. A device (114) according to claim 24, each of said digital video streams (110) may comprise sequences of frames, each of said sequences of frames comprising at least a key frame, at least one reference frame and further frames, said at least one key frame and said at least one reference frame suitable for deriving frame information for said further frames, wherein said buffered video information comprises at least one of a key frame or at least one reference frame of at least a second digital video stream.

26. A device (114) according to any of claims 24 to 25, the device (114) furthermore comprising a decoder (118) for decoding of frames of said at least a first digital video stream and for decoding of said buffered video information.

27. A device (114) according to any of claims 24 to 26, the controller (100) being adapted for controlling said decoding of the buffered video information when the second digital video stream is selected to be displayed.

28. A device (114) according to any of claims 24 to 27, wherein said buffer (116) for buffering video information from a plurality of video images comprises a first sub-buffer for buffering said frames of a first video stream and at least one second sub-buffer for buffering video information for at least a second digital video stream.

29. A display system for displaying at least one digital video stream from a plurality of video streams, the display system comprising a controller according to any of claims 18 to 23 or a device for handling a plurality of digital video frames according to any of claims 24 to 28.

30. A computer program product for executing the method as claimed in any of claims 1 to 17.

31. A machine readable data storage device storing the computer program product of claim 30.

32. Transmission of the computer program product of claim 30 over a local or wide area telecommunications network.

Pinterest Ex. 1004 Page 166 of 371

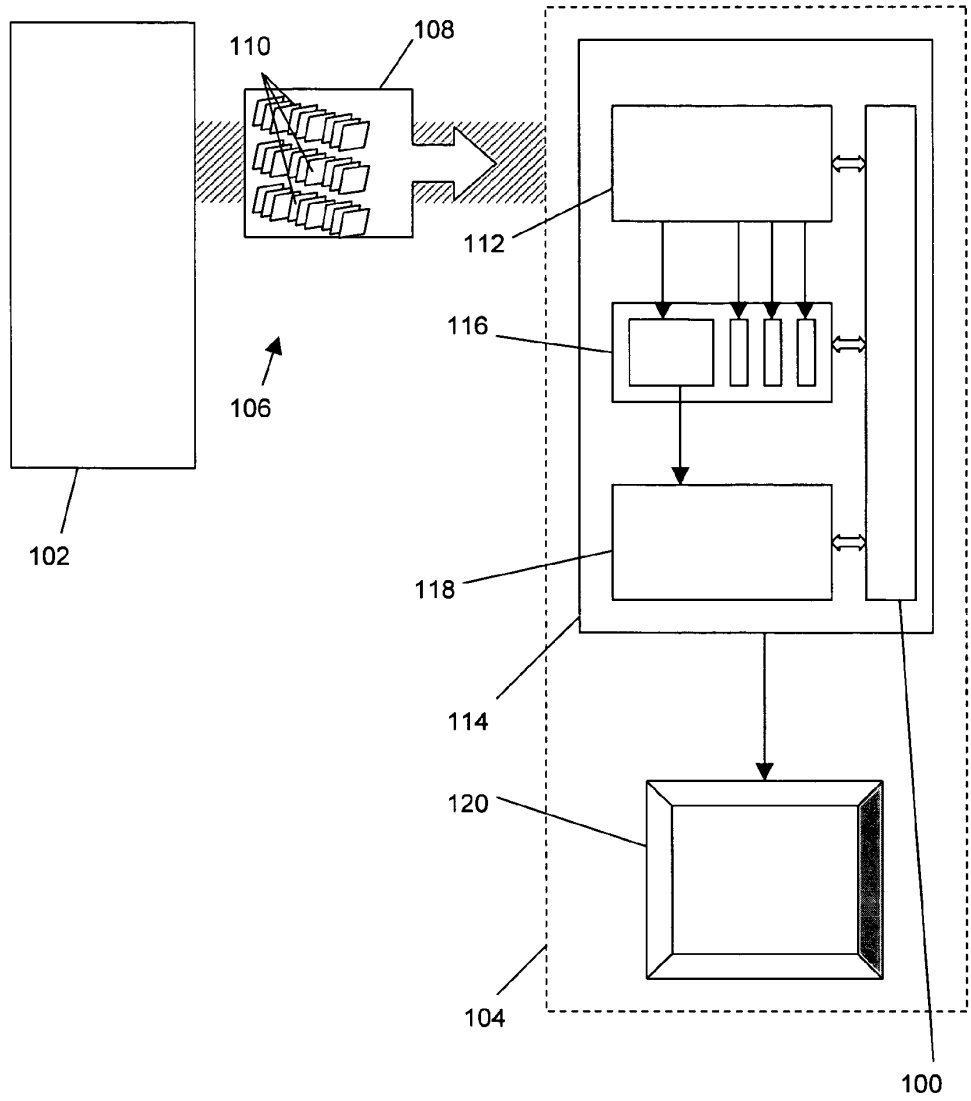


Fig. 1

Pinterest Ex. 1004 Page 167 of 371

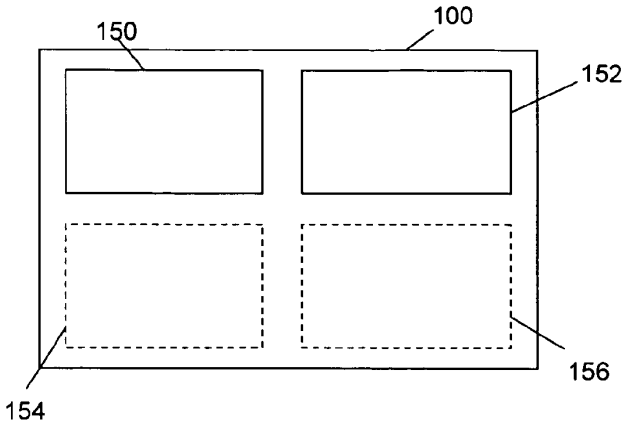


Fig. 2

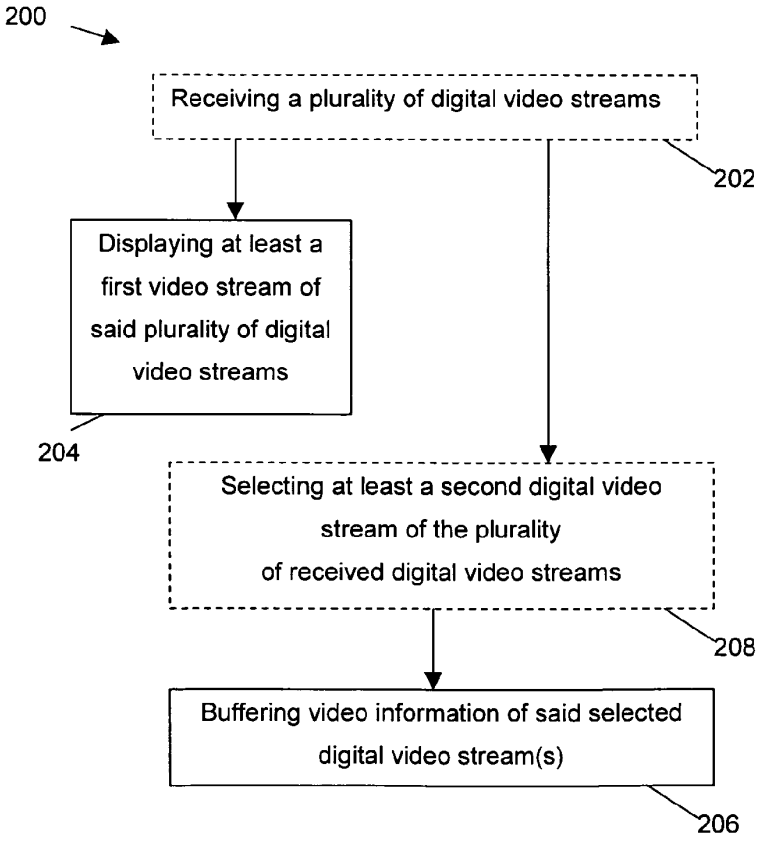


Fig. 3

Pinterest Ex. 1004 Page 168 of 371

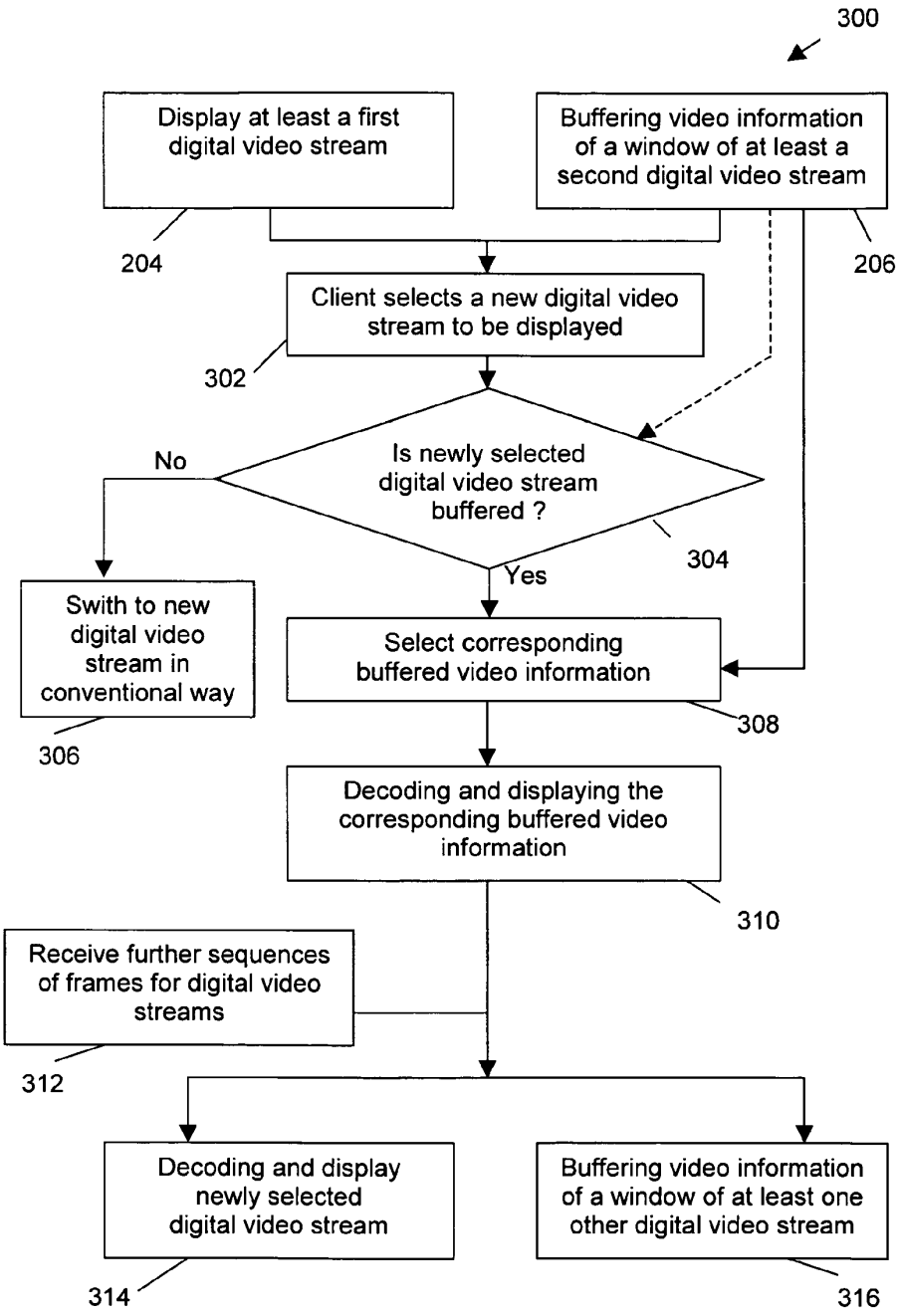


Fig. 4

Pinterest Ex. 1004 Page 169 of 371

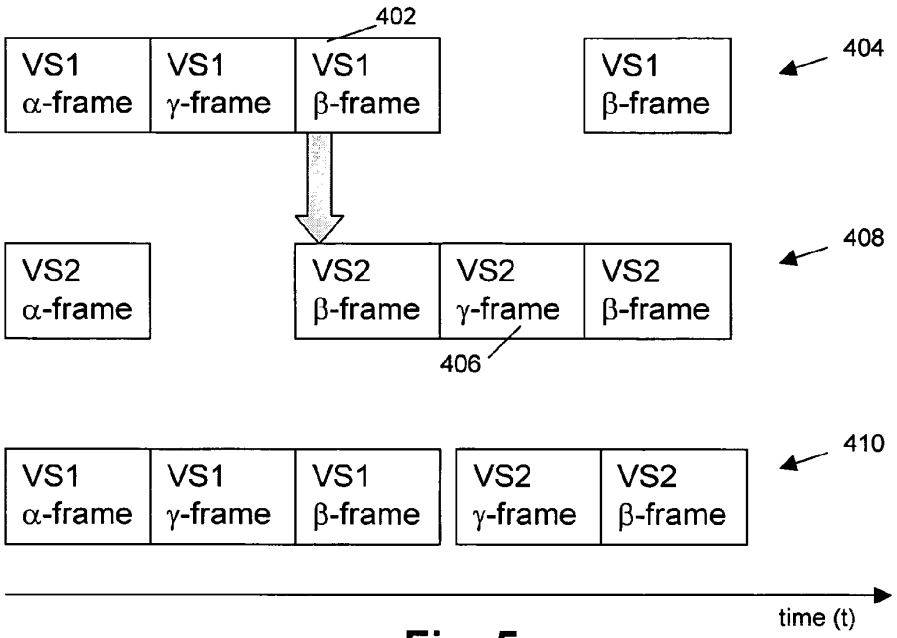


Fig. 5

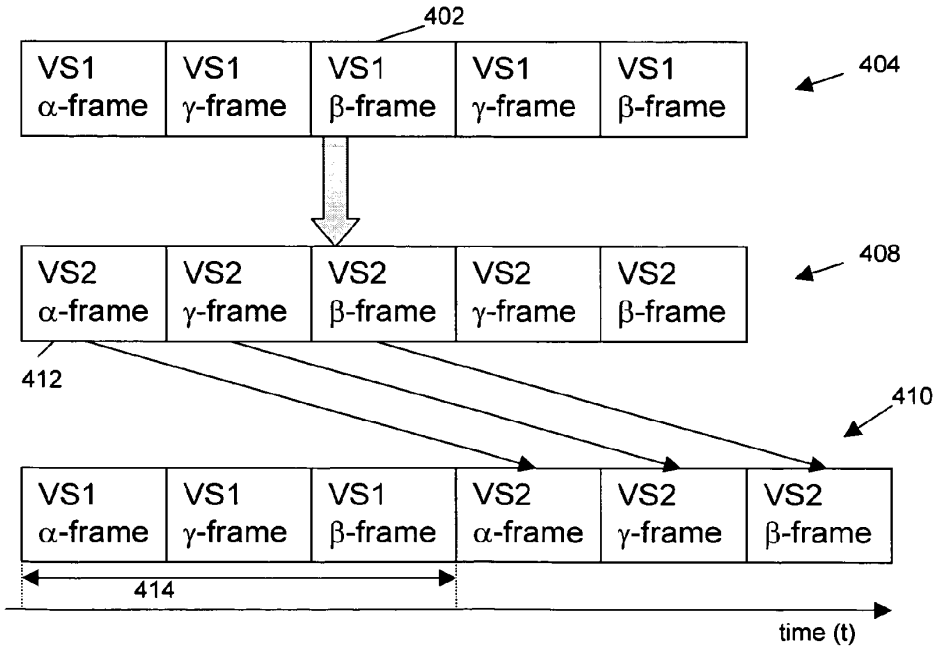


Fig. 6

Pinterest Ex. 1004 Page 170 of 371

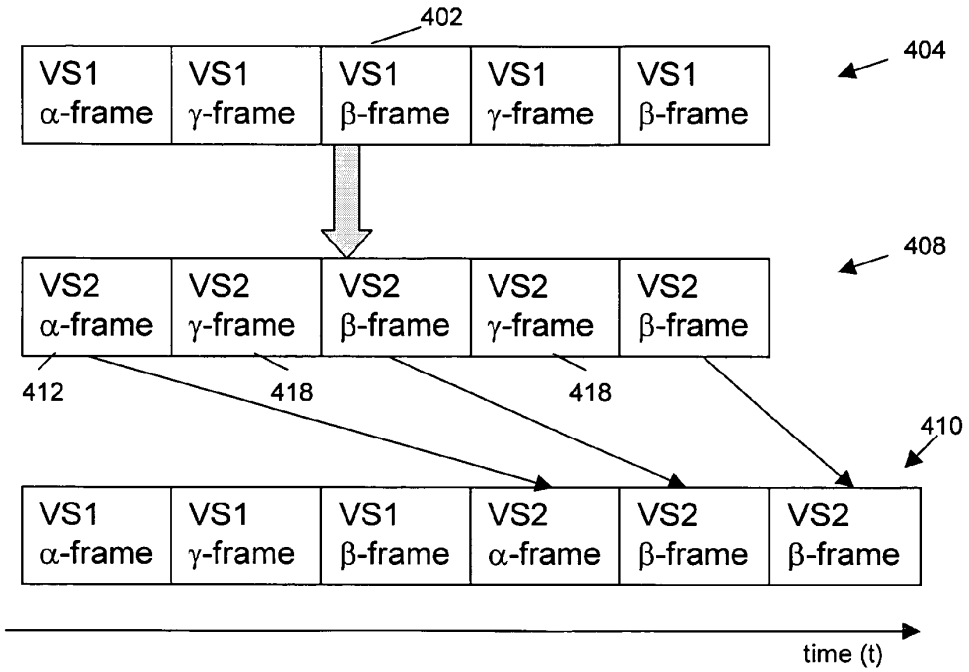


Fig. 7

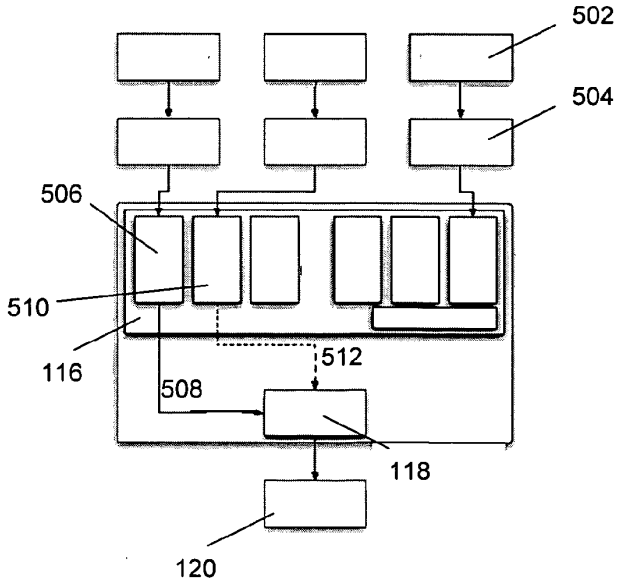


Fig. 8

Pinterest Ex. 1004 Page 171 of 371

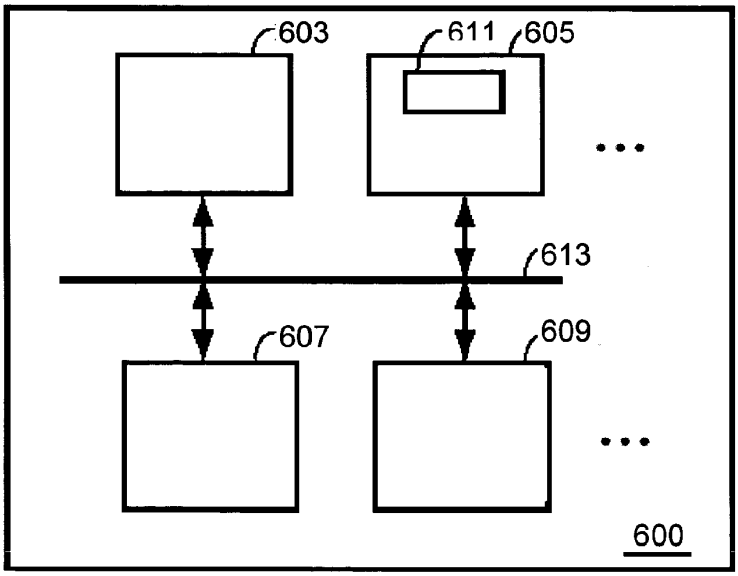


Fig. 9

Pinterest Ex. 1004 Page 172 of 371

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 2486

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 591 013 B1 (TAUNTON MARK) 8 July 2003 (2003-07-08) * the whole document * -----	1-3, 6-10,12, 14-16, 18-32	H04N7/24 H04N5/00 H04N5/44 H04N5/50
X	EP 1 185 087 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 6 March 2002 (2002-03-06) * paragraph [0008] - paragraph [0048] * -----	1-4, 6-10,12, 15,16, 18-22, 24-27, 29-32	
X	US 6 118 498 A (REITMEIER ET AL) 12 September 2000 (2000-09-12) * the whole document * -----	1,8-10, 12,14, 15,18, 24,29-32	
X	WO 2004/114667 A (THOMSON LICENSING S.A; BOYCE, JILL, MACDONALD; TOURAPIS, ALEXANDROS, M) 29 December 2004 (2004-12-29) * page 11, line 28 - page 13, line 3; figure 6 * -----	1,11,15, 18,24, 29-32	TECHNICAL FIELDS SEARCHED (IPC) H04N
X	US 2004/111741 A1 (DEPIETRO MARK) 10 June 2004 (2004-06-10) * paragraph [0005] * * paragraphs [0010] - [0023] * * paragraph [0035] - paragraph [0067] * -----	1,13,15, 18, 24-27, 29-32	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 February 2006	McGrath, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Pinterest Ex. 1004 Page 173 of 371

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 02 2486

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-02-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6591013 B1	08-07-2003	WO 0057646 A1	28-09-2000
		GB 2363276 A	12-12-2001
		US 2003194139 A1	16-10-2003
EP 1185087 A	06-03-2002	CN 1349348 A	15-05-2002
		JP 2002125158 A	26-04-2002
		US 6714264 B1	30-03-2004
US 6118498 A	12-09-2000	AU 9588298 A	12-04-1999
		CN 1302506 A	04-07-2001
		EP 1025697 A1	09-08-2000
		JP 2001517904 T	09-10-2001
		WO 9916247 A1	01-04-1999
WO 2004114667 A	29-12-2004	WO 2004114668 A1	29-12-2004
US 2004111741 A1	10-06-2004	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Pinterest Ex. 1004 Page 174 of 371

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2004019530 A **[0005]**
- US 20040194134 A1 **[0006]**
- US 20040181813 A1 **[0006]**

Pinterest Ex. 1004 Page 175 of 371

(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :19/03/2020

(21) Application No.202047011998 A
(43) Publication Date : 15/05/2020

(54) Title of the invention : BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

(51) International classification :H04W 28/02
(31) Priority Document No :201741031917
(32) Priority Date :08/09/2017
(33) Name of priority country :India
(86) International Application No :PCT/US2018/046723
Filing Date :14/08/2018
(87) International Publication No :WO 2019/050660
(61) Patent of Addition to Application Number :NA
Filing Date :NA
(62) Divisional to Application Number :NA
Filing Date :NA

(71)**Name of Applicant :**
1)OPENTV, INC.
Address of Applicant :275 Sacramento Street San Francisco, California 94111 U.S.A.
(72)**Name of Inventor :**
1)GOGOI, Amarendra N.
2)GUPTA, Sanjay Kumar
3)SWAMI, Ravikant

(57) Abstract :
Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

No. of Pages : 22 No. of Claims : 15

Pinterest Ex. 1004 Page 176 of 371

PATENT COOPERATION TREATY

From the INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
MONIQUE M. PERDOK
SCHWEGMAN Lundberg & Woessner, P.A.
P.O. BOX 2938
Minneapolis, Minnesota 55402 USA

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (CHAPTER II OF THE PATENT COOPERATION TREATY)

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	01 APR 2020
Applicant's or agent's file reference	IMPORTANT NOTIFICATION
2050.354WO1	

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2018/046723	14 August 2018 (14.08.2018)	08 September 2017 (08.09.2017)

Applicant: **OPENTV, INC.**

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the *PCT Applicant's Guide*.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the IPEA/US	Authorized officer
COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: IPEA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA	KIM NGUYEN
Facsimile No. (571)273-8300	Telephone No. (571)272-4441

Form PCT/IPEA/416 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference **2050.354WO1**	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. **PCT/US2018/046723**	International filing date *(day/month/year)* **14 August 2018 (14.08.2018)**	Priority date *(day/month/year)* **08 September 2017 (08.09.2017)**

International Patent Classification (IPC) or both national classification and IPC
IPC: H04W 28/02
CPC: H04W 28/02, 12/06, 28/10; H04N 19/463, 19/30

Applicant **OPENTV, INC.**

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 14 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
      ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4*bis*, 70.2(e), 70.16 and 91.2).
      ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____ containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*ter* of Annex C of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☑ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☑ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20 December 2018 (20.12.2018)	**18 March 2020 (18.03.2020)**
Name and mailing address of the IPEA/US **COMMISSIONER FOR PATENTS MAIL STOP PCT, ATTN: IPEA/US P.O. BOX 1450 ALEXANDRIA, VA 22313-1450, UNITED STATES OF AMERICA** Facsimile No. **(571)273-8300**	Authorized officer **KIM NGUYEN** Telephone No. **(571)272-4441**

Form PCT/IPEA/409 (cover sheet) (January 2015)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2018/046723

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:
   - [x] the international application in the language in which it was filed.
   - [ ] a translation of the international application into _____ which is the language of a translation furnished for the purposes of:
     - [ ] international search (Rules 12.3(a) and 23.1(b))
     - [ ] publication of the international application (Rule 12.4(a))
     - [ ] international preliminary examination (Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
   - [ ] the international application as originally filed/furnished, or
   - [x] the description:
     pages **1-21** as originally filed/furnished.
     pages* _____ received by this Authority on _____
     pages* _____ received by this Authority on _____
   - [x] the claims:
     Nos. _____ as originally filed/furnished.
     Nos.* _____ as amended (together with any statement) under Article 19
     Nos.* **1-20** received by this Authority on **20 December 2018 (20.12.2018)**
   - [x] the drawings:
     pages **1/5-5/5** as originally filed/furnished.
     pages* _____ received by this Authority on _____
     pages* _____ received by this Authority on _____
   - [ ] a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages _____
   - [ ] the claims, Nos. _____
   - [ ] the drawings, sheets/figs _____
   - [ ] the sequence listing *(specify)*: _____
4. [ ] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-*bis*)):
   - [ ] the description, pages _____
   - [ ] the claims, Nos. _____
   - [ ] the drawings, sheets/figs _____
   - [ ] the sequence listing *(specify)*: _____
5. [ ] This report has been established:
   - [ ] taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-*bis*) and 70.2(e)).
   - [ ] without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.4*bis* and 70.2(e)).
6. With regard to top-up searches (Rules 66.1*ter* and 70.2(f)):
   - [x] A top-up search was carried out by this Authority on **18 March 2020 (18.03.2020)**
     - [ ] Additional relevant documents have been discovered during the top-up search.
   - [ ] No top-up search was carried out by this Authority because it would serve no useful purpose.
7. [ ] Supplementary international search report(s) from Authority(ies) _____ has/ have been received and taken into account in establishing this report (Rule 45*bis*.8(b) and (c)).

** If item 4 applies, some or all of those sheets may be marked "superseded."*

Form PCT/IPEA/409 (Box No. I) (January 2015)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2018/046723

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims		NO
Inventive step (IS)	Claims	1-20	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

---------- **EXPLANATION** ----------

Claims 1-20 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a method as recited in the context of claim 1, and similarly recited in the context of claim 6 or 11.

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	41259270
Application Number:	16645598
International Application Number:	
Confirmation Number:	7292
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Customer Number:	44367
Filer:	Garrett M. Hall/Clayton Finn
Filer Authorized By:	Garrett M. Hall
Attorney Docket Number:	2050.354US1
Receipt Date:	01-DEC-2020
Filing Date:	09-MAR-2020
Time Stamp:	13:16:39
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	16645598_IDS_11-27-2020.pdf	636121 6ad66a403d78371985e34692c88c1a897fd1380f	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.					
2	Foreign Reference	0001_1_for_cn111194565a_f.pdf	1411706 7e65db62e0e4b1c9cd649e92e229e433973a5b0	no	21
Warnings:					
Information:					
3	Foreign Reference	0002_1_for_ep3050307b1_f.pdf	637960 ecc88474950fe8204ba9b47071e861309b4bdc8e	no	23
Warnings:					
Information:					
4	Foreign Reference	0003_1_for_ep_1775953_a1_f.pdf	345229 4539609b5955ebfdde5e8c8b334dacf44b354b4b	no	25
Warnings:					
Information:					
5	Foreign Reference	0004_1_for_in202047011998a_f.pdf	112088 66c9b0b5970465e7548eeabadca8933036c796fb	no	1
Warnings:					
Information:					
6	Non Patent Literature	0005_2_npl_2050354ep1_eesr_09292020_f.pdf	355613 e0121ef8a56264e7da0a5fadac90cde75fb9b936	no	9
Warnings:					
Information:					
7	Non Patent Literature	0006_2_npl_2050354wo1_pctib326_04012020_f.pdf	244805 becd72cd071dcde3640abb33453c42f214de121c	no	4
Warnings:					
Information:					

8	Non Patent Literature	0007_2_npl_a_novel_multichannel_streaming_scheme_to_reduce_ch_f.pdf	1396469 6e3a8e8999584eba25f1be66e5b6a838d6030c86	no	10
Warnings:					
Information:					
9	Non Patent Literature	0008_2_npl_intelligent_prefetching_to_reduce_channel_switchi_f.pdf	557656 8ae68b3217c032af3a5230d19e0b0c180b5b43e6	no	6
Warnings:					
Information:					
		Total Files Size (in bytes):	5697647		

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/645,598	03/09/2020	Amarendra N. Gogoi	2050.354US1

CONFIRMATION NO. 7292

44367
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

PUBLICATION NOTICE

OC000000119369693

Title:BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Publication No.US-2020-0267428-A1
Publication Date:08/20/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
16645598	

Applicant(s) Amarendra Gogoi

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1			1			
2				1		
3				1		
4				1		
5				1		
6			1			
7				1		
8				1		
9				1		
10			1			
11				1		
12				1		
13				1		
14				1		
15				1		
16				1		
17				1		
18				1		
19				1		
20				1		
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
Total Indep	0		3		0	
Total Depend	0	↵	17	↵	0	↵
Total Claims	0		20		0	

	*		*		*	
	Indep	Depend	Indep	Depend	Indep	Depend
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/645,598	03/09/2020		1200	2050.354US1	20	3

CONFIRMATION NO. 7292

44367
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

FILING RECEIPT

OC000000118362644

Date Mailed: 05/14/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Amarendra N. Gogoi, Fremont, CA;
Sanjay Gupta, Bangalore, INDIA;
Ravikant Swami, Bangalore, INDIA;

Applicant(s)

OpenTV, Inc., San Francisco, CA;

Power of Attorney: The patent practitioners associated with Customer Number 44367

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US2018/046723 08/14/2018

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
INDIA 201741031917 09/08/2017

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/12/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/645,598**

Projected Publication Date: 08/20/2020

Non-Publication Request: No

Early Publication Request: No
Title

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

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

U.S. APPLICATION NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
16/645,598	Amarendra N. Gogoi	2050.354US1

44367
SCHWEGMAN LUNDBERG & WOESSNER/OPEN TV
P.O. BOX 2938
MINNEAPOLIS, MN 55402-0938

INTERNATIONAL APPLICATION NO.	
PCT/US2018/046723	
I.A. FILING DATE	PRIORITY DATE
08/14/2018	09/08/2017

CONFIRMATION NO. 7292
371 ACCEPTANCE LETTER

OC000000116962645

Date Mailed: 05/14/2020

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

03/09/2020
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Copy of the International Application filed on 03/09/2020
- Copy of the International Search Report filed on 03/09/2020
- Preliminary Amendments filed on 03/09/2020
- Information Disclosure Statements filed on 03/09/2020
- Inventor's Oath or Declaration filed on 03/09/2020
- U.S. Basic National Fees filed on 03/09/2020
- Authorize Access to Search Results filed on 03/09/2020
- Priority Documents filed on 03/09/2020
- Power of Attorney filed on 03/09/2020
- Authorization to Permit Access filed on 03/09/2020
- Application Data Sheet (37 CFR 1.76) filed on 03/09/2020

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

CELESTINE K MILLER-DUCKETT

Telephone: (703) 756-1033

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/645,598

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	140
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1200

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

CLAIMS

What is claimed is:

1. A method comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

2. The method of claim 1, further comprising:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

3. The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

4. The method of claim 3, further comprising preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

5. The method of claim 3, further comprising:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 192 of 371

6. A system comprising:

one or more hardware processors; and

a storage device storing instructions that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

7. The system of claim 6, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

8. The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

9. The system of claim 8, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

10. The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 193 of 371

11. A machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

12. The machine-readable medium of claim 11, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

13. The machine-readable medium of claim 12, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

14. The machine-readable medium of claim 13, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

15. The machine-readable medium of claim 13, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

Pinterest Ex. 1004 Page 194 of 371

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 195 of 371

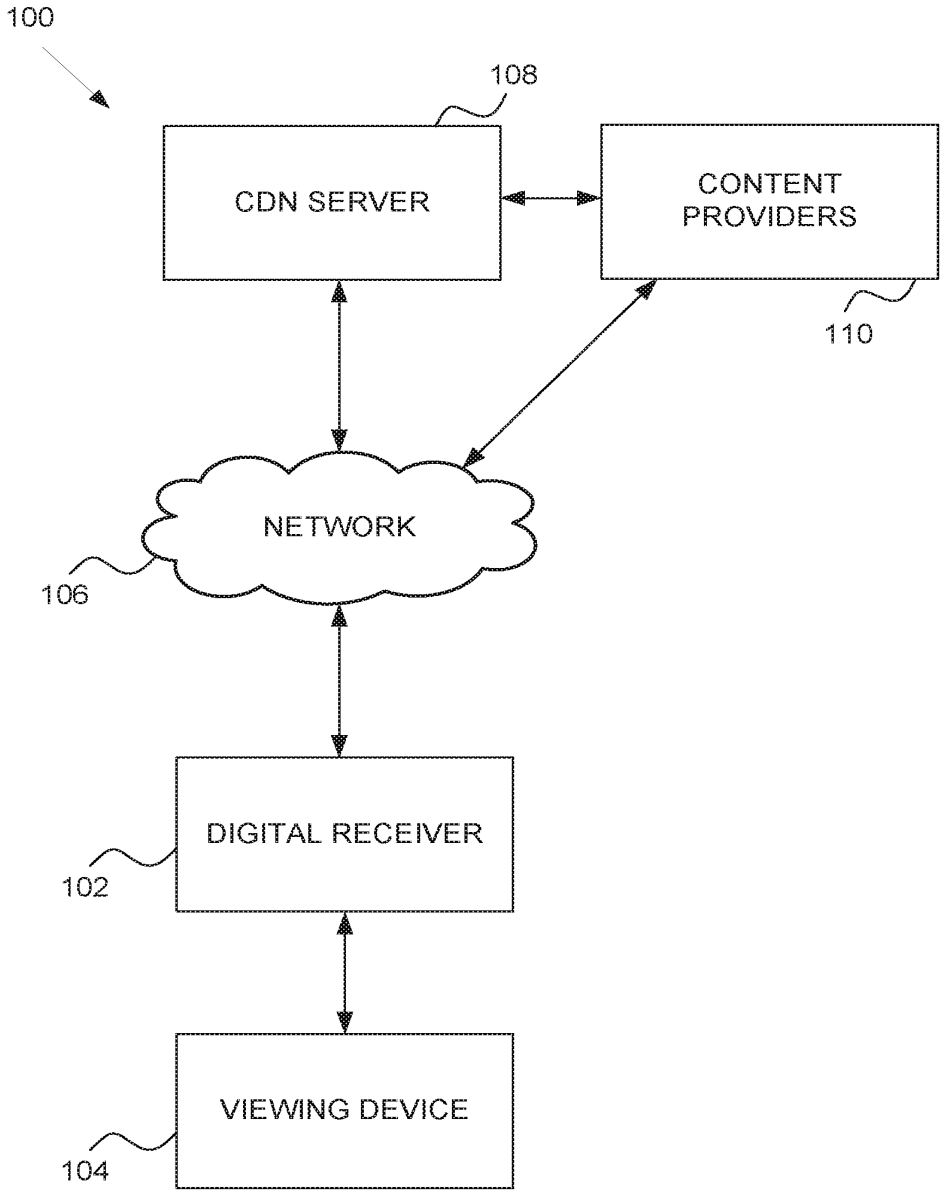

100
108
CDN SERVER
CONTENT PROVIDERS
110
NETWORK
106
DIGITAL RECEIVER
102
VIEWING DEVICE
104

FIG. 1

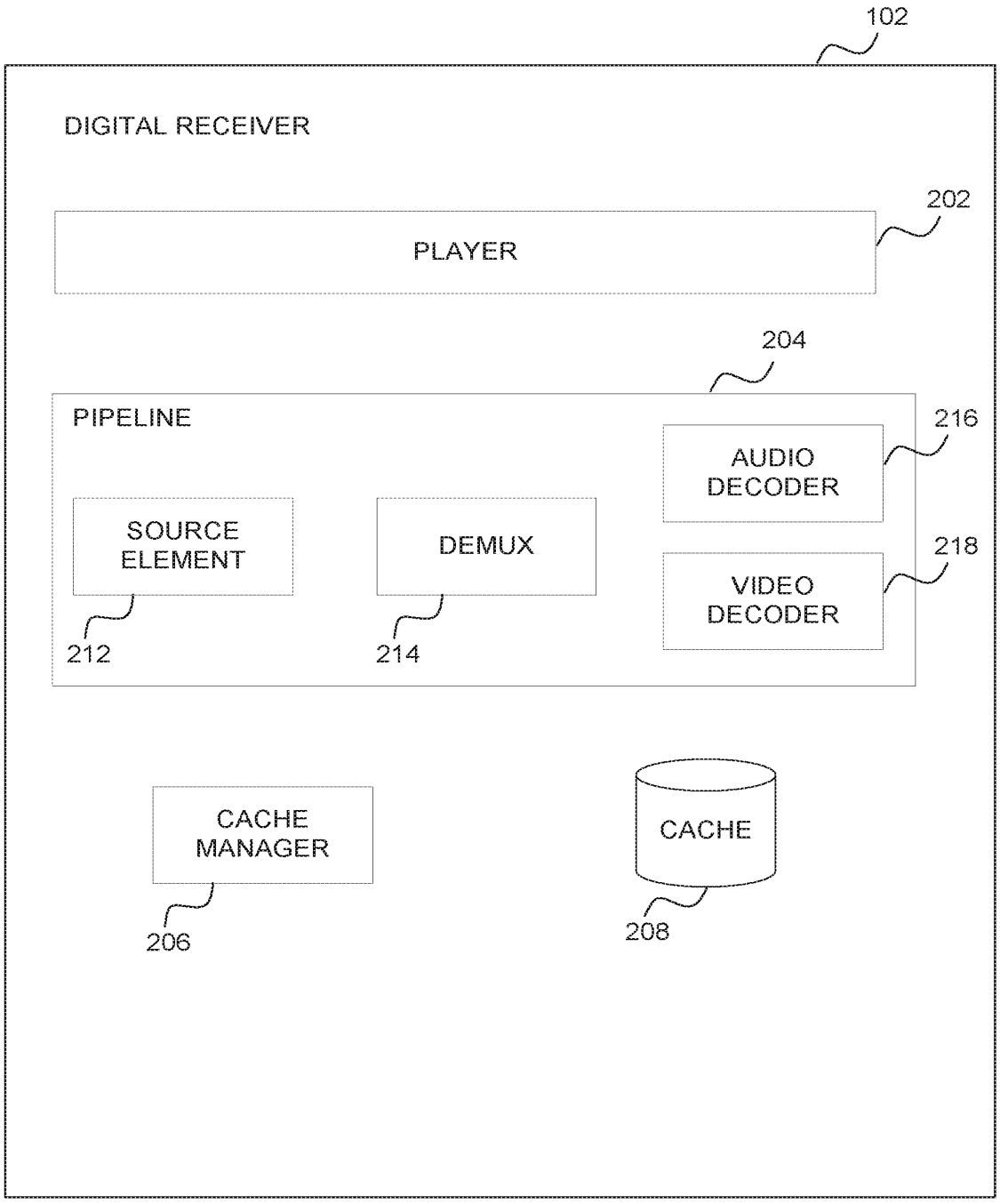

102
DIGITAL RECEIVER
202
PLAYER
204
PIPELINE
216
AUDIO DECODER
218
VIDEO DECODER
SOURCE ELEMENT
212
DEMUX
214
CACHE MANAGER
206
CACHE
208

FIG. 2

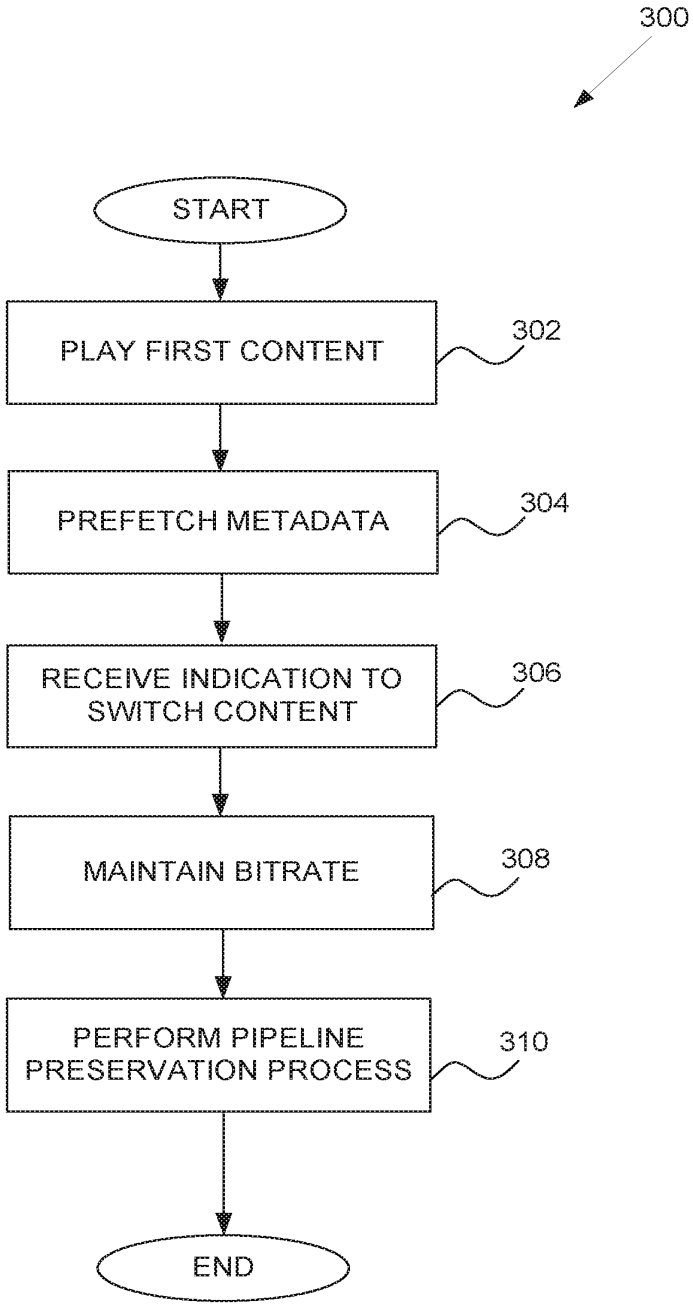

300
START
PLAY FIRST CONTENT
302
PREFETCH METADATA
304
RECEIVE INDICATION TO SWITCH CONTENT
306
MAINTAIN BITRATE
308
PERFORM PIPELINE PRESERVATION PROCESS
310
END

FIG. 3

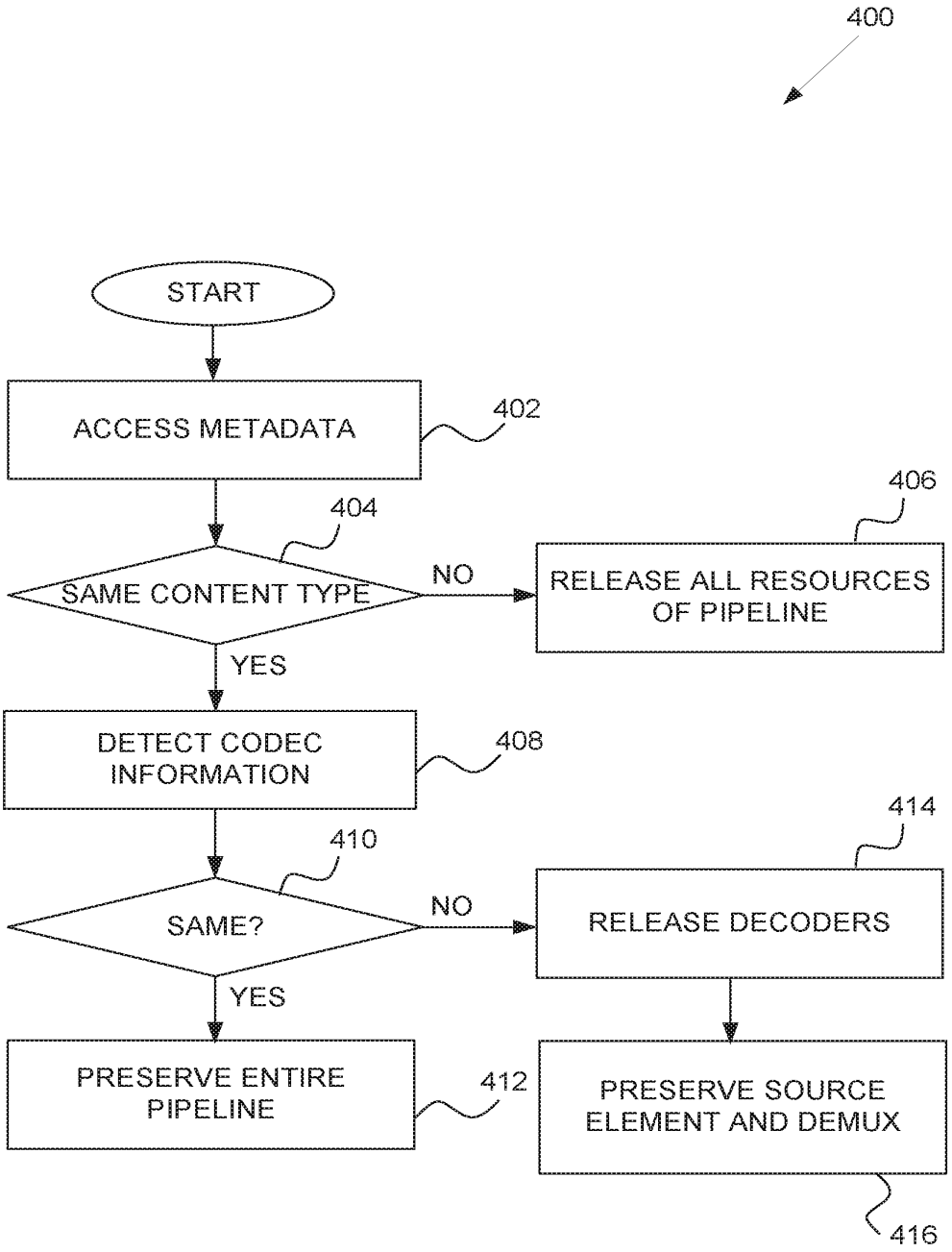

400
START
ACCESS METADATA
402
404
SAME CONTENT TYPE
NO
406
RELEASE ALL RESOURCES OF PIPELINE
YES
DETECT CODEC INFORMATION
408
410
SAME?
NO
414
RELEASE DECODERS
YES
PRESERVE ENTIRE PIPELINE
412
PRESERVE SOURCE ELEMENT AND DEMUX
416

FIG. 4

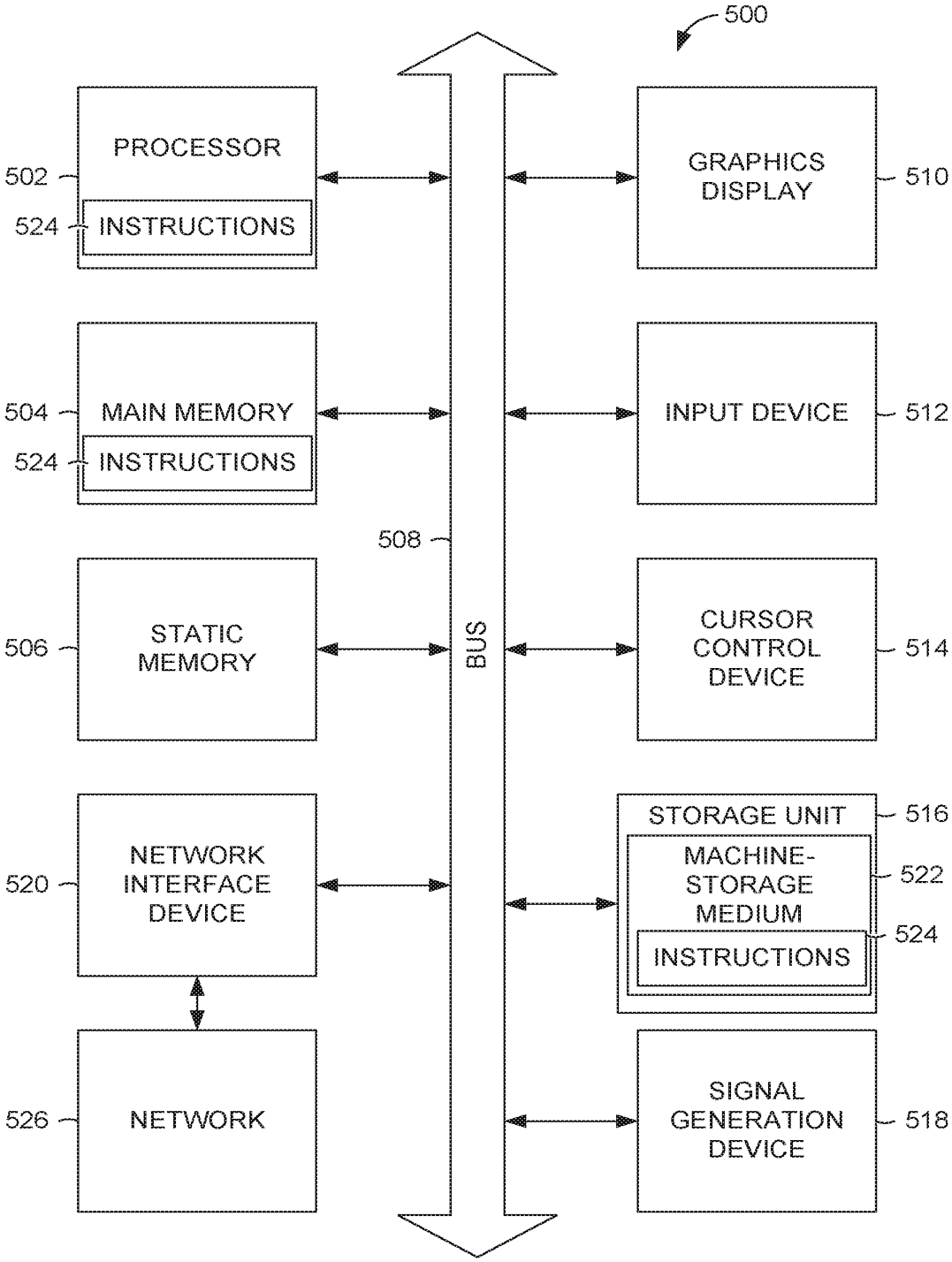

500
PROCESSOR
502
524
INSTRUCTIONS
MAIN MEMORY
504
524
INSTRUCTIONS
508
STATIC MEMORY
506
BUS
NETWORK INTERFACE DEVICE
520
NETWORK
526
GRAPHICS DISPLAY
510
INPUT DEVICE
512
CURSOR CONTROL DEVICE
514
STORAGE UNIT
516
MACHINE-STORAGE MEDIUM
522
524
INSTRUCTIONS
SIGNAL GENERATION DEVICE
518

FIG. 5

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

CLAIM OF PRIORITY

[0001] This application claims priority to India Application Serial No. 201741031917, filed on September 8, 2017, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure generally relates to machines configured to the technical field of special-purpose machines that optimizes a content change process (e.g., channel change) including computerized variants of such special-purpose machines and improvements to such variants, and to the technologies by which such special-purpose machines become improved compared to other special-purpose machines that facilitate optimizing content changes. In particular, the present disclosure addresses systems and methods for preserving a download bitrate and a content playback pipeline during a content change process.

BACKGROUND

[0003] Conventionally, during a switch in content (e.g., caused by a channel change or a selection of a different piece of content), a delay occurs as certain information is obtained before the new piece of content (e.g., program, movie, show) is rendered and displayed. Additionally, for adaptive bitrate streaming content, the content typically starts streaming or download at a low (or lowest) bitrate before slowly increasing in bitrate until an optimum bitrate is achieved. This results in initial video or images being grainy. Furthermore, the delay may be increased by a need to build a content playback pipeline each time a change in content occurs.

Pinterest Ex. 1004 Page 201 of 371

BRIEF DESCRIPTION OF DRAWINGS

[0004] Various ones of the appended drawings merely illustrate example embodiments of the present invention and cannot be considered as limiting its scope.

[0005] FIG. 1 is a diagram illustrating an example environment for optimizing content changes;

[0006] FIG. 2 is a block diagram illustrating an example embodiment of components within a digital receiver in accordance with an example embodiment.

[0007] FIG. 3 is a flow diagram of a method for optimizing a content change process in accordance with example embodiments.

[0008] FIG. 4 is a flow diagram of a method for preserving a content delivery pipeline in accordance with example embodiments.

[0009] FIG. 5 is a diagrammatic representation of a machine in an example form of a computing system within which a set of instructions may be executed for causing the machine to perform any one or more of the methodologies discussed herein, according to an example embodiment.

Pinterest Ex. 1004 Page 202 of 371

DETAILED DESCRIPTION

[0010] The description that follows includes systems, methods, techniques, instruction sequences, and computing machine program products that embody illustrative embodiments of the present inventive subject matter. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide an understanding of various embodiments of the inventive subject matter. It will be evident, however, to those skilled in the art, that embodiments of the inventive subject matter may be practiced without some or other of these specific details. In general, well-known instruction instances, protocols, structures, and techniques have not been shown in detail. Examples merely typify possible variations. Unless explicitly stated otherwise, structures (e.g., structural components, such as modules) are optional and may be combined or subdivided, and operations (e.g., in a procedure, algorithm, or other function) may vary in sequence or be combined or subdivided.

[0011] Example embodiments described herein provide systems and methods for optimizing content changes or switch in content being viewed, such as through a channel change or selection of a different piece of content from a watchlist. In some embodiments, the system uses navigational context (e.g., the way a user is interacting with an application) to identify content of (potential) interest to a viewer. The system then prefetches metadata for the content of interest from a content provider and stores the metadata to local cache. The metadata comprises preconditions for rendering and display of a piece of content that include a minimum set of data that a system can obtain without having to decrypt the content. The prefetched metadata may be used, in example embodiments, to determine whether to preserve at least a portion of a content playback pipeline (also referred to herein as a "content deliver pipeline" or simply a "pipeline").

[0012] Conventionally, a same piece of content is broken up into segments (e.g., 10 second segments) and each segment is available in various bitrates. A low bitrate may be grainy, while a high bitrate will normally have better image quality. Typically, when playback of a new piece of content starts, the system does not know the quality of the network bandwidth. As a result, in order to start playback as quickly as possible, conventional systems start with a lowest bitrate. Thus, every time a user switches from one content to the next content, the playback will start with the lowest bitrate and slowly increase or improve according the capability of the network. In contrast, example

Pinterest Ex. 1004 Page 203 of 371

embodiments, preserve a previous bitrate when switching to a new piece of content. That is, when a user selects a new piece of content to playback (e.g., switching from a previous piece of content to the new piece of content), example embodiments maintain or preserve a (heuristically determined) bitrate used for streaming or downloading the previous piece of content when initiating the playback of the new piece of content. This allows for starting playback as quickly as possible while also providing better image quality from the start.

[0013] Furthermore, in conventional systems, a switch or transition in content typically causes a previous content delivery pipeline to be deconstructed (e.g., resources previous acquired are released). Subsequently, a new pipeline is created for the new piece of content (e.g., new resources are acquired). In contrast, example embodiments may maintain or preserve a portion (or an entire) content delivery pipeline (e.g., comprising a source element, a demultiplexer ("demux"), a video decoder, and an audio decoder) used to obtain the previous piece of content instead of reconstructing a pipeline (e.g., destroying the content delivery pipeline and building a new content delivery pipeline). The preservation of the pipeline also allows for playback of the new content as quickly as possible.

[0014] As a result, one or more of the methodologies described herein facilitate solving the technical problem of optimizing content change (e.g., reducing time for a change in channel or loading of new content) regardless of the delivery channel - whether the content is broadcast (e.g., IPTV and multicast) or over-the-top (OTT). The methodologies include causing playback, by a digital receiver, of a first piece of content and receiving a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content. The methodologies further include determining whether to preserve at least a portion of a playback pipeline when switching to playback of the new piece of content. In some embodiments, preservation of at least a portion of the playback pipeline comprises determining whether to retrain an audio decoder and a video decoder of the pipeline when switching to playback of the new piece of content. Accordingly, one or more of the methodologies discussed herein improves upon latency during content changes while maintaining image quality. It is noted that content changes include a selection of a piece of content for viewing (e.g., from a content access

Pinterest Ex. 1004 Page 204 of 371

page such as a favorites grid or via a programming guide) as well as channel changes (e.g., linear channels changes).

[0015] With reference to FIG. 1, an embodiment of an example environment 100 that enables optimizing content changes (e.g., reducing latency during channel changes or selection of a piece of content for viewing) is shown. In example embodiments, a digital receiver 102 of a user provides access to digital content and manages content change operations. In one embodiment, the digital receiver 102 is a set-top box. The digital receiver 102 is coupled to a viewing device 104 (e.g., a television or monitor) on which the user can view the digital content. In some embodiments, the digital receiver 102 (e.g., operations of the digital receiver 102) may be combined with the viewing device 104 (e.g., a smart television, a tablet, or smartphone). The components of the digital receiver 102 used to perform operations of example embodiments will be discussed in more detail in connection with FIG. 2 below.

[0016] In some embodiments, the digital receiver 102 accesses (e.g., pulls, receives, retrieves) content via a network 106 from a content distribution network (CDN) server 108. The CDN server 108 may obtain the content from one or more content providers 110 (e.g., servers of the content providers 110). In example embodiments, the CDN server 108 may be associated with a third party service (e.g., Netflix, Hulu, YouTube, Amazon,) that stores and provides content, such as, for example but not limited to, over-the-top (OTT) content, video-on-demand (VOD) content, Internet content, or broadcast content to the digital receiver 102 via the network 106. The content comprises text, images, audio, and/or video content (e.g., movies, television shows, videos), and in some embodiments comprise live (e.g., in real-time) content. In some embodiments, the content providers 110 provide content, over the network 106 directly to the digital receiver 102 for display on the viewing device 104.

[0017] One or more portions of the network 106 may be an ad hoc network, an intranet, an extranet, a virtual private network (VPN), a local area network (LAN), a wireless LAN (WLAN), a wide area network (WAN), a wireless WAN (WWAN), a metropolitan area network (MAN), a portion of the Internet, a portion of the Public Switched Telephone Network (PSTN), a cellular telephone network, a wireless network, a WiFi network, a WiMax network, a satellite network, a cable network, a broadcast network, another type of network, or a combination of two or more such networks. Any one or more portions of the network 106 may communicate information via a

Pinterest Ex. 1004 Page 205 of 371

transmission or signal medium. As used herein, "transmission medium" refers to any intangible (e.g., transitory) medium that is capable of communicating (e.g., transmitting) instructions for execution by a machine (e.g., by one or more processors of such a machine), and includes digital or analog communication signals or other intangible media to facilitate communication of such software.

[0018] It is noted that the environment 100 shown in FIG. 1 is merely an example. For instance, any number of CDN servers 108 and content providers 110 may be embodied within the environment 100. Additionally, some components of the environment 100 may be combined. For example, the functions of the digital receiver 102 may be embodied within the viewing device 104 to form a single device, such as a smart television, tablet, smartphone, or any other device that is capable of obtaining, rendering, and displaying content. Moreover, the functions described herein for any single system or machine may be subdivided among multiple systems or machines.

[0019] Any of the systems or machines (e.g., databases, devices, servers) shown in, or associated with, FIG. 1 may be, include, or otherwise be implemented in a special-purpose (e.g., specialized or otherwise non-generic) computer that has been modified (e.g., configured or programmed by software, such as one or more software modules of an application, operating system, firmware, middleware, or other program) to perform one or more of the functions described herein for that system or machine. For example, a special-purpose computer system able to implement any one or more of the methodologies described herein is discussed below with respect to FIG. 5, and such a special-purpose computer may accordingly be a means for performing any one or more of the methodologies discussed herein. Within the technical field of such special-purpose computers, a special-purpose computer that has been modified by the structures discussed herein to perform the functions discussed herein is technically improved compared to other special-purpose computers that lack the structures discussed herein or are otherwise unable to perform the functions discussed herein. Accordingly, a special-purpose machine configured according to the systems and methods discussed herein provides an improvement to the technology of similar special-purpose machines.

[0020] FIG. 2 is a block diagram illustrating an example embodiment of components within the digital receiver 102 in accordance with an example embodiment. In example embodiments, the digital receiver 102 manages access to content streamed over the network 106. In particular, the digital receiver 102 prefetches metadata, preserves a

Pinterest Ex. 1004 Page 206 of 371

bitrate used for playback (e.g., streaming or downloading) of a previous piece of content when initiating the playback of a new piece of content, and preserves at least a portion of a content delivery pipeline. To enable these operations, the digital receiver 102 comprises a player 202, a content delivery pipeline 204 (also referred to as "pipeline"), a cache manager 206, and a cache 208, all of which may be configured to communicate with each other (e.g., over a bus, shared memory, or a switch). The digital receiver 102 comprises other components (not shown) that are not pertinent to operations of example embodiments.

[0021] The player 202 is configured to manage the pipeline 204. In example embodiments, the player 204 instantiates (e.g., constructs) the pipeline 204 when a first piece of content is selected for display. A different pipeline may be constructed for each type of content. For example, the player 202 constructs a HTTP Live Streaming (HLS) pipeline for HLS content and constructs a Dynamic Adaptive Streaming over HTTP (DASH) pipeline for DASH content. The player 204 also decides whether to maintain at least a portion of the pipeline 204 or construct a new pipeline when a switch in content occurs (e.g., channel change or selection of new content for viewing). An example method for managing the preservation of the pipeline is discussed in further detail in connection with FIG. 4 below.

[0022] The pipeline 204 is constructed by the player 202 by acquiring appropriate resources for obtaining and processing content data in order to playback selected content. The resources of the pipeline 204 comprise a source element 212, a demultiplexer ("demux") 214, an audio decoder 216, and a video decoder 218. The source element 212 manages the downloading of content data for the selected piece of content. The source element 212 also manages bitrate adaptation at the digital receiver 102. Specifically, the source element 212 remembers a last bitrate that is used for playback of a current/previous piece of content, and continues to use that bitrate for playback of the new content. As such, if the last bitrate is high, the source element 212 will start with the same high bitrate for the new content. If the new content cannot be playback at that bitrate, then the source element 212 will lower the bitrate. For example, if the downloading of the content takes less time than anticipated, there is spare bandwidth and the bitrate can be increased. Conversely, if the download is taking longer than anticipated, then the bitrate is decreased. As such, example embodiments,

Pinterest Ex. 1004 Page 207 of 371

will start the playback of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing).

[0023] The demux demultiplexes the content data obtained from the CDN server 108 or the content provider 110 to obtain an audio signal and a video signal. The audio signal is transmitted to the audio decoder 216 for processing, while the video signal is transmitted to the video decoder 218 for processing. The results from the audio and video decoders 216 and 218 are output (e.g., transmitted) to the viewing device 104 for presentation to the user.

[0024] The cache manager 206 manages the prefetching of metadata for content that may potentially be selected for playback. In some embodiments, the cache manager 206 predicts content the user may be interested in viewing. For example, a user may be navigating a linear list of channels or programs (e.g., an electronic programming guide; "EPG") in a particular direction (e.g., up or down). In this embodiment, the cache manager 206 predicts a next set of content based on the direction of navigation on the linear list. In another example, the user may be viewing a video-on-demand (VoD) catalog or a watchlist of a user. If the user requests information or hovers over a selection for a piece of content, the cache manager 206 uses this as prediction that the piece of content is of interest to the user. Alternatively, the cache manager may consider all (or some) pieces of content in viewable portion of the catalog or watchlist as content of interest. In any of these cases, the cache manager 206 prefetches the metadata for the content of interest, and stores the prefetched data to the cache 208. The metadata may comprise, for example, one or more uniform resource locators (URLs) where the chunks of content are available, URLs for different bit rates, license data (e.g., where to obtain a license from), and codec information. The codec information will be used by the player 202 to determine whether to preserve at least a portion of the pipeline 204, as will be discussed further below. If the user subsequently selects content for which the metadata is already prefetched, then the metadata can be accessed from the cache 208 instead of having to be retrieved over the network 106 from the CDN server 108 or the content provider 110 after selection. This will assist in the reduction of latency in playback.

[0025] Any one or more of the components (e.g., modules, decoders, resources) described herein may be implemented using hardware alone (e.g., one or more processors of a machine) or a combination of hardware and software. For example, any

Pinterest Ex. 1004 Page 208 of 371

component described herein may physically include an arrangement of one or more of the processors or configure a processor (e.g., among one or more processors of a machine) to perform the operations described herein for that module. Accordingly, different components described herein may include and configure different arrangements of the processors at different points in time or a single arrangement of the processors at different points in time. Each component described herein is an example of a means for performing the operations described herein for that component. Moreover, any two or more of these components may be combined into a single component, and the functions described herein for a single component may be subdivided among multiple components. Furthermore, according to various example embodiments, components described herein as being implemented within a single machine, database, or device may be distributed across multiple machines, databases, or devices.

[0026] FIG. 3 is a flow diagram of an example method 300 for optimizing content change in accordance with example embodiments. In example embodiments, the method 300 is performed in part or in whole by components of the digital receiver 102. Accordingly, the method 300 is described by way of example with reference to the digital receiver 102. However, it shall be appreciated that at least some of the operations of the method 300 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 300 is not intended to be limited to the digital receiver 102.

[0027] In operation 302, a first piece of content is caused to be played by the viewing device 104. In example embodiments, the player 202 constructs the pipeline 204 for obtaining and processing the content data for the first piece of content. In particular, the player 202 acquires the source element 212, the demux 214, the audio decoder 216, and the video decoder 218 to form the pipeline 204. The data content is processed by the pipeline 204 and presented on the viewing device 104.

[0028] In operation 304, metadata for a set of one or more content of interest is prefetched. In example embodiments, the cache manager 206 predicts content of interest of a user and prefetches the metadata for the content of interest. The prefetched data is then stored to the cache 208. The metadata may comprise, but is not limited to, one or more URLs where the chunks of content are available, one or more URL for

Pinterest Ex. 1004 Page 209 of 371

different bit rates, license data (e.g., where to obtain a license from), and codec information.

[0029] In operation 306, the player 202 receives an indication to switch to a new piece of content for playback. The indication may be received from a control device of the user (e.g., a remote controller). In some embodiments, the user may scroll through an EPG or be viewing a catalog or watchlist, and selects a new piece of content for viewing.

[0030] In operation 308, the digital receiver 102 maintains the bitrate when switching playback to the new piece of content. In example embodiments, when transitioning playback from an ongoing playback operation to a new playback operation, the source element 212 uses a heuristic bitrate derived for playback of the first piece of content for playback of the new piece of content. Thus, the source element 212 attempts to maintain or preserve the bitrate for playback as opposed to starting a new playback from the lowest possible bitrate. If the new piece of content cannot be delivered at that bitrate, then the source element 212 will lower the bitrate. As such, example embodiments, will start the download of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing). This allows playback of the new content at a most optimal bitrate instantly instead of having to heuristically re-compute the optimal bitrate starting from the lowest possible bitrate. Conventionally, the derivation of the optimal bitrate usually requires downloading several segments or chunks of content data resulting in a gradual improvement of picture quality. However, example embodiments that use the previous derived heuristic bitrate maintain the same level of image quality as that of the previous playback from a very beginning of playback for the new content.

[0031] In operation 310, a pipeline preservation process is performed to determine whether to maintain at least a portion of the pipeline used to playback the first piece of content for use with the playback of the new piece of content. Furthermore, if the pipeline is to be maintained or preserve, a determination is made as to whether all the resources of the pipeline should be preserved or only a portion of the pipeline preserved (e.g., only some of the resources are kept and others are released). The pipeline preservation process will be discussed in more detail in connection with FIG. 4.

[0032] FIG. 4 is a flow diagram of an example method 400 for preserving a content delivery pipeline in accordance with example embodiments. In example embodiments,

Pinterest Ex. 1004 Page 210 of 371

the method 400 is performed in part or in whole by the player 202 with respect the resources of the pipeline 204. Accordingly, the method 400 is described by way of example with reference to the player 202 and the pipeline 204. However, it shall be appreciated that at least some of the operations of the method 400 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 400 is not intended to be limited to the player 202 and the pipeline 204.

[0033] In operation 402, in response to receiving the indication to switch playback to new content, the cache manager 206 accesses the prefetched metadata stored in the cache 208 for the new content. The prefetched metadata for the new content may comprise one or more URLs where the new content is available, one or more URLs for different bit rates associated with the new content, license data for the new content, and codec information for the new content. The prefetched metadata may also indicate whether the new content is of a same type as the first piece of content. For example, the first piece of content and the new content may both be in a HTTP Live Streaming (HLS) format or both be in a Dynamic Adaptive Streaming over HTTP (DASH) format.

[0034] In operation 404, the player 202 determines whether the first piece of content and the new content are of the same content type. If the first piece of content and the new content are not of the same type (e.g., first piece of content is in HLS format and the new content is in DASH format), then the resources of the pipeline 204 (e.g., the source element 212, the demux 214, the audio decoder 216, and the video decoder 218) are released in operation 406. Releasing all the resources of the pipeline 204 essentially deconstructs the pipeline 204. The player 202 them creates a new pipeline by acquiring other resources that are applicable to the content type of the new content.

[0035] If in operation 404 the player 202 determines that the first piece of content and the new content are of the same content type (e.g., both are HLS format), then in operation 408, codec information is detected for the new content. In example embodiments, the player 202 examines the prefetched metadata for the new content for the codec information. The codec information indicates types of decoders needed for the new content.

[0036] In operation 410, a determination is made by the player 202 as to whether the types of decoders needed for the new content is the same as the decoders currently in the pipeline 204 for the first piece of content. If the types of decoders needed is the same,

Pinterest Ex. 1004 Page 211 of 371

then in operation 412 the entire pipeline 204 is preserved. In other words, the resources of the pipeline 204 are maintained and continued to be used to playback the new content.

[0037] However, if in operation 410 the player 202 determines that the new content needs different decoders, then in operation 414, the decoders (e.g., the audio decoder 216 and the video decoder 208) are released. Subsequently in operation 416, a remaining portion of the pipeline 204 (e.g., the source element 212 and the demux 214) are preserved or maintained. In these embodiments, the player 202 acquires a new set of decoders (e.g., a new audio decoder and a new video decoder) applicable to the new content, and adds the new set of decoders to the preserved portion of the pipeline 204.

[0038] While example embodiments are discussed with respect to pipeline and bitrate preservation applicable to both DASH and HLS, example embodiments for preservation of bitrate and the pipeline is applicable for any type of content that is adaptive in nature (e.g., where the content bitrate can change based on bandwidth).

[0039] FIG. 5 is a block diagram illustrating components of a machine 500, according to some example embodiments, able to read instructions 524 from a machine-storage medium 522 (e.g., a non-transitory machine-storage medium, a machine-readable storage medium, a computer-readable storage medium, or any suitable combination thereof) and perform any one or more of the methodologies discussed herein, in whole or in part. Specifically, FIG. 5 shows the machine 500 in the example form of a computer device (e.g., a computer) within which the instructions 524 (e.g., software, a program, an application, an applet, an app, or other executable code) for causing the machine 500 to perform any one or more of the methodologies discussed herein may be executed, in whole or in part.

[0040] For example, the instructions 524 may cause the machine 500 to execute the flow diagrams of FIGs. 3 and 4. The instructions 524 can transform the general, non-programmed machine 500 into a particular machine (e.g., specially configured machine) programmed to carry out the described and illustrated functions in the manner described.

[0041] In alternative embodiments, the machine 500 operates as a standalone device or may be connected (e.g., networked) to other machines. The machine 500 may be a server computer, a client computer, a personal computer (PC), a tablet computer, a laptop computer, a netbook, a set-top box (e.g. STB), a personal digital assistant (PDA),

Pinterest Ex. 1004 Page 212 of 371

a cellular telephone, a smartphone, a web appliance, a network router, a network switch, a network bridge, a power adapter, or any machine 500 capable of executing the instructions 524, sequentially or otherwise, that specify actions to be taken by that machine 500. Further, while only a single machine 500 is illustrated, the term "machine" shall also be taken to include a collection of machines that individually or jointly execute the instructions 524 to perform any one or more of the methodologies discussed herein.

[0042] The machine 500 includes a processor 502 (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), an application specific integrated circuit (ASIC), a radio-frequency integrated circuit (RFIC), or any suitable combination thereof), a main memory 504, and a static memory 506, which are configured to communicate with each other via a bus 508. The processor 502 may contain microcircuits that are configurable, temporarily or permanently, by some or all of the instructions 524 such that the processor 502 is configurable to perform any one or more of the methodologies described herein, in whole or in part. For example, a set of one or more microcircuits of the processor 502 may be configurable to execute one or more modules (e.g., software modules) described herein.

[0043] The machine 500 may further include a graphics display 510 (e.g., a plasma display panel (PDP), a light emitting diode (LED) display, a liquid crystal display (LCD), a projector, a cathode ray tube (CRT), or any other display capable of displaying graphics or video). The machine 500 may also include an alphanumeric input device 512 (e.g., a keyboard or keypad), a cursor control device 514 (e.g., a mouse, a touchpad, a trackball, a joystick, a motion sensor, an eye tracking device, or other pointing instrument), a storage unit 516, a signal generation device 518 (e.g., a sound card, an amplifier, a speaker, a headphone jack, or any suitable combination thereof), and a network interface device 520.

[0044] The storage unit 516 includes the machine-storage medium 522 (e.g., a tangible machine-readable storage medium) on which are stored the instructions 524 embodying any one or more of the methodologies or functions described herein. The instructions 524 may also reside, completely or at least partially, within the main memory 504, within the processor 502 (e.g., within the processor's cache memory), or both, before or during execution thereof by the machine 500. Accordingly, the main

Pinterest Ex. 1004 Page 213 of 371

memory 504 and the processor 502 may be considered machine-storage media 522 (e.g., tangible and non-transitory machine-storage media).

[0045] In some example embodiments, the machine 500 may be a portable computing device and have one or more additional input components (e.g., sensors or gauges). Examples of such input components include an image input component (e.g., one or more cameras), an audio input component (e.g., a microphone), a direction input component (e.g., a compass), a location input component (e.g., a global positioning system (GPS) receiver), an orientation component (e.g., a gyroscope), a motion detection component (e.g., one or more accelerometers), an altitude detection component (e.g., an altimeter), and a gas detection component (e.g., a gas sensor). Inputs harvested by any one or more of these input components may be accessible and available for use by any of the modules described herein.

EXECUTABLE INSTRUCTIONS AND MACHINE-STORAGE MEDIUM

[0046] The various memories (i.e., 504, 506, and/or memory of the processor(s) 502) and/or storage unit 516 may store one or more sets of instructions and data structures (e.g., software) 524 embodying or utilized by any one or more of the methodologies or functions described herein. These instructions, when executed by processor(s) 502 cause various operations to implement the disclosed embodiments.

[0047] As used herein, the terms "machine-storage medium," "device-storage medium," "computer-storage medium" (referred to collectively as "machine-storage medium 522") mean the same thing and may be used interchangeably in this disclosure. The terms refer to a single or multiple storage devices and/or media (e.g., a centralized or distributed database, and/or associated caches and servers) that store executable instructions and/or data, as well as cloud-based storage systems or storage networks that include multiple storage apparatus or devices. The terms shall accordingly be taken to include, but not be limited to, solid-state memories, and optical and magnetic media, including memory internal or external to processors. Specific examples of machine-storage media, computer-storage media, and/or device-storage media 522 include non-volatile memory, including by way of example semiconductor memory devices, e.g., erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), FPGA, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks;

Pinterest Ex. 1004 Page 214 of 371

and CD-ROM and DVD-ROM disks. The terms machine-storage media, computer-storage media, and device-storage media 522 specifically exclude carrier waves, modulated data signals, and other such media, at least some of which are covered under the term "signal medium" discussed below.

SIGNAL MEDIUM

[0048] The term "signal medium" or "transmission medium" shall be taken to include any form of modulated data signal, carrier wave, and so forth. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a matter as to encode information in the signal.

COMPUTER READABLE MEDIUM

[0049] The terms "machine-readable medium," "computer-readable medium" and "device-readable medium" mean the same thing and may be used interchangeably in this disclosure. The terms are defined to include both machine-storage media and signal media. Thus, the terms include both storage devices/media and carrier waves/modulated data signals.

[0050] The instructions 524 may further be transmitted or received over a communications network 526 using a transmission medium via the network interface device 520 and utilizing any one of a number of well-known transfer protocols (e.g., HTTP). Examples of communication networks 526 include a local area network (LAN), a wide area network (WAN), the Internet, mobile telephone networks, plain old telephone service (POTS) networks, and wireless data networks (e.g., WiFi, LTE, and WiMAX networks). The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding, or carrying instructions 524 for execution by the machine 500, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

[0051] Throughout this specification, plural instances may implement components, operations, or structures described as a single instance. Although individual operations of one or more methods are illustrated and described as separate operations, one or more of the individual operations may be performed concurrently, and nothing requires that the operations be performed in the order illustrated. Structures and functionality presented as separate components in example configurations may be implemented as a

Pinterest Ex. 1004 Page 215 of 371

combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements fall within the scope of the subject matter herein.

[0052] Certain embodiments are described herein as including logic or a number of components, modules, or mechanisms. Modules may constitute either software modules (e.g., code embodied on a machine-storage medium 522 or in a transmission signal) or hardware modules. A "hardware module" is a tangible unit capable of performing certain operations and may be configured or arranged in a certain physical manner. In various example embodiments, one or more computer systems (e.g., a standalone computer system, a client computer system, or a server computer system) or one or more hardware modules of a computer system (e.g., a processor 502 or a group of processors 502) may be configured by software (e.g., an application or application portion) as a hardware module that operates to perform certain operations as described herein.

[0053] In some embodiments, a hardware module may be implemented mechanically, electronically, or any suitable combination thereof. For example, a hardware module may include dedicated circuitry or logic that is permanently configured to perform certain operations. For example, a hardware module may be a special-purpose processor, such as a field-programmable gate array (FPGA) or an ASIC. A hardware module may also include programmable logic or circuitry that is temporarily configured by software to perform certain operations. For example, a hardware module may include software encompassed within a general-purpose processor or other programmable processor. It will be appreciated that the decision to implement a hardware module mechanically, in dedicated and permanently configured circuitry, or in temporarily configured circuitry (e.g., configured by software) may be driven by cost and time considerations.

[0054] Accordingly, the phrase "hardware module" should be understood to encompass a tangible entity, be that an entity that is physically constructed, permanently configured (e.g., hardwired), or temporarily configured (e.g., programmed) to operate in a certain manner or to perform certain operations described herein. As used herein, "hardware-implemented module" refers to a hardware module. Considering embodiments in which hardware modules are temporarily configured (e.g.,

Pinterest Ex. 1004 Page 216 of 371

programmed), each of the hardware modules need not be configured or instantiated at any one instance in time. For example, where a hardware module comprises a general-purpose processor configured by software to become a special-purpose processor, the general-purpose processor may be configured as respectively different special-purpose processors (e.g., comprising different hardware modules) at different times. Software may accordingly configure a processor, for example, to constitute a particular hardware module at one instance of time and to constitute a different hardware module at a different instance of time.

[0055] The various operations of example methods described herein may be performed, at least partially, by one or more processors that are temporarily configured (e.g., by software) or permanently configured to perform the relevant operations. Whether temporarily or permanently configured, such processors may constitute processor-implemented modules that operate to perform one or more operations or functions described herein. As used herein, "processor-implemented module" refers to a hardware module implemented using one or more processors.

[0056] Similarly, the methods described herein may be at least partially processor-implemented, a processor being an example of hardware. For example, at least some of the operations of a method may be performed by one or more processors or processor-implemented modules.

EXAMPLES

[0057] Example 1 is a method for optimizing a content change process. The method comprises causing playback, by a digital receiver, of a first piece of content; receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0058] In example 2, the subject matter of example 1 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0059] In example 3, the subject matter of examples 1-2 can optionally include wherein the determining whether to preserve comprises detecting codec information for

Pinterest Ex. 1004 Page 217 of 371

the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0060] In example 4, the subject matter of examples 1-3 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0061] In example 5, the subject matter of examples 1-4 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0062] Example 6 is a system optimizing a content change process. The system includes one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0063] In example 7, the subject matter of example 6 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0064] In example 8, the subject matter of examples 6-7 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0065] In example 9, the subject matter of examples 6-8 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0066] In example 10, the subject matter of examples 6-9 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types

Pinterest Ex. 1004 Page 218 of 371

indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0067] Example 11 is machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0068] In example 12, the subject matter of example 11 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0069] In example 13, the subject matter of examples 11-12 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0070] In example 14, the subject matter of examples 11-13 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0071] In example 15, the subject matter of examples 11-14 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0072] Some portions of the subject matter discussed herein may be presented in terms of algorithms or symbolic representations of operations on data stored as bits or binary digital signals within a machine memory (e.g., a computer memory). Such algorithms or symbolic representations are examples of techniques used by those of ordinary skill in the data processing arts to convey the substance of their work to others skilled in the art. As used herein, an "algorithm" is a self-consistent sequence of operations or similar processing leading to a desired result. In this context, algorithms and operations involve physical manipulation of physical quantities. Typically, but not

Pinterest Ex. 1004 Page 219 of 371

necessarily, such quantities may take the form of electrical, magnetic, or optical signals capable of being stored, accessed, transferred, combined, compared, or otherwise manipulated by a machine. It is convenient at times, principally for reasons of common usage, to refer to such signals using words such as "data," "content," "bits," "values," "elements," "symbols," "characters," "terms," "numbers," "numerals," or the like. These words, however, are merely convenient labels and are to be associated with appropriate physical quantities.

[0073] Unless specifically stated otherwise, discussions herein using words such as "processing," "computing," "calculating," "determining," "presenting," "displaying," or the like may refer to actions or processes of a machine (e.g., a computer) that manipulates or transforms data represented as physical (e.g., electronic, magnetic, or optical) quantities within one or more memories (e.g., volatile memory, non-volatile memory, or any suitable combination thereof), registers, or other machine components that receive, store, transmit, or display information. Furthermore, unless specifically stated otherwise, the terms "a" or "an" are herein used, as is common in patent documents, to include one or more than one instance. Finally, as used herein, the conjunction "or" refers to a non-exclusive "or," unless specifically stated otherwise.

[0074] Although an overview of the inventive subject matter has been described with reference to specific example embodiments, various modifications and changes may be made to these embodiments without departing from the broader scope of embodiments of the present invention. For example, various embodiments or features thereof may be mixed and matched or made optional by a person of ordinary skill in the art. Such embodiments of the inventive subject matter may be referred to herein, individually or collectively, by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept if more than one is, in fact, disclosed.

[0075] The embodiments illustrated herein are believed to be described in sufficient detail to enable those skilled in the art to practice the teachings disclosed. Other embodiments may be used and derived therefrom, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. The Detailed Description, therefore, is not to be taken in a limiting sense, and the scope of various embodiments is defined only by the appended claims, along with the full range of equivalents to which such claims are entitled.

Pinterest Ex. 1004 Page 220 of 371

[0076] Moreover, plural instances may be provided for resources, operations, or structures described herein as a single instance. Additionally, boundaries between various resources, operations, modules, engines, and data stores are somewhat arbitrary, and particular operations are illustrated in a context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within a scope of various embodiments of the present invention. In general, structures and functionality presented as separate resources in the example configurations may be implemented as a combined structure or resource. Similarly, structures and functionality presented as a single resource may be implemented as separate resources. These and other variations, modifications, additions, and improvements fall within a scope of embodiments of the present invention as represented by the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

Pinterest Ex. 1004 Page 221 of 371

PCT REQUEST

Original (for **SUBMISSION**)

0	**For receiving Office use only**	
0-1	International Application No.	PCT/US18/46723
0-2	International Filing Date	14 August 2018 (14.08.2018)
0-3	Name of receiving Office and "PCT International Application"	RO/US

0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT-SAFE [EFS-Web mode] Version 3.51.081.257 MT/FOP 20180401/0.20.5.24
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	United States Patent and Trademark Office (USPTO) (RO/US)
0-7	**Applicant's or agent's file reference**	2050-354WO1
I	**Title of Invention**	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
II	**Applicant**	
II-1	This person is	Applicant only
II-2	Applicant for	All designated States
II-4	Name	OPENTV, INC.
II-5	Address	275 Sacramento Street San Francisco, California 94111 United States of America
II-6	State of nationality	US
II-7	State of residence	US
III-1	**Applicant and/or inventor**	
III-1-1	This person is	Applicant and inventor
III-1-2	Applicant for	All designated States
III-1-4	Name (LAST, First)	GOGOI, Amarendra N.
III-1-5	Address	275 Sacramento Street San Francisco, California 94111 United States of America
III-1-6	State of nationality	US
III-1-7	State of residence	US

PCT REQUEST

Original (for **SUBMISSION**)

III-2	**Applicant and/or inventor**	
III-2-1	This person is	Applicant and inventor
III-2-2	Applicant for	All designated States
III-2-4	Name (LAST, First)	GUPTA, Sanjay Kumar
III-2-5	Address	RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor Mahadevapura Post, ITPL Road 560 048 Bangalore India
III-2-6	State of nationality	IN
III-2-7	State of residence	IN
III-3	**Applicant and/or inventor**	
III-3-1	This person is	Applicant and inventor
III-3-2	Applicant for	All designated States
III-3-4	Name (LAST, First)	SWAMI, Ravikant
III-3-5	Address	RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor Mahadevapura Post, ITPL Road 560 048 Bangalore India
III-3-6	State of nationality	IN
III-3-7	State of residence	IN
IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	Agent
IV-1-1	Name (LAST, First)	PERDOK, Monique M.
IV-1-2	Address	Schwegman Lundberg & Woessner, P.A. P.O. Box 2938 Minneapolis, Minnesota 55402 United States of America
IV-1-3	Telephone No.	612-373-6900
IV-1-4	Facsimile No.	612-339-3061
IV-1-5	e-mail	request@slwip.com
IV-1-5(a)	E-mail authorization The receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority are authorized to use this e-mail address, if the Office or Authority so wishes, to send notifications issued in respect of this international application:	exclusively in electronic form (no paper notifications will be sent)
IV-1-6	Agent's registration No.	42,989

PCT REQUEST

Original (for **SUBMISSION**)

IV-2	**Additional agent(s)**	additional agent(s) with same address as first named agent	
IV-2-1	Name(s)	ARORA, Suneel(42,267); BEEKMAN, Marvin L.(38,377); BIANCHI, Timothy E.(39,610); BLACK, David W.(42,331); SCHEER, Bradley W.(47,059); LANG, Roger(58,829)	
V	**DESIGNATIONS**		
V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**		
VI-1	**Priority claim of earlier national application**		
VI-1-1	Filing date	08 September 2017 (08.09.2017)	
VI-1-2	Number	201741031917	
VI-1-3	Country or Member of WTO	IN	
VI-2	**Incorporation by reference :** where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.		
VII-1	**International Searching Authority Chosen**	United States Patent and Trademark Office (USPTO) (ISA/US)	
VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	

PCT REQUEST

Original (for **SUBMISSION**)

IX	Check list	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	4	✓
IX-2	Description	21	-
IX-3	Claims	4	-
IX-4	Abstract	1	✓
IX-5	Drawings	5	-
IX-7	TOTAL	35	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	✓	-
IX-11	Copy of general power of attorney	✓	-
IX-19	Other	PCT Transmittal	
IX-20	**Figure of the drawings which should accompany the abstract**	3	
IX-21	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	/Monique M. Perdok/	
X-1-1	Name (LAST, First)	PERDOK, MONIQUE M. / REG. NO. 42,989	
X-1-3	Capacity (if such capacity is not obvious from reading the request)		

FOR RECEIVING OFFICE USE ONLY

10-1	**Date of actual receipt of the purported international application**	14 August 2018 (14.08.2018)
10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	
10-5	**International Searching Authority**	ISA/US
10-6	**Transmittal of search copy delayed until search fee is paid**	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	**Date of receipt of the record copy by the International Bureau**	

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 March 2019 (14.03.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/050660 A1

(51) International Patent Classification:
H04W 28/02 (2009.01)

(21) International Application Number:
PCT/US2018/046723

(22) International Filing Date:
14 August 2018 (14.08.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201741031917 08 September 2017 (08.09.2017) IN

(71) Applicant: **OPENTV, INC.** [US/US]; 275 Sacramento Street, San Francisco, California 94111 (US).

(72) Inventors: **GOGOI, Amarendra N.**; 275 Sacramento Street, San Francisco, California 94111 (US). **GUPTA, Sanjay Kumar**; RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN). **SWAMI, Ravikant**; RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN).

(74) Agent: **PERDOK, Monique M.** et al.; Schwegman Lundberg & Woessner, P.A., P.O. Box 2938, Minneapolis, Minnesota 55402 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

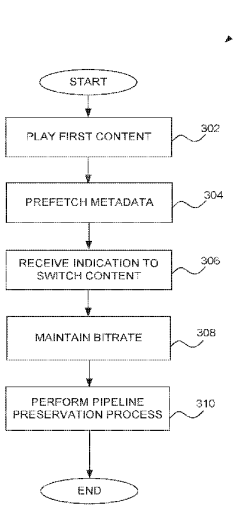


FIG. 3

(57) Abstract: Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[Continued on next page]

WO 2019/050660 A1

Published:
— *with international search report (Art. 21(3))*

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92*bis*.1 and Administrative Instructions, Section 422)

To:

PERDOK, Monique M.
Schwegman Lundberg & Woessner, P.A.
P.O. Box 2938
Minneapolis, Minnesota 55402
ÉTATS-UNIS D'AMÉRIQUE

Date of mailing *(day/month/year)*
08 October 2018 (08.10.2018)

Applicant's or agent's file reference
2050-354WO1

IMPORTANT NOTIFICATION

International application No.
PCT/US2018/046723

International filing date *(day/month/year)*
14 August 2018 (14.08.2018)

1. The following indications appeared on record concerning:

☒ the applicant ☒ the inventor ☐ the agent ☐ the common representative

Name and Address
GOGOI, Amarendra N.
GUPTA, Sanjay Kumar
SWAMI, Ravikant

State of Nationality | State of Residence

Telephone No.

Facsimile No.

E-mail address

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address
See Box 3.

State of Nationality | State of Residence

Telephone No.

Facsimile No.

E-mail address
☐ Notifications by e-mail authorized

3. Further observations, if necessary:
The persons identified in Box 1 are now inventors only.

4. A copy of this notification has been sent to:

☒ the receiving Office
☐ the International Searching Authority
☐ the Authority(ies) specified for supplementary search
☐ the International Preliminary Examining Authority
☐ the designated Offices concerned
☐ the elected Offices concerned
☐ other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 89 70

Authorized officer
Beard Nathalie
e-mail pct.team6@wipo.int
Telephone No. +41 22 338 74 06

PD026438IN-SC

US8/46723

INTELLECTUAL PROPERTY INDIA
पेटेंट|डिजाइन| व्यापार
चिह्न|भौगोलिक उपदर्शन

सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
वाणिज्य एवं उद्योग मंत्रालय
MINISTRY OF COMMERCE & INDUSTRY
पेटेंट कार्यालय
THE PATENT OFFICE

जिस किसी से संबन्धित हो
TO WHOMSOEVER IT MAY CONCERN

मैं, अधोहस्ताक्षरी जो पेटेंट अधिनियम, 1970 की धारा 73(3) के तहत महानियंत्रक एकस्व, अभिकल्प एवं व्यापार चिह्न की ओर से प्रमाणपत्र हस्ताक्षर व जारी करने के लिए प्राधिकृत अधिकारी हूँ एतदद्वारा यह प्रमाणित करता(ती) हूँ कि निम्नलिखित पेटेंट आवेदन के संबंध मे फाइल दस्तावेज़(जों) की सही प्रतिलिपि इसके साथ संलग्न है:

I, the undersigned, being an officer duly authorized to sign and issue the certificate on behalf of the Controller General of Patents, Designs and Trademarks in accordance with the provisions of Section 73(3) of the Patents Act, 1970, hereby certify that annexed hereto is aTrue Copy of the document(s) as filed in connection with the following Patent Application:

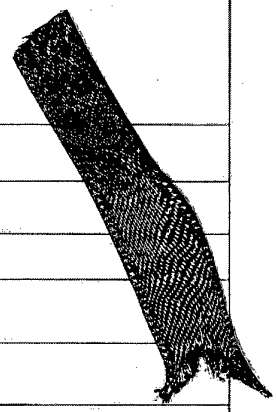
क) आवेदन संख्या/a) ***Application Number: 201741031917***
ख) फाइल करने की तारीख/b) ***Date of Filing: 08/09/2017***
ग) अनुरोधित दस्तावेज़(जों) का नाम:
C) Name of the document(s) requested: Provisional Specification

यह [redacted] पेटेंट अधिनियम, 1970 की धारा 147(1) के अधीन मुझमे निहित शक्तियों के तहत जारी कि[redacted]/This certificate is issued under the powers vested in me U/S 147(1) of The Patents

[redacted]his 17th day of July 2018

नियंत्रक पेटेंट व डिजाइन/Controller of Patents and Designs
(प्राधिकृत हस्ताक्षरी/Authorised Signatory)

FORM 1 **THE PATENTS ACT, 1970 (39 of 1970)** **&** **The Patents Rules, 2003** **APPLICATION FOR GRANT OF PATENT** [See section 7,54 & 135 and sub- rule (1) of rule 20]	**(FOR OFFICE USE ONLY)**



	Application No.:	
	Filing Date:	
	Amount of Fee Paid:	
	CBR No:	
	Signature:	

1. APPLICANT'S REFERENCE/ IDENTIFICATION NO. (AS ALLOTTED BY OFFICE)	

2. TYPE OF APPLICATION [Please tick (✓) at the appropriate category]

Ordinary (☑)		Convention (☒)		PCT-NP (☒)	
Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )

3A. APPLICANT(S)

Name in Full	Nationality	Country of Residence	Address of the Applicant
OPENTV, INC.	United States	United States of America	275 Sacramento Street, San Francisco, California 94111, United States of America

3B. CATEGORY OF APPLICANT [Please tick (✓) at the appropriate category]

Natural Person (☒)	Other than Natural Person

	Small Entity (☒)	Startup (☒)	Others (☑)

4. INVENTOR(S) [Please tick (✓) at the appropriate category]

Are all the inventor(s) same as the applicant(s) named above?	Yes ( )	No (☑)

If "No", furnish the details of the inventor(s)

Name in Full	Nationality	Country of Residence	Address of the Inventor
GOGOI, Amarendra N.	United States	United States of America	275 Sacramento Street, San Francisco, California 94111, United States of America
GUPTA, Sanjay Kumar	Indian	India	275 Sacramento Street, San Francisco, California 94111, United States of America
SWAMI, Ravikant	Indian	India	275 Sacramento Street, San Francisco, California 94111, United States of America

5. TITLE OF THE INVENTION

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

6. AUTHORISED REGISTERED PATENT AGENT(S)	IN/PA No.	**IN/PA-1433**
	Name	**MALATHI LAKSHMIKUMARAN**
	Mobile No.	98 183 01173
7. ADDRESS FOR SERVICE OF APPLICANT IN INDIA	Name	**LAKSHMI KUMARAN & SRIDHARAN**
	Postal Address	2, Wallace garden, 2nd Street, Chennai - 600 006 India
	Telephone No.	**(+91) 044 2833 4700**
	Mobile No.	98 183 01173
	Fax No.	**(+91) 044 2833 4702**

Pinterest Ex. 1004 Page 231 of 371

	E-mail ID	iprdel@lakshmisri.com

8. IN CASE OF APPLICATION CLAIMING PRIORITY OF APPLICATION FILED IN CONVENTION COUNTRY, PARTICULARS OF CONVENTION APPLICATION : N/A

Country	Application Number	Filing Date	Name of Applicant	Title of Invention	IPC (as classified in the convention country)
Nil	Nil	Nil	Nil	Nil	

9. IN CASE OF PCT NATIONAL PHASE APPLICATION, PARTICULARS OF INTERNATIONAL APPLICATION FILED UNDER PATENT CO-OPERATION TREATY (PCT) : N/A

International Application No.	International filing date as allotted by the receiving office
Nil	Nil

10. IN CASE OF DIVISIONAL APPLICATION FILED UNDER SECTION 16, PARTICULARS OF ORIGINAL (FIRST) APPLICATION : N/A

Original (First) Application No.	Date of filing of Original (First) Application
Nil	Nil

11. IN CASE OF PATENT OF ADDITION FILED UNDER SECTION 54, PARTICULARS OF MAIN APPLICATION OR PATENT: N/A

Main Application/Patent No.	Date of filing of Main Application
Nil	Nil

12. DECLARATIONS

(i) Declaration by the Inventor(s)

(In case the applicant is an assignee: the inventor(s) may sign herein below or the applicant may upload the assignment or enclose the assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period).

I/We, the above named inventor(s) is/are the true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

Name	Signature	Date

Pinterest Ex. 1004 Page 232 of 371

GOGOI, Amarendra N.	Amarendra N Gogoi	11/09/2017
GUPTA, Sanjay Kumar	Gupta	November 09, 2017
SWAMI, Ravikant	Swami	NOVEMBER 09, 2017

(ii) Declaration by the Applicant(s) in the convention country

(In case the applicant in India is different than the applicant in the convention country: the applicant in the convention country may sign herein below or applicant in India may upload the assignment from the applicant in the convention country or enclose the said assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period)

I/We, the Applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

Name	Signature	Date

(iii) Declaration by the Applicant(s)

I/We the applicant(s) hereby declare that

- ☑ I am /We are in possession of the above mentioned invention.
- ☑ Specification relating to the invention is filed with this application.
- ☒ The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.
- ☑ There is no lawful ground of objection(s) to the grant of patent to me/us.
- ☒ I am / we are the true & first Inventors.
- ☑ I am / we are the assignee or legal representative of true & first Inventors.
- ☒ The application or each of applications, particulars of which are given in

Pinterest Ex. 1004 Page 233 of 371

Paragraph-8 was the first application in convention country / countries in respect of my/our invention(s).

☒ I / We claim priority from the above mentioned application(s) filed in convention country/countries and state that no application for protection in respect of the invention has been made in a convention country before that date by me/us or by any person from which I/We derive the title.

☒ My/our application in India is based on International application under Patent Cooperation Treaty (PCT) as mentioned in Paragraph-9.

☒ The application is divided out of my/our application particulars of which is given in Paragraph-10 and pray that this application may be treated as deemed to have been filed on N/A under section 16 of the Act.

☒ The said invention is an improvement in or modification of the invention particulars of which are given in Paragraph-11.

13. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION

(a) Form 2

Item	Details	Fee	Remarks
Complete/ Provisional specification (Description Part)#	No. of pages of Description : 26		
Claim(s)	No. of claims : 0 No. of pages : 0		
Abstract	No. of pages : 0		
Drawing(s)	No. of drawings : 5 No. of pages : 5		

In case of a complete specification, if the applicant desires to adopt the drawings filed with his provisional specification as the drawings or part of the drawings for the complete specification under rule 13(4), the number of such pages filed with the provisional specification are required to be mentioned here.

Pinterest Ex. 1004 Page 234 of 371

(b) Provisional Specification ~~(in conformation with the International application/as amended before the IPEA, as applicable (2 copies)~~.

(c) ~~Sequence listing in electronic form~~

(d) Drawings ~~(in conformation with the International application / as amended before the IPEA, as applicable (2 copies)~~.

(e) ~~Priority document(s) or a request to retrieve the priority document(s) from DAS (Digital Access Service) if the applicant had already requested the office of first filing to make the priority document(s) available to DAS~~.

(f) Translation of priority document/Specification/International Search Report /International Preliminary Report on Patentability.

(g) Statement and undertaking on FORM-3

(i) Power of Authority-Already Filed

Total fee ₹8,800/- in Cash/ Banker's Cheque /Bank Draft /Electronic - Online Net banking Transfer.

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

Date: 8 September 2017

Signature:

Name: **T.SRINIVASAN**
IN/PA -507
OF LAKSHMI KUMARAN & SRIDHARAN
AGENT FOR THE APPLICANT(S)

To.
The Controller of Patents
The Patent Office at Chennai

Pinterest Ex. 1004 Page 235 of 371

FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003

PROVISIONAL SPECIFICATION
(See section 10, rule 13)

1. Title of the invention: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

2. Applicant(s)

NAME	NATIONALITY	ADDRESS
OPENTV, INC.	United States	275 Sacramento Street, San Francisco, California 94111, United States of America

3. Preamble to the description

PROVISIONAL SPECIFICATION
The following specification describes the invention.

201741031917
08/09/2017

Pinterest Ex. 1004 Page 236 of 371

FIELD

[0001] The present disclosure generally relates to machines configured to the technical field of special-purpose machines that optimizes a content change process (e.g., channel change) including computerized variants of such special-purpose machines and improvements to such variants, and to the technologies by which such special-purpose machines become improved compared to other special-purpose machines that facilitate optimizing content changes. In particular, the present disclosure addresses systems and methods for preserving a download bitrate and a content playback pipeline during a content change process.

BACKGROUND

[0002] Conventionally, during a switch in content (e.g., caused by a channel change or a selection of a different piece of content), a delay occurs as certain information is obtained before the new piece of content (e.g., program, movie, show) is rendered and displayed. Additionally, for adaptive bitrate streaming content, the content typically starts streaming or download at a low (or lowest) bitrate before slowly increasing in bitrate until an optimum bitrate is achieved. This results in initial video or images being grainy. Furthermore, the delay may be increased by a need to build a content playback pipeline each time a change in content occurs.

BRIEF DESCRIPTION OF DRAWINGS

[0003] Various ones of the appended drawings merely illustrate example embodiments of the present invention and cannot be considered as limiting its scope.

[0004] FIG. 1 is a diagram illustrating an example environment for optimizing content changes;

[0005] FIG. 2 is a block diagram illustrating an example embodiment of components within a digital receiver in accordance with an example embodiment.

[0006] FIG. 3 is a flow diagram of a method for optimizing a content change process in accordance with example embodiments.

Pinterest Ex. 1004 Page 237 of 371

[0007] FIG. 4 is a flow diagram of a method for preserving a content delivery pipeline in accordance with example embodiments.

[0008] FIG. 5 is a diagrammatic representation of a machine in an example form of a computing system within which a set of instructions may be executed for causing the machine to perform any one or more of the methodologies discussed herein, according to an example embodiment.

DETAILED DESCRIPTION

[0009] The description that follows includes systems, methods, techniques, instruction sequences, and computing machine program products that embody illustrative embodiments of the present inventive subject matter. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide an understanding of various embodiments of the inventive subject matter. It will be evident, however, to those skilled in the art, that embodiments of the inventive subject matter may be practiced without some or other of these specific details. In general, well-known instruction instances, protocols, structures, and techniques have not been shown in detail. Examples merely typify possible variations. Unless explicitly stated otherwise, structures (e.g., structural components, such as modules) are optional and may be combined or subdivided, and operations (e.g., in a procedure, algorithm, or other function) may vary in sequence or be combined or subdivided.

[0010] Example embodiments described herein provide systems and methods for optimizing content changes or switch in content being viewed, such as through a channel change or selection of a different piece of content from a watchlist. In some embodiments, the system uses navigational context (e.g., the way a user is interacting with an application) to identify content of (potential) interest to a viewer. The system then prefetches metadata for the content of interest from a content provider and stores the metadata to local cache. The metadata comprises preconditions for rendering and display of a piece of content that include a minimum set of data that a system can obtain without having to decrypt the content. The prefetched metadata may be used, in example embodiments, to determine whether to preserve at least a portion of a content playback pipeline (also referred to herein as a "content deliver pipeline" or simply a "pipeline").

Pinterest Ex. 1004 Page 238 of 371

[0011] Conventionally, a same piece of content is broken up into segments (e.g., 10 second segments) and each segment is available in various bitrates. A low bitrate may be grainy, while a high bitrate will normally have better image quality. Typically, when playback of a new piece of content starts, the system does not know the quality of the network bandwidth. As a result, in order to start playback as quickly as possible, conventional systems start with a lowest bitrate. Thus, every time a user switches from one content to the next content, the playback will start with the lowest bitrate and slowly increase or improve according the capability of the network. In contrast, example embodiments, preserve a previous bitrate when switching to a new piece of content. That is, when a user selects a new piece of content to playback (e.g., switching from a previous piece of content to the new piece of content), example embodiments maintain or preserve a (heuristically determined) bitrate used for streaming or downloading the previous piece of content when initiating the playback of the new piece of content. This allows for starting playback as quickly as possible while also providing better image quality from the start.

[0012] Furthermore, in conventional systems, a switch or transition in content typically causes a previous content delivery pipeline to be deconstructed (e.g., resources previous acquired are released). Subsequently, a new pipeline is created for the new piece of content (e.g., new resources are acquired). In contrast, example embodiments may maintain or preserve a portion (or an entire) content delivery pipeline (e.g., comprising a source element, a demultiplexer ("demux"), a video decoder, and an audio decoder) used to obtain the previous piece of content instead of reconstructing a pipeline (e.g., destroying the content delivery pipeline and building a new content delivery pipeline). The preservation of the pipeline also allows for playback of the new content as quickly as possible.

[0013] As a result, one or more of the methodologies described herein facilitate solving the technical problem of optimizing content change (e.g., reducing time for a change in channel or loading of new content) regardless of the delivery channel - whether the content is broadcast (e.g., IPTV and multicast) or over-the-top (OTT). The methodologies include causing playback, by a digital receiver, of a first piece of content and receiving a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content. The

Pinterest Ex. 1004 Page 239 of 371

methodologies further include determining whether to preserve at least a portion of a playback pipeline when switching to playback of the new piece of content. In some embodiments, preservation of at least a portion of the playback pipeline comprises determining whether to retrain an audio decoder and a video decoder of the pipeline when switching to playback of the new piece of content. Accordingly, one or more of the methodologies discussed herein improves upon latency during content changes while maintaining image quality. It is noted that content changes include a selection of a piece of content for viewing (e.g., from a content access page such as a favorites grid or via a programming guide) as well as channel changes (e.g., linear channels changes).

[0014] With reference to FIG. 1, an embodiment of an example environment 100 that enables optimizing content changes (e.g., reducing latency during channel changes or selection of a piece of content for viewing) is shown. In example embodiments, a digital receiver 102 of a user provides access to digital content and manages content change operations. In one embodiment, the digital receiver 102 is a set-top box. The digital receiver 102 is coupled to a viewing device 104 (e.g., a television or monitor) on which the user can view the digital content. In some embodiments, the digital receiver 102 (e.g., operations of the digital receiver 102) may be combined with the viewing device 104 (e.g., a smart television, a tablet, or smartphone). The components of the digital receiver 102 used to perform operations of example embodiments will be discussed in more detail in connection with FIG. 2 below.

[0015] In some embodiments, the digital receiver 102 accesses (e.g., pulls, receives, retrieves) content via a network 106 from a content distribution network (CDN) server 108. The CDN server 108 may obtain the content from one or more content providers 110 (e.g., servers of the content providers 110). In example embodiments, the CDN server 108 may be associated with a third party service (e.g., Netflix, Hulu, YouTube, Amazon,) that stores and provides content, such as, for example but not limited to, over-the-top (OTT) content, video-on-demand (VOD) content, Internet content, or broadcast content to the digital receiver 102 via the network 106. The content comprises text, images, audio, and/or video content (e.g., movies, television shows, videos), and in some embodiments comprise live (e.g., in real-time) content. In some embodiments, the content providers 110 provide

Pinterest Ex. 1004 Page 240 of 371

content, over the network 106 directly to the digital receiver 102 for display on the viewing device 104.

[0016] One or more portions of the network 106 may be an ad hoc network, an intranet, an extranet, a virtual private network (VPN), a local area network (LAN), a wireless LAN (WLAN), a wide area network (WAN), a wireless WAN (WWAN), a metropolitan area network (MAN), a portion of the Internet, a portion of the Public Switched Telephone Network (PSTN), a cellular telephone network, a wireless network, a WiFi network, a WiMax network, a satellite network, a cable network, a broadcast network, another type of network, or a combination of two or more such networks. Any one or more portions of the network 106 may communicate information via a transmission or signal medium. As used herein, "transmission medium" refers to any intangible (e.g., transitory) medium that is capable of communicating (e.g., transmitting) instructions for execution by a machine (e.g., by one or more processors of such a machine), and includes digital or analog communication signals or other intangible media to facilitate communication of such software.

[0017] It is noted that the environment 100 shown in FIG. 1 is merely an example. For instance, any number of CDN servers 108 and content providers 110 may be embodied within the environment 100. Additionally, some components of the environment 100 may be combined. For example, the functions of the digital receiver 102 may be embodied within the viewing device 104 to form a single device, such as a smart television, tablet, smartphone, or any other device that is capable of obtaining, rendering, and displaying content. Moreover, the functions described herein for any single system or machine may be subdivided among multiple systems or machines.

[0018] Any of the systems or machines (e.g., databases, devices, servers) shown in, or associated with, FIG. 1 may be, include, or otherwise be implemented in a special-purpose (e.g., specialized or otherwise non-generic) computer that has been modified (e.g., configured or programmed by software, such as one or more software modules of an application, operating system, firmware, middleware, or other program) to perform one or more of the functions described herein for that system or machine. For example, a special-purpose computer system able to implement any one or more of the methodologies described herein is discussed below with respect to FIG. 5, and such a special-purpose

Pinterest Ex. 1004 Page 241 of 371

computer may accordingly be a means for performing any one or more of the methodologies discussed herein. Within the technical field of such special-purpose computers, a special-purpose computer that has been modified by the structures discussed herein to perform the functions discussed herein is technically improved compared to other special-purpose computers that lack the structures discussed herein or are otherwise unable to perform the functions discussed herein. Accordingly, a special-purpose machine configured according to the systems and methods discussed herein provides an improvement to the technology of similar special-purpose machines.

[0019] FIG. 2 is a block diagram illustrating an example embodiment of components within the digital receiver 102 in accordance with an example embodiment. In example embodiments, the digital receiver 102 manages access to content streamed over the network 106. In particular, the digital receiver 102 prefetches metadata, preserves a bitrate used for playback (e.g., streaming or downloading) of a previous piece of content when initiating the playback of a new piece of content, and preserves at least a portion of a content delivery pipeline. To enable these operations, the digital receiver 102 comprises a player 202, a content delivery pipeline 204 (also referred to as "pipeline"), a cache manager 206, and a cache 208, all of which may be configured to communicate with each other (e.g., over a bus, shared memory, or a switch). The digital receiver 102 comprises other components (not shown) that are not pertinent to operations of example embodiments.

[0020] The player 202 is configured to manage the pipeline 204. In example embodiments, the player 204 instantiates (e.g., constructs) the pipeline 204 when a first piece of content is selected for display. A different pipeline may be constructed for each type of content. For example, the player 202 constructs a HTTP Live Streaming (HLS) pipeline for HLS content and constructs a Dynamic Adaptive Streaming over HTTP (DASH) pipeline for DASH content. The player 204 also decides whether to maintain at least a portion of the pipeline 204 or construct a new pipeline when a switch in content occurs (e.g., channel change or selection of new content for viewing). An example method for managing the preservation of the pipeline is discussed in further detail in connection with FIG. 4 below.

[0021] The pipeline 204 is constructed by the player 202 by acquiring appropriate resources for obtaining and processing content data in order to playback selected content.

Pinterest Ex. 1004 Page 242 of 371

The resources of the pipeline 204 comprise a source element 212, a demultiplexer ("demux") 214, an audio decoder 216, and a video decoder 218. The source element 212 manages the downloading of content data for the selected piece of content. The source element 212 also manages bitrate adaptation at the digital receiver 102. Specifically, the source element 212 remembers a last bitrate that is used for playback of a current/previous piece of content, and continues to use that bitrate for playback of the new content. As such, if the last bitrate is high, the source element 212 will start with the same high bitrate for the new content. If the new content cannot be playback at that bitrate, then the source element 212 will lower the bitrate. For example, if the downloading of the content takes less time than anticipated, there is spare bandwidth and the bitrate can be increased. Conversely, if the download is taking longer than anticipated, then the bitrate is decreased. As such, example embodiments, will start the playback of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing).

[0022] The demux demultiplexes the content data obtained from the CDN server 108 or the content provider 110 to obtain an audio signal and a video signal. The audio signal is transmitted to the audio decoder 216 for processing, while the video signal is transmitted to the video decoder 218 for processing. The results from the audio and video decoders 216 and 218 are output (e.g., transmitted) to the viewing device 104 for presentation to the user.

[0023] The cache manager 206 manages the prefetching of metadata for content that may potentially be selected for playback. In some embodiments, the cache manager 206 predicts content the user may be interested in viewing. For example, a user may be navigating a linear list of channels or programs (e.g., an electronic programming guide; "EPG") in a particular direction (e.g., up or down). In this embodiment, the cache manager 206 predicts a next set of content based on the direction of navigation on the linear list. In another example, the user may be viewing a video-on-demand (VoD) catalog or a watchlist of a user. If the user requests information or hovers over a selection for a piece of content, the cache manager 206 uses this as prediction that the piece of content is of interest to the user. Alternatively, the cache manager may consider all (or some) pieces of content in viewable portion of the catalog or watchlist as content of interest. In any of these cases, the cache manager 206 prefetches the metadata for the content of interest, and stores the prefetched data to the cache 208. The metadata may comprise, for example, one or more

Pinterest Ex. 1004 Page 243 of 371

uniform resource locators (URLs) where the chunks of content are available, URLs for different bit rates, license data (e.g., where to obtain a license from), and codec information. The codec information will be used by the player 202 to determine whether to preserve at least a portion of the pipeline 204, as will be discussed further below. If the user subsequently selects content for which the metadata is already prefetched, then the metadata can be accessed from the cache 208 instead of having to be retrieved over the network 106 from the CDN server 108 or the content provider 110 after selection. This will assist in the reduction of latency in playback.

[0024] Any one or more of the components (e.g., modules, decoders, resources) described herein may be implemented using hardware alone (e.g., one or more processors of a machine) or a combination of hardware and software. For example, any component described herein may physically include an arrangement of one or more of the processors or configure a processor (e.g., among one or more processors of a machine) to perform the operations described herein for that module. Accordingly, different components described herein may include and configure different arrangements of the processors at different points in time or a single arrangement of the processors at different points in time. Each component described herein is an example of a means for performing the operations described herein for that component. Moreover, any two or more of these components may be combined into a single component, and the functions described herein for a single component may be subdivided among multiple components. Furthermore, according to various example embodiments, components described herein as being implemented within a single machine, database, or device may be distributed across multiple machines, databases, or devices.

[0025] FIG. 3 is a flow diagram of an example method 300 for optimizing content change in accordance with example embodiments. In example embodiments, the method 300 is performed in part or in whole by components of the digital receiver 102. Accordingly, the method 300 is described by way of example with reference to the digital receiver 102. However, it shall be appreciated that at least some of the operations of the method 300 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 300 is not intended to be limited to the digital receiver 102.

Pinterest Ex. 1004 Page 244 of 371

[0026] In operation 302, a first piece of content is caused to be played by the viewing device 104. In example embodiments, the player 202 constructs the pipeline 204 for obtaining and processing the content data for the first piece of content. In particular, the player 202 acquires the source element 212, the demux 214, the audio decoder 216, and the video decoder 218 to form the pipeline 204. The data content is processed by the pipeline 204 and presented on the viewing device 104.

[0027] In operation 304, metadata for a set of one or more content of interest is prefetched. In example embodiments, the cache manager 206 predicts content of interest of a user and prefetches the metadata for the content of interest. The prefetched data is then stored to the cache 208. The metadata may comprise, but is not limited to, one or more URLs where the chunks of content are available, one or more URL for different bit rates, license data (e.g., where to obtain a license from), and codec information.

[0028] In operation 306, the player 202 receives an indication to switch to a new piece of content for playback. The indication may be received from a control device of the user (e.g., a remote controller). In some embodiments, the user may scroll through an EPG or be viewing a catalog or watchlist, and selects a new piece of content for viewing.

[0029] In operation 308, the digital receiver 102 maintains the bitrate when switching playback to the new piece of content. In example embodiments, when transitioning playback from an ongoing playback operation to a new playback operation, the source element 212 uses a heuristic bitrate derived for playback of the first piece of content for playback of the new piece of content. Thus, the source element 212 attempts to maintain or preserve the bitrate for playback as opposed to starting a new playback from the lowest possible bitrate. If the new piece of content cannot be delivered at that bitrate, then the source element 212 will lower the bitrate. As such, example embodiments, will start the download of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing). This allows playback of the new content at a most optimal bitrate instantly instead of having to heuristically re-compute the optimal bitrate starting from the lowest possible bitrate. Conventionally, the derivation of the optimal bitrate usually requires downloading several segments or chunks of content data resulting in a gradual improvement of picture quality. However, example embodiments that use the

Pinterest Ex. 1004 Page 245 of 371

previous derived heuristic bitrate maintain the same level of image quality as that of the previous playback from a very beginning of playback for the new content.

[0030] In operation 310, a pipeline preservation process is performed to determine whether to maintain at least a portion of the pipeline used to playback the first piece of content for use with the playback of the new piece of content. Furthermore, if the pipeline is to be maintained or preserve, a determination is made as to whether all the resources of the pipeline should be preserved or only a portion of the pipeline preserved (e.g., only some of the resources are kept and others are released). The pipeline preservation process will be discussed in more detail in connection with FIG. 4.

[0031] FIG. 4 is a flow diagram of an example method 400 for preserving a content delivery pipeline in accordance with example embodiments. In example embodiments, the method 400 is performed in part or in whole by the player 202 with respect the resources of the pipeline 204. Accordingly, the method 400 is described by way of example with reference to the player 202 and the pipeline 204. However, it shall be appreciated that at least some of the operations of the method 400 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 400 is not intended to be limited to the player 202 and the pipeline 204.

[0032] In operation 402, in response to receiving the indication to switch playback to new content, the cache manager 206 accesses the prefetched metadata stored in the cache 208 for the new content. The prefetched metadata for the new content may comprise one or more URLs where the new content is available, one or more URLs for different bit rates associated with the new content, license data for the new content, and codec information for the new content. The prefetched metadata may also indicate whether the new content is of a same type as the first piece of content. For example, the first piece of content and the new content may both be in a HTTP Live Streaming (HLS) format or both be in a Dynamic Adaptive Streaming over HTTP (DASH) format.

[0033] In operation 404, the player 202 determines whether the first piece of content and the new content are of the same content type. If the first piece of content and the new content are not of the same type (e.g., first piece of content is in HLS format and the new content is in DASH format), then the resources of the pipeline 204 (e.g., the source element

Pinterest Ex. 1004 Page 246 of 371

212, the demux 214, the audio decoder 216, and the video decoder 218) are released in operation 406. Releasing all the resources of the pipeline 204 essentially deconstructs the pipeline 204. The player 202 them creates a new pipeline by acquiring other resources that are applicable to the content type of the new content.

[0034] If in operation 404 the player 202 determines that the first piece of content and the new content are of the same content type (e.g., both are HLS format), then in operation 408, codec information is detected for the new content. In example embodiments, the player 202 examines the prefetched metadata for the new content for the codec information. The codec information indicates types of decoders needed for the new content.

[0035] In operation 410, a determination is made by the player 202 as to whether the types of decoders needed for the new content is the same as the decoders currently in the pipeline 204 for the first piece of content. If the types of decoders needed is the same, then in operation 412 the entire pipeline 204 is preserved. In other words, the resources of the pipeline 204 are maintained and continued to be used to playback the new content.

[0036] However, if in operation 410 the player 202 determines that the new content needs different decoders, then in operation 414, the decoders (e.g., the audio decoder 216 and the video decoder 208) are released. Subsequently in operation 416, a remaining portion of the pipeline 204 (e.g., the source element 212 and the demux 214) are preserved or maintained. In these embodiments, the player 202 acquires a new set of decoders (e.g., a new audio decoder and a new video decoder) applicable to the new content, and adds the new set of decoders to the preserved portion of the pipeline 204.

[0037] While example embodiments are discussed with respect to pipeline and bitrate preservation applicable to both DASH and HLS, example embodiments for preservation of bitrate and the pipeline is applicable for any type of content that is adaptive in nature (e.g., where the content bitrate can change based on bandwidth).

[0038] FIG. 5 is a block diagram illustrating components of a machine 500, according to some example embodiments, able to read instructions 524 from a machine-storage medium 522 (e.g., a non-transitory machine-storage medium, a machine-readable storage medium, a computer-readable storage medium, or any suitable combination thereof) and perform any one or more of the methodologies discussed herein, in whole or in part. Specifically, FIG. 5 shows the machine 500 in the example form of a computer device (e.g., a computer) within

Pinterest Ex. 1004 Page 247 of 371

which the instructions 524 (e.g., software, a program, an application, an applet, an app, or other executable code) for causing the machine 500 to perform any one or more of the methodologies discussed herein may be executed, in whole or in part.

[0039] For example, the instructions 524 may cause the machine 500 to execute the flow diagrams of FIGs. 3 and 4. The instructions 524 can transform the general, non-programmed machine 500 into a particular machine (e.g., specially configured machine) programmed to carry out the described and illustrated functions in the manner described.

[0040] In alternative embodiments, the machine 500 operates as a standalone device or may be connected (e.g., networked) to other machines. The machine 500 may be a server computer, a client computer, a personal computer (PC), a tablet computer, a laptop computer, a netbook, a set-top box (e.g. STB), a personal digital assistant (PDA), a cellular telephone, a smartphone, a web appliance, a network router, a network switch, a network bridge, a power adapter, or any machine 500 capable of executing the instructions 524, sequentially or otherwise, that specify actions to be taken by that machine 500. Further, while only a single machine 500 is illustrated, the term "machine" shall also be taken to include a collection of machines that individually or jointly execute the instructions 524 to perform any one or more of the methodologies discussed herein.

[0041] The machine 500 includes a processor 502 (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), an application specific integrated circuit (ASIC), a radio-frequency integrated circuit (RFIC), or any suitable combination thereof), a main memory 504, and a static memory 506, which are configured to communicate with each other via a bus 508. The processor 502 may contain microcircuits that are configurable, temporarily or permanently, by some or all of the instructions 524 such that the processor 502 is configurable to perform any one or more of the methodologies described herein, in whole or in part. For example, a set of one or more microcircuits of the processor 502 may be configurable to execute one or more modules (e.g., software modules) described herein.

[0042] The machine 500 may further include a graphics display 510 (e.g., a plasma display panel (PDP), a light emitting diode (LED) display, a liquid crystal display (LCD), a projector, a cathode ray tube (CRT), or any other display capable of displaying graphics or video). The machine 500 may also include an alphanumeric input device 512 (e.g., a

Pinterest Ex. 1004 Page 248 of 371

keyboard or keypad), a cursor control device 514 (e.g., a mouse, a touchpad, a trackball, a joystick, a motion sensor, an eye tracking device, or other pointing instrument), a storage unit 516, a signal generation device 518 (e.g., a sound card, an amplifier, a speaker, a headphone jack, or any suitable combination thereof), and a network interface device 520.

[0043] The storage unit 516 includes the machine-storage medium 522 (e.g., a tangible machine-readable storage medium) on which are stored the instructions 524 embodying any one or more of the methodologies or functions described herein. The instructions 524 may also reside, completely or at least partially, within the main memory 504, within the processor 502 (e.g., within the processor's cache memory), or both, before or during execution thereof by the machine 500. Accordingly, the main memory 504 and the processor 502 may be considered machine-storage media 522 (e.g., tangible and non-transitory machine-storage media).

[0044] In some example embodiments, the machine 500 may be a portable computing device and have one or more additional input components (e.g., sensors or gauges). Examples of such input components include an image input component (e.g., one or more cameras), an audio input component (e.g., a microphone), a direction input component (e.g., a compass), a location input component (e.g., a global positioning system (GPS) receiver), an orientation component (e.g., a gyroscope), a motion detection component (e.g., one or more accelerometers), an altitude detection component (e.g., an altimeter), and a gas detection component (e.g., a gas sensor). Inputs harvested by any one or more of these input components may be accessible and available for use by any of the modules described herein.

EXECUTABLE INSTRUCTIONS AND MACHINE-STORAGE MEDIUM

[0045] The various memories (i.e., 504, 506, and/or memory of the processor(s) 502) and/or storage unit 516 may store one or more sets of instructions and data structures (e.g., software) 524 embodying or utilized by any one or more of the methodologies or functions described herein. These instructions, when executed by processor(s) 502 cause various operations to implement the disclosed embodiments.

[0046] As used herein, the terms "machine-storage medium," "device-storage medium," "computer-storage medium" (referred to collectively as "machine-storage medium 522")

Pinterest Ex. 1004 Page 249 of 371

mean the same thing and may be used interchangeably in this disclosure. The terms refer to a single or multiple storage devices and/or media (e.g., a centralized or distributed database, and/or associated caches and servers) that store executable instructions and/or data, as well as cloud-based storage systems or storage networks that include multiple storage apparatus or devices. The terms shall accordingly be taken to include, but not be limited to, solid-state memories, and optical and magnetic media, including memory internal or external to processors. Specific examples of machine-storage media, computer-storage media, and/or device-storage media 522 include non-volatile memory, including by way of example semiconductor memory devices, e.g., erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), FPGA, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks. The terms machine-storage media, computer-storage media, and device-storage media 522 specifically exclude carrier waves, modulated data signals, and other such media, at least some of which are covered under the term "signal medium" discussed below.

SIGNAL MEDIUM

[0047] The term "signal medium" or "transmission medium" shall be taken to include any form of modulated data signal, carrier wave, and so forth. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a matter as to encode information in the signal.

COMPUTER READABLE MEDIUM

[0048] The terms "machine-readable medium," "computer-readable medium" and "device-readable medium" mean the same thing and may be used interchangeably in this disclosure. The terms are defined to include both machine-storage media and signal media. Thus, the terms include both storage devices/media and carrier waves/modulated data signals.

[0049] The instructions 524 may further be transmitted or received over a communications network 526 using a transmission medium via the network interface device 520 and utilizing any one of a number of well-known transfer protocols (e.g.,

Pinterest Ex. 1004 Page 250 of 371

HTTP). Examples of communication networks 526 include a local area network (LAN), a wide area network (WAN), the Internet, mobile telephone networks, plain old telephone service (POTS) networks, and wireless data networks (e.g., WiFi, LTE, and WiMAX networks). The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding, or carrying instructions 524 for execution by the machine 500, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

[0050] Throughout this specification, plural instances may implement components, operations, or structures described as a single instance. Although individual operations of one or more methods are illustrated and described as separate operations, one or more of the individual operations may be performed concurrently, and nothing requires that the operations be performed in the order illustrated. Structures and functionality presented as separate components in example configurations may be implemented as a combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements fall within the scope of the subject matter herein.

[0051] Certain embodiments are described herein as including logic or a number of components, modules, or mechanisms. Modules may constitute either software modules (e.g., code embodied on a machine-storage medium 522 or in a transmission signal) or hardware modules. A "hardware module" is a tangible unit capable of performing certain operations and may be configured or arranged in a certain physical manner. In various example embodiments, one or more computer systems (e.g., a standalone computer system, a client computer system, or a server computer system) or one or more hardware modules of a computer system (e.g., a processor 502 or a group of processors 502) may be configured by software (e.g., an application or application portion) as a hardware module that operates to perform certain operations as described herein.

[0052] In some embodiments, a hardware module may be implemented mechanically, electronically, or any suitable combination thereof. For example, a hardware module may include dedicated circuitry or logic that is permanently configured to perform certain operations. For example, a hardware module may be a special-purpose processor, such as a

Pinterest Ex. 1004 Page 251 of 371

field-programmable gate array (FPGA) or an ASIC. A hardware module may also include programmable logic or circuitry that is temporarily configured by software to perform certain operations. For example, a hardware module may include software encompassed within a general-purpose processor or other programmable processor. It will be appreciated that the decision to implement a hardware module mechanically, in dedicated and permanently configured circuitry, or in temporarily configured circuitry (e.g., configured by software) may be driven by cost and time considerations.

[0053] Accordingly, the phrase "hardware module" should be understood to encompass a tangible entity, be that an entity that is physically constructed, permanently configured (e.g., hardwired), or temporarily configured (e.g., programmed) to operate in a certain manner or to perform certain operations described herein. As used herein, "hardware-implemented module" refers to a hardware module. Considering embodiments in which hardware modules are temporarily configured (e.g., programmed), each of the hardware modules need not be configured or instantiated at any one instance in time. For example, where a hardware module comprises a general-purpose processor configured by software to become a special-purpose processor, the general-purpose processor may be configured as respectively different special-purpose processors (e.g., comprising different hardware modules) at different times. Software may accordingly configure a processor, for example, to constitute a particular hardware module at one instance of time and to constitute a different hardware module at a different instance of time.

[0054] The various operations of example methods described herein may be performed, at least partially, by one or more processors that are temporarily configured (e.g., by software) or permanently configured to perform the relevant operations. Whether temporarily or permanently configured, such processors may constitute processor-implemented modules that operate to perform one or more operations or functions described herein. As used herein, "processor-implemented module" refers to a hardware module implemented using one or more processors.

[0055] Similarly, the methods described herein may be at least partially processor-implemented, a processor being an example of hardware. For example, at least some of the operations of a method may be performed by one or more processors or processor-implemented modules.

Pinterest Ex. 1004 Page 252 of 371

EXAMPLES

[0056] Example 1 is a method for optimizing a content change process. The method comprises causing playback, by a digital receiver, of a first piece of content; receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0057] In example 2, the subject matter of example 1 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0058] In example 3, the subject matter of examples 1-2 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0059] In example 4, the subject matter of examples 1-3 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0060] In example 5, the subject matter of examples 1-4 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0061] Example 6 is a system optimizing a content change process. The system includes one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection,

Pinterest Ex. 1004 Page 253 of 371

maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0062] In example 7, the subject matter of example 6 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0063] In example 8, the subject matter of examples 6-7 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0064] In example 9, the subject matter of examples 6-8 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0065] In example 10, the subject matter of examples 6-9 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0066] Example 11 is machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0067] In example 12, the subject matter of example 11 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0068] In example 13, the subject matter of examples 11-12 can optionally include wherein the determining whether to preserve comprises detecting codec information for the

Pinterest Ex. 1004 Page 254 of 371

new piece of content, the codec information indicating types of decoders needed for the new content; determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0069] In example 14, the subject matter of examples 11-13 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0070] In example 15, the subject matter of examples 11-14 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0071] Some portions of the subject matter discussed herein may be presented in terms of algorithms or symbolic representations of operations on data stored as bits or binary digital signals within a machine memory (e.g., a computer memory). Such algorithms or symbolic representations are examples of techniques used by those of ordinary skill in the data processing arts to convey the substance of their work to others skilled in the art. As used herein, an "algorithm" is a self-consistent sequence of operations or similar processing leading to a desired result. In this context, algorithms and operations involve physical manipulation of physical quantities. Typically, but not necessarily, such quantities may take the form of electrical, magnetic, or optical signals capable of being stored, accessed, transferred, combined, compared, or otherwise manipulated by a machine. It is convenient at times, principally for reasons of common usage, to refer to such signals using words such as "data," "content," "bits," "values," "elements," "symbols," "characters," "terms," "numbers," "numerals," or the like. These words, however, are merely convenient labels and are to be associated with appropriate physical quantities.

[0072] Unless specifically stated otherwise, discussions herein using words such as "processing," "computing," "calculating," "determining," "presenting," "displaying," or the like may refer to actions or processes of a machine (e.g., a computer) that manipulates or transforms data represented as physical (e.g., electronic, magnetic, or optical) quantities within one or more memories (e.g., volatile memory, non-volatile memory, or any suitable combination thereof), registers, or other machine components that receive, store, transmit,

Pinterest Ex. 1004 Page 255 of 371

or display information. Furthermore, unless specifically stated otherwise, the terms "a" or "an" are herein used, as is common in patent documents, to include one or more than one instance. Finally, as used herein, the conjunction "or" refers to a non-exclusive "or," unless specifically stated otherwise.

[0073] Although an overview of the inventive subject matter has been described with reference to specific example embodiments, various modifications and changes may be made to these embodiments without departing from the broader scope of embodiments of the present invention. For example, various embodiments or features thereof may be mixed and matched or made optional by a person of ordinary skill in the art. Such embodiments of the inventive subject matter may be referred to herein, individually or collectively, by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept if more than one is, in fact, disclosed.

[0074] The embodiments illustrated herein are believed to be described in sufficient detail to enable those skilled in the art to practice the teachings disclosed. Other embodiments may be used and derived therefrom, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. The Detailed Description, therefore, is not to be taken in a limiting sense, and the scope of various embodiments is defined only by the appended claims, along with the full range of equivalents to which such claims are entitled.

[0075] Moreover, plural instances may be provided for resources, operations, or structures described herein as a single instance. Additionally, boundaries between various resources, operations, modules, engines, and data stores are somewhat arbitrary, and particular operations are illustrated in a context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within a scope of various embodiments of the present invention. In general, structures and functionality presented as separate resources in the example configurations may be implemented as a combined structure or resource. Similarly, structures and functionality presented as a single resource may be implemented as separate resources. These and other variations, modifications, additions, and improvements fall within a scope of embodiments of the present invention as

Pinterest Ex. 1004 Page 256 of 371

represented by the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

Pinterest Ex. 1004 Page 257 of 371

CLAIMS

What is claimed is:

1. A method comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

2. The method of claim 1, further comprising:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

3. The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content;

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

4. The method of claim 3, further comprising preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

5. The method of claim 3, further comprising:

Pinterest Ex. 1004 Page 258 of 371

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

6. A system comprising:

one or more hardware processors; and

a storage device storing instructions that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

7. The system of claim 6, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

8. The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content;

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

9. The system of claim 8, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

Pinterest Ex. 1004 Page 259 of 371

10. The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

11. A machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

12. The machine-readable medium of claim 11, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

13. The machine-readable medium of claim 12, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content;

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

Pinterest Ex. 1004 Page 260 of 371

14. The machine-readable medium of claim 13, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

15. The machine-readable medium of claim 13, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Date 08 September 2017

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

To,
The Controller of Patents
The Patent Office at Chennai

Pinterest Ex. 1004 Page 261 of 371

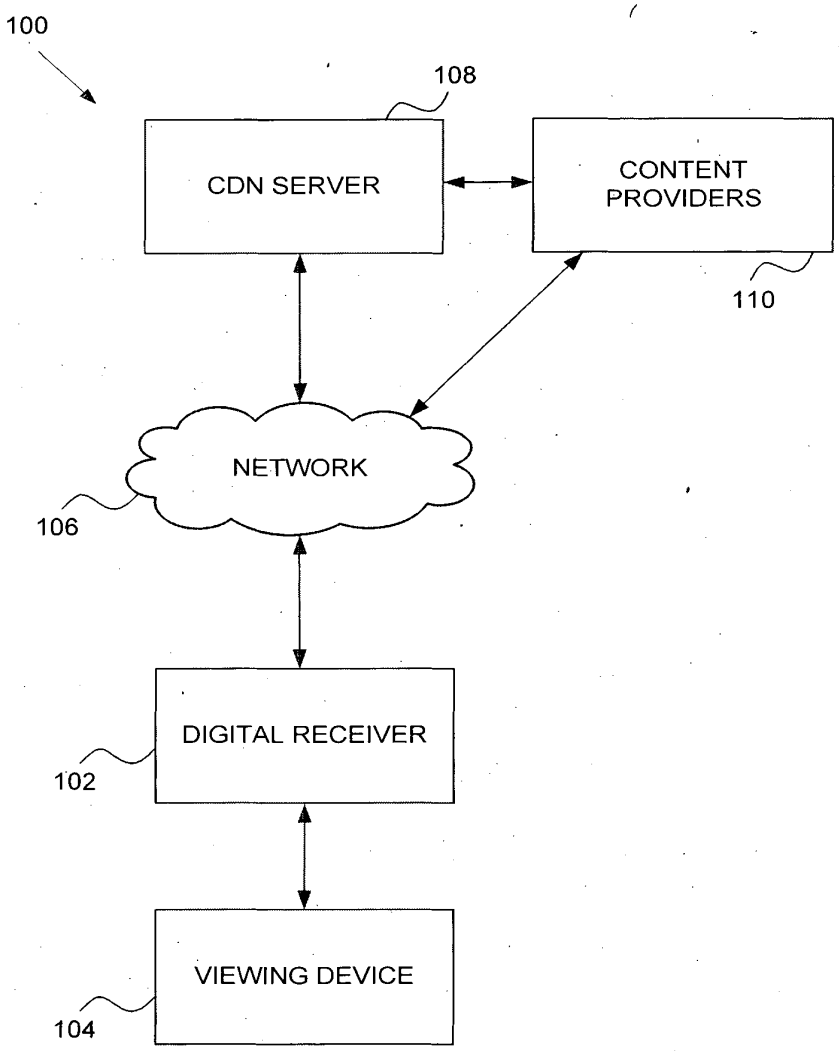


FIG. 1

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

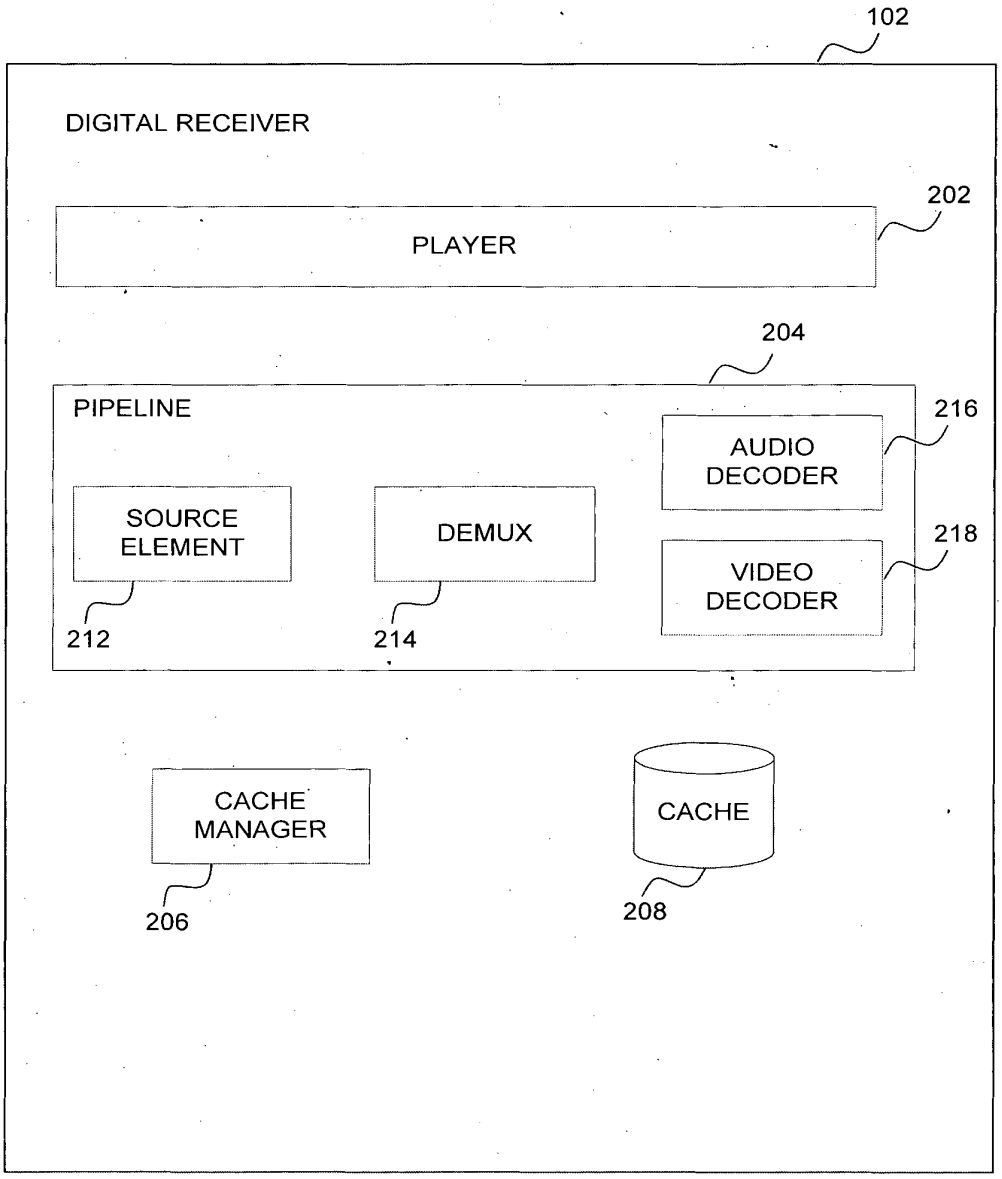


FIG. 2

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

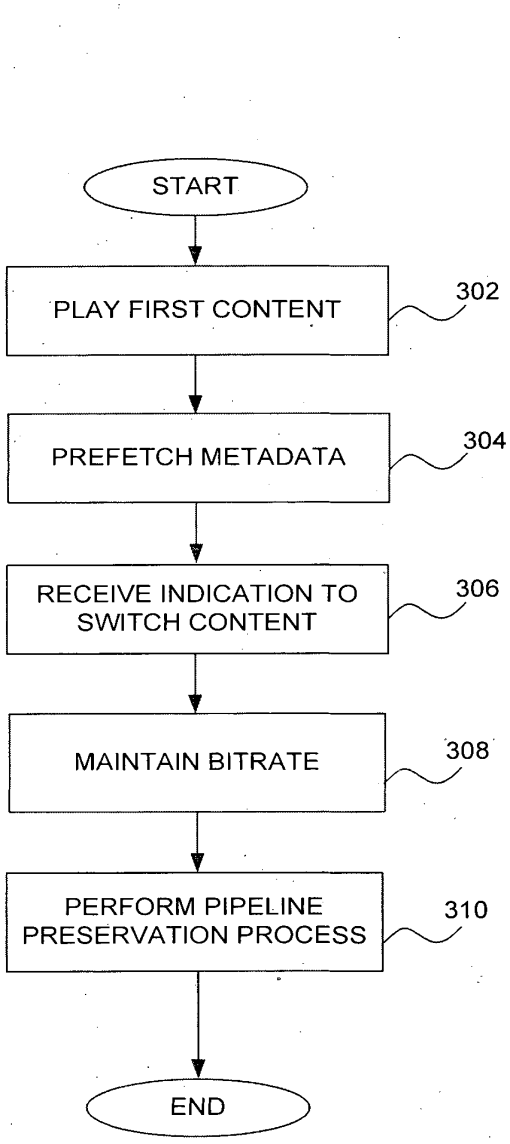


FIG. 3

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

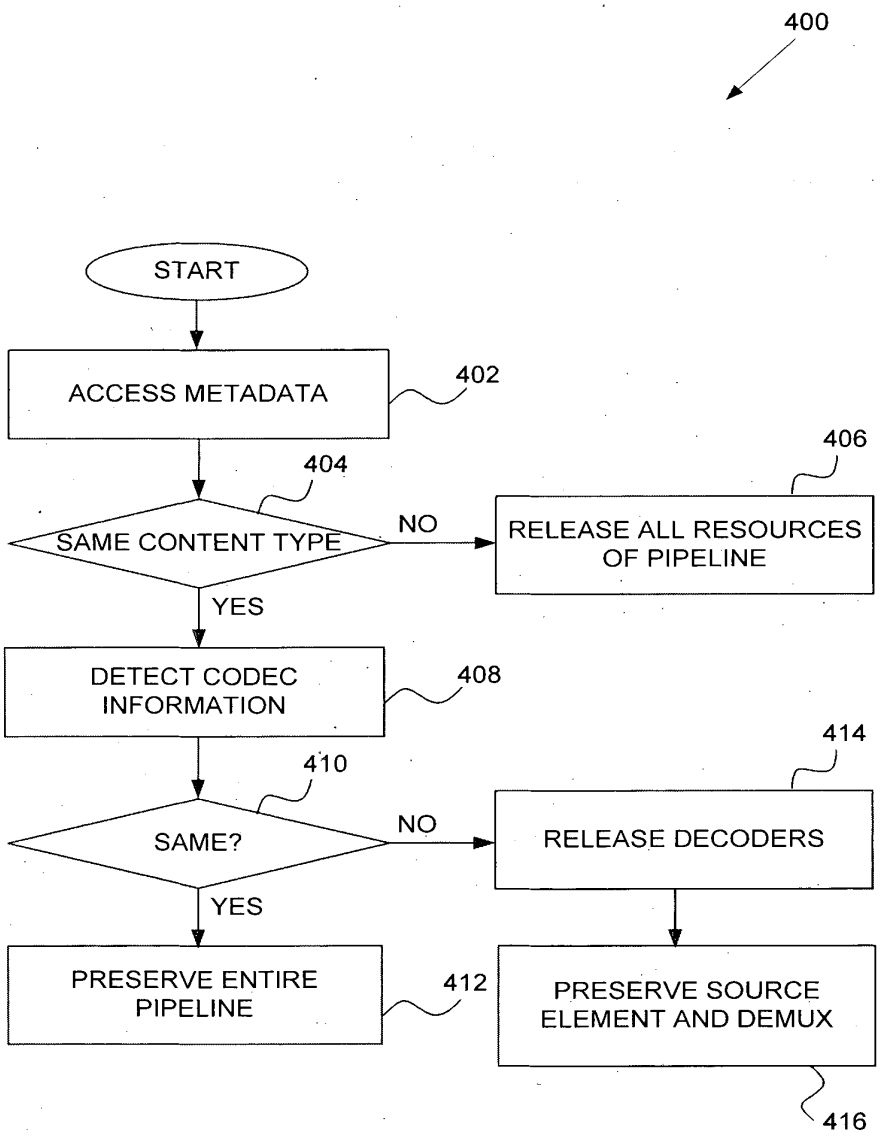


FIG. 4

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

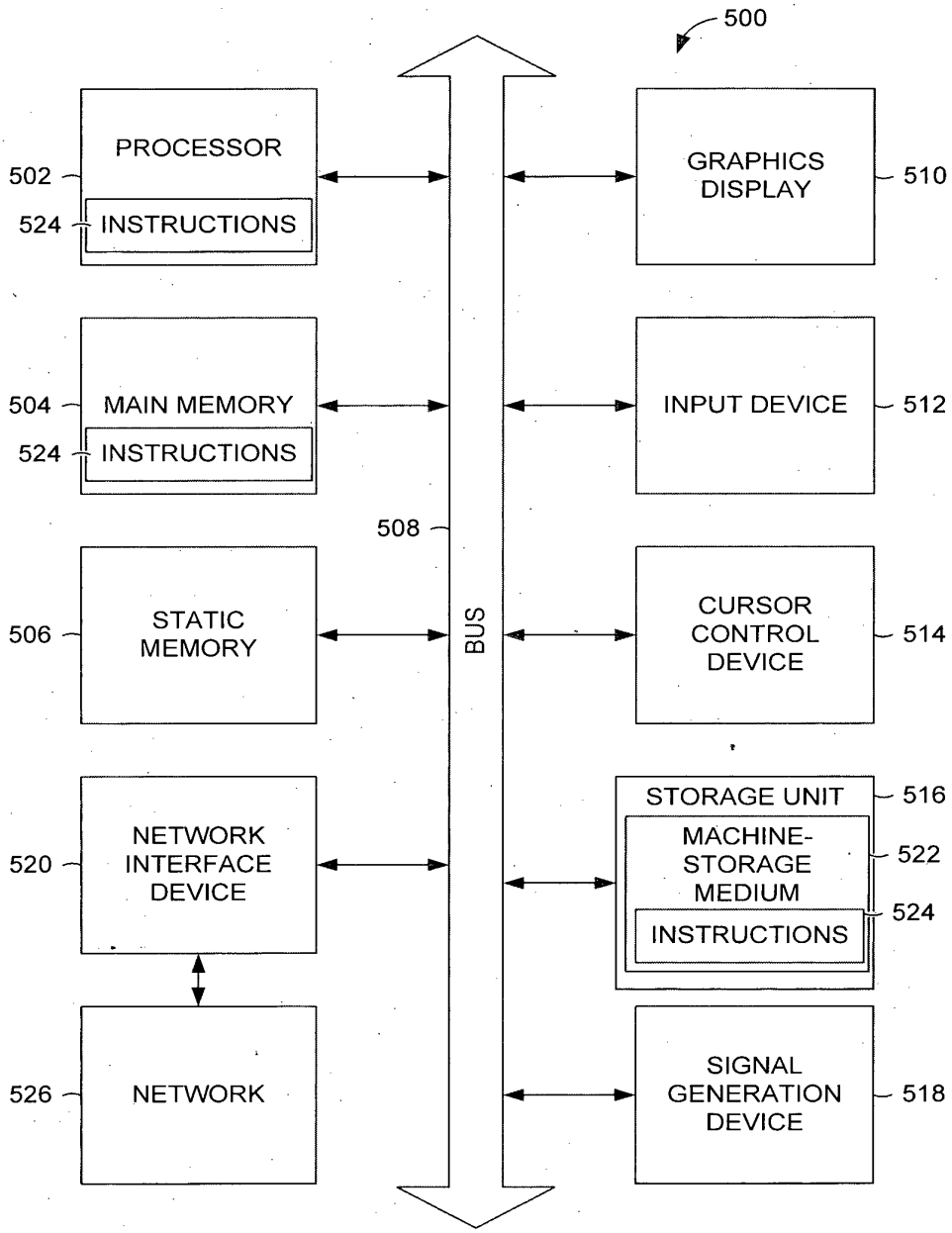


FIG. 5

MALATHI LAKSHMIKUMARAN
IN/PA-1433
Agent for the Applicant

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/US2018/046723**
International filing date:		**14 August 2018 (14.08.2018)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**IN**
	Number:	**201741031917**
	Filing date:	**08 September 2017 (08.09.2017)**
Date of receipt at the International Bureau:		**03 September 2018 (03.09.2018)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

Modified form PTO/SB/08A(04-07) OMB 651-0031
US Patent & 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.

Substitute for form 1449A/PTO **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use as many sheets as necessary)	*Complete if Known*	
	Application Number	Unknown
	Filing Date	Herewith
	First Named Inventor	Amarendra N. Gogoi
	Group Art Unit	Unknown
	Examiner Name	Unknown
Sheet 1 of 1	Attorney Docket No: 2050.354US1	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-8,532,171	9/10/2013	Narayanan, Karthik, et al.
	US-20090254657A1	10/8/2009	Melnyk, Miguel A, et al.
	US-20100158101A1	6/24/2010	Wu, Chung-Ping, et al.
	US-20110296047A1	12/1/2011	Orr, Brian
	US-20170244924A1	8/24/2017	Shintani, Peter, et al.

FOREIGN PATENT DOCUMENTS

Examiner Initial *	Foreign Document Number	Publication Date	Name of Patentee or Applicant of cited Document	T 1
	TW-201931861A	8/1/2019	Gogoi, Amarendra N, et al.	
	WO-2019050660A1	3/14/2019	Gogoi, Amarendra N., et al.	

OTHER DOCUMENTS – NON PATENT LITERATURE DOCUMENTS

Examiner Initial *	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, page(s), volume-issue number(s), publisher, city and/or country where published.	T 1
	"International Application Serial No. PCT/US2018/046723, International Search Report mailed 10-22-18", 2 pgs	
	"International Application Serial No. PCT/US2018/046723, Written Opinion mailed 10-22-18", 9 pgs	

EXAMINER **DATE CONSIDERED**

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant is to place a check mark here if English language Translation is attached

Espacenet

TW201931861A Bitrate and pipeline preservation for content presentation

Applicants: OPENTV INC [US]

Inventors: GOGOI AMARENDRA N [US],GUPTA SANJAY KUMAR [IN],SWAMI RAVIKANT [IN]

Classifications:
IPC ***H04N21/23;***

CPC **H04W28/02 (EP);**

Priorities: IN201741031917A 2017-09-08

Application: TW107126926A·2018-08-02

Publication: TW201931861A· 2019-08-01

Published as: TW201931861A;**WO2019050660A1**

Bitrate and pipeline preservation for content presentation

Abstract

Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

【19】中華民國　　【12】發明公開公報　(A)
【11】公開編號：201931861　　申請實體審查：無
【43】公開日：中華民國 108 (2019) 年 08 月 01 日
【51】Int. Cl.：　*H04N21/23　(2011.01)*

【54】發明名稱：用於內容呈現之位元率及管線保留技術
BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

【21】申請案號：107126926　　【22】申請日：中華民國 107 (2018) 年 08 月 02 日
【30】優先權：2017/09/08　印度　201741031917

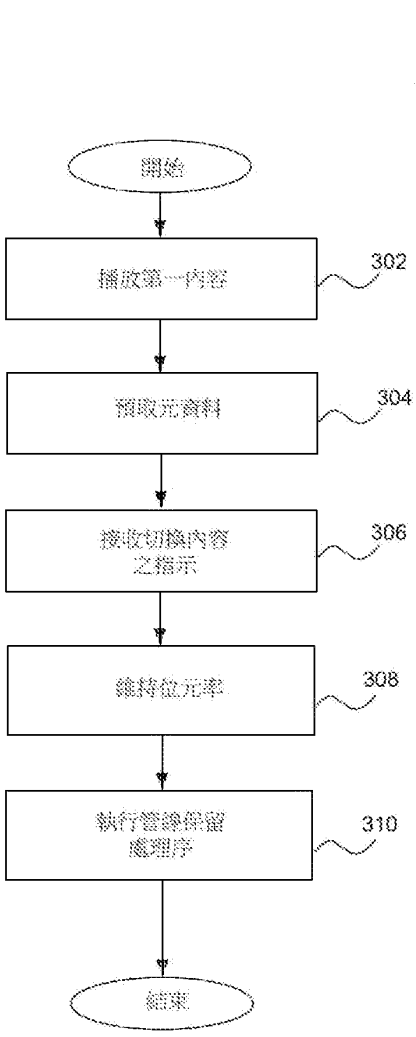
【72】發明人：高戈伊　阿瑪蘭德拉 N. (US) GOGOI, AMARENDRA N.；古普塔　山傑 K. (IN) GUPTA, SANJAY KUMAR；史瓦米　拉維康特 (IN) SWAMI, RAVIKANT
【71】申請人：美商開放電視股份有限公司　OPENTV, INC.
美國
【74】代理人：劉法正；尹重君

【57】發明摘要：

本發明提供用於最佳化一內容改變處理序之系統及方法。在實例實施例中，一數位接收器致使播放一第一內容片段。該數位接收器在該第一內容片段之該播放期間接收一新內容片段之一選擇以供播放。回應於該接收到該選擇，該數位接收器維持用於播放該第一內容片段之一位元率以起始該新內容片段之播放。

指定代表圖：

Pinterest Ex. 1004 Page 270 of 371



【圖3】

符號簡單說明：

300・・・實例方法

302、304、306、308、310・・・操作

Pinterest Ex. 1004 Page 271 of 371

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 March 2019 (14.03.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/050660 A1

(51) International Patent Classification:
H04W 28/02 (2009.01)

(21) International Application Number:
PCT/US2018/046723

(22) International Filing Date:
14 August 2018 (14.08.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201741031917 08 September 2017 (08.09.2017) IN

(71) Applicant: **OPENTV, INC.** [US/US]; 275 Sacramento Street, San Francisco, California 94111 (US).

(72) Inventors: **GOGOI, Amarendra N.**; 275 Sacramento Street, San Francisco, California 94111 (US). **GUPTA, Sanjay Kumar**; RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN). **SWAMI, Ravikant**; RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN).

(74) Agent: **PERDOK, Monique M.** et al.; Schwegman Lundberg & Woessner, P.A., P.O. Box 2938, Minneapolis, Minnesota 55402 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

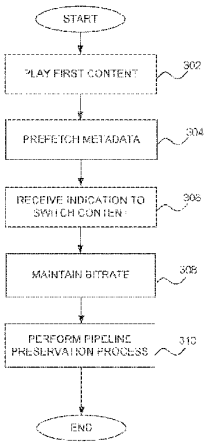


FIG. 3

(57) Abstract: Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[Continued on next page]

WO 2019/050660 A1

Published:
---- *with international search report (Art. 21(3))*

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

CLAIM OF PRIORITY

[0001] This application claims priority to India Application Serial No. 201741031917, filed on September 8, 2017, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure generally relates to machines configured to the technical field of special-purpose machines that optimizes a content change process (e.g., channel change) including computerized variants of such special-purpose machines and improvements to such variants, and to the technologies by which such special-purpose machines become improved compared to other special-purpose machines that facilitate optimizing content changes. In particular, the present disclosure addresses systems and methods for preserving a download bitrate and a content playback pipeline during a content change process.

BACKGROUND

[0003] Conventionally, during a switch in content (e.g., caused by a channel change or a selection of a different piece of content), a delay occurs as certain information is obtained before the new piece of content (e.g., program, movie, show) is rendered and displayed. Additionally, for adaptive bitrate streaming content, the content typically starts streaming or download at a low (or lowest) bitrate before slowly increasing in bitrate until an optimum bitrate is achieved. This results in initial video or images being grainy. Furthermore, the delay may be increased by a need to build a content playback pipeline each time a change in content occurs.

Pinterest Ex. 1004 Page 274 of 371

BRIEF DESCRIPTION OF DRAWINGS

[0004] Various ones of the appended drawings merely illustrate example embodiments of the present invention and cannot be considered as limiting its scope.

[0005] FIG. 1 is a diagram illustrating an example environment for optimizing content changes;

[0006] FIG. 2 is a block diagram illustrating an example embodiment of components within a digital receiver in accordance with an example embodiment.

[0007] FIG. 3 is a flow diagram of a method for optimizing a content change process in accordance with example embodiments.

[0008] FIG. 4 is a flow diagram of a method for preserving a content delivery pipeline in accordance with example embodiments.

[0009] FIG. 5 is a diagrammatic representation of a machine in an example form of a computing system within which a set of instructions may be executed for causing the machine to perform any one or more of the methodologies discussed herein, according to an example embodiment.

Pinterest Ex. 1004 Page 275 of 371

DETAILED DESCRIPTION

[0010] The description that follows includes systems, methods, techniques, instruction sequences, and computing machine program products that embody illustrative embodiments of the present inventive subject matter. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide an understanding of various embodiments of the inventive subject matter. It will be evident, however, to those skilled in the art, that embodiments of the inventive subject matter may be practiced without some or other of these specific details. In general, well-known instruction instances, protocols, structures, and techniques have not been shown in detail. Examples merely typify possible variations. Unless explicitly stated otherwise, structures (e.g., structural components, such as modules) are optional and may be combined or subdivided, and operations (e.g., in a procedure, algorithm, or other function) may vary in sequence or be combined or subdivided.

[0011] Example embodiments described herein provide systems and methods for optimizing content changes or switch in content being viewed, such as through a channel change or selection of a different piece of content from a watchlist. In some embodiments, the system uses navigational context (e.g., the way a user is interacting with an application) to identify content of (potential) interest to a viewer. The system then prefetches metadata for the content of interest from a content provider and stores the metadata to local cache. The metadata comprises preconditions for rendering and display of a piece of content that include a minimum set of data that a system can obtain without having to decrypt the content. The prefetched metadata may be used, in example embodiments, to determine whether to preserve at least a portion of a content playback pipeline (also referred to herein as a "content deliver pipeline" or simply a "pipeline").

[0012] Conventionally, a same piece of content is broken up into segments (e.g., 10 second segments) and each segment is available in various bitrates. A low bitrate may be grainy, while a high bitrate will normally have better image quality. Typically, when playback of a new piece of content starts, the system does not know the quality of the network bandwidth. As a result, in order to start playback as quickly as possible, conventional systems start with a lowest bitrate. Thus, every time a user switches from one content to the next content, the playback will start with the lowest bitrate and slowly increase or improve according the capability of the network. In contrast, example

Pinterest Ex. 1004 Page 276 of 371

embodiments, preserve a previous bitrate when switching to a new piece of content. That is, when a user selects a new piece of content to playback (e.g., switching from a previous piece of content to the new piece of content), example embodiments maintain or preserve a (heuristically determined) bitrate used for streaming or downloading the previous piece of content when initiating the playback of the new piece of content. This allows for starting playback as quickly as possible while also providing better image quality from the start.

[0013] Furthermore, in conventional systems, a switch or transition in content typically causes a previous content delivery pipeline to be deconstructed (e.g., resources previous acquired are released). Subsequently, a new pipeline is created for the new piece of content (e.g., new resources are acquired). In contrast, example embodiments may maintain or preserve a portion (or an entire) content delivery pipeline (e.g., comprising a source element, a demultiplexer ("demux"), a video decoder, and an audio decoder) used to obtain the previous piece of content instead of reconstructing a pipeline (e.g., destroying the content delivery pipeline and building a new content delivery pipeline). The preservation of the pipeline also allows for playback of the new content as quickly as possible.

[0014] As a result, one or more of the methodologies described herein facilitate solving the technical problem of optimizing content change (e.g., reducing time for a change in channel or loading of new content) regardless of the delivery channel - whether the content is broadcast (e.g., IPTV and multicast) or over-the-top (OTT). The methodologies include causing playback, by a digital receiver, of a first piece of content and receiving a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content. The methodologies further include determining whether to preserve at least a portion of a playback pipeline when switching to playback of the new piece of content. In some embodiments, preservation of at least a portion of the playback pipeline comprises determining whether to retrain an audio decoder and a video decoder of the pipeline when switching to playback of the new piece of content. Accordingly, one or more of the methodologies discussed herein improves upon latency during content changes while maintaining image quality. It is noted that content changes include a selection of a piece of content for viewing (e.g., from a content access

Pinterest Ex. 1004 Page 277 of 371

page such as a favorites grid or via a programming guide) as well as channel changes (e.g., linear channels changes).

[0015] With reference to FIG. 1, an embodiment of an example environment 100 that enables optimizing content changes (e.g., reducing latency during channel changes or selection of a piece of content for viewing) is shown. In example embodiments, a digital receiver 102 of a user provides access to digital content and manages content change operations. In one embodiment, the digital receiver 102 is a set-top box. The digital receiver 102 is coupled to a viewing device 104 (e.g., a television or monitor) on which the user can view the digital content. In some embodiments, the digital receiver 102 (e.g., operations of the digital receiver 102) may be combined with the viewing device 104 (e.g., a smart television, a tablet, or smartphone). The components of the digital receiver 102 used to perform operations of example embodiments will be discussed in more detail in connection with FIG. 2 below.

[0016] In some embodiments, the digital receiver 102 accesses (e.g., pulls, receives, retrieves) content via a network 106 from a content distribution network (CDN) server 108. The CDN server 108 may obtain the content from one or more content providers 110 (e.g., servers of the content providers 110). In example embodiments, the CDN server 108 may be associated with a third party service (e.g., Netflix, Hulu, YouTube, Amazon,) that stores and provides content, such as, for example but not limited to, over-the-top (OTT) content, video-on-demand (VOD) content, Internet content, or broadcast content to the digital receiver 102 via the network 106. The content comprises text, images, audio, and/or video content (e.g., movies, television shows, videos), and in some embodiments comprise live (e.g., in real-time) content. In some embodiments, the content providers 110 provide content, over the network 106 directly to the digital receiver 102 for display on the viewing device 104.

[0017] One or more portions of the network 106 may be an ad hoc network, an intranet, an extranet, a virtual private network (VPN), a local area network (LAN), a wireless LAN (WLAN), a wide area network (WAN), a wireless WAN (WWAN), a metropolitan area network (MAN), a portion of the Internet, a portion of the Public Switched Telephone Network (PSTN), a cellular telephone network, a wireless network, a WiFi network, a WiMax network, a satellite network, a cable network, a broadcast network, another type of network, or a combination of two or more such networks. Any one or more portions of the network 106 may communicate information via a

Pinterest Ex. 1004 Page 278 of 371

transmission or signal medium. As used herein, "transmission medium" refers to any intangible (e.g., transitory) medium that is capable of communicating (e.g., transmitting) instructions for execution by a machine (e.g., by one or more processors of such a machine), and includes digital or analog communication signals or other intangible media to facilitate communication of such software.

[0018] It is noted that the environment 100 shown in FIG. 1 is merely an example. For instance, any number of CDN servers 108 and content providers 110 may be embodied within the environment 100. Additionally, some components of the environment 100 may be combined. For example, the functions of the digital receiver 102 may be embodied within the viewing device 104 to form a single device, such as a smart television, tablet, smartphone, or any other device that is capable of obtaining, rendering, and displaying content. Moreover, the functions described herein for any single system or machine may be subdivided among multiple systems or machines.

[0019] Any of the systems or machines (e.g., databases, devices, servers) shown in, or associated with, FIG. 1 may be, include, or otherwise be implemented in a special-purpose (e.g., specialized or otherwise non-generic) computer that has been modified (e.g., configured or programmed by software, such as one or more software modules of an application, operating system, firmware, middleware, or other program) to perform one or more of the functions described herein for that system or machine. For example, a special-purpose computer system able to implement any one or more of the methodologies described herein is discussed below with respect to FIG. 5, and such a special-purpose computer may accordingly be a means for performing any one or more of the methodologies discussed herein. Within the technical field of such special-purpose computers, a special-purpose computer that has been modified by the structures discussed herein to perform the functions discussed herein is technically improved compared to other special-purpose computers that lack the structures discussed herein or are otherwise unable to perform the functions discussed herein. Accordingly, a special-purpose machine configured according to the systems and methods discussed herein provides an improvement to the technology of similar special-purpose machines.

[0020] FIG. 2 is a block diagram illustrating an example embodiment of components within the digital receiver 102 in accordance with an example embodiment. In example embodiments, the digital receiver 102 manages access to content streamed over the network 106. In particular, the digital receiver 102 prefetches metadata, preserves a

Pinterest Ex. 1004 Page 279 of 371

bitrate used for playback (e.g., streaming or downloading) of a previous piece of content when initiating the playback of a new piece of content, and preserves at least a portion of a content delivery pipeline. To enable these operations, the digital receiver 102 comprises a player 202, a content delivery pipeline 204 (also referred to as "pipeline"), a cache manager 206, and a cache 208, all of which may be configured to communicate with each other (e.g., over a bus, shared memory, or a switch). The digital receiver 102 comprises other components (not shown) that are not pertinent to operations of example embodiments.

[0021] The player 202 is configured to manage the pipeline 204. In example embodiments, the player 204 instantiates (e.g., constructs) the pipeline 204 when a first piece of content is selected for display. A different pipeline may be constructed for each type of content. For example, the player 202 constructs a HTTP Live Streaming (HLS) pipeline for HLS content and constructs a Dynamic Adaptive Streaming over HTTP (DASH) pipeline for DASH content. The player 204 also decides whether to maintain at least a portion of the pipeline 204 or construct a new pipeline when a switch in content occurs (e.g., channel change or selection of new content for viewing). An example method for managing the preservation of the pipeline is discussed in further detail in connection with FIG. 4 below.

[0022] The pipeline 204 is constructed by the player 202 by acquiring appropriate resources for obtaining and processing content data in order to playback selected content. The resources of the pipeline 204 comprise a source element 212, a demultiplexer ("demux") 214, an audio decoder 216, and a video decoder 218. The source element 212 manages the downloading of content data for the selected piece of content. The source element 212 also manages bitrate adaptation at the digital receiver 102. Specifically, the source element 212 remembers a last bitrate that is used for playback of a current/previous piece of content, and continues to use that bitrate for playback of the new content. As such, if the last bitrate is high, the source element 212 will start with the same high bitrate for the new content. If the new content cannot be playback at that bitrate, then the source element 212 will lower the bitrate. For example, if the downloading of the content takes less time than anticipated, there is spare bandwidth and the bitrate can be increased. Conversely, if the download is taking longer than anticipated, then the bitrate is decreased. As such, example embodiments,

Pinterest Ex. 1004 Page 280 of 371

will start the playback of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing).

[0023] The demux demultiplexes the content data obtained from the CDN server 108 or the content provider 110 to obtain an audio signal and a video signal. The audio signal is transmitted to the audio decoder 216 for processing, while the video signal is transmitted to the video decoder 218 for processing. The results from the audio and video decoders 216 and 218 are output (e.g., transmitted) to the viewing device 104 for presentation to the user.

[0024] The cache manager 206 manages the prefetching of metadata for content that may potentially be selected for playback. In some embodiments, the cache manager 206 predicts content the user may be interested in viewing. For example, a user may be navigating a linear list of channels or programs (e.g., an electronic programming guide; "EPG") in a particular direction (e.g., up or down). In this embodiment, the cache manager 206 predicts a next set of content based on the direction of navigation on the linear list. In another example, the user may be viewing a video-on-demand (VoD) catalog or a watchlist of a user. If the user requests information or hovers over a selection for a piece of content, the cache manager 206 uses this as prediction that the piece of content is of interest to the user. Alternatively, the cache manager may consider all (or some) pieces of content in viewable portion of the catalog or watchlist as content of interest. In any of these cases, the cache manager 206 prefetches the metadata for the content of interest, and stores the prefetched data to the cache 208. The metadata may comprise, for example, one or more uniform resource locators (URLs) where the chunks of content are available, URLs for different bit rates, license data (e.g., where to obtain a license from), and codec information. The codec information will be used by the player 202 to determine whether to preserve at least a portion of the pipeline 204, as will be discussed further below. If the user subsequently selects content for which the metadata is already prefetched, then the metadata can be accessed from the cache 208 instead of having to be retrieved over the network 106 from the CDN server 108 or the content provider 110 after selection. This will assist in the reduction of latency in playback.

[0025] Any one or more of the components (e.g., modules, decoders, resources) described herein may be implemented using hardware alone (e.g., one or more processors of a machine) or a combination of hardware and software. For example, any

Pinterest Ex. 1004 Page 281 of 371

component described herein may physically include an arrangement of one or more of the processors or configure a processor (e.g., among one or more processors of a machine) to perform the operations described herein for that module. Accordingly, different components described herein may include and configure different arrangements of the processors at different points in time or a single arrangement of the processors at different points in time. Each component described herein is an example of a means for performing the operations described herein for that component. Moreover, any two or more of these components may be combined into a single component, and the functions described herein for a single component may be subdivided among multiple components. Furthermore, according to various example embodiments, components described herein as being implemented within a single machine, database, or device may be distributed across multiple machines, databases, or devices.

[0026] FIG. 3 is a flow diagram of an example method 300 for optimizing content change in accordance with example embodiments. In example embodiments, the method 300 is performed in part or in whole by components of the digital receiver 102. Accordingly, the method 300 is described by way of example with reference to the digital receiver 102. However, it shall be appreciated that at least some of the operations of the method 300 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 300 is not intended to be limited to the digital receiver 102.

[0027] In operation 302, a first piece of content is caused to be played by the viewing device 104. In example embodiments, the player 202 constructs the pipeline 204 for obtaining and processing the content data for the first piece of content. In particular, the player 202 acquires the source element 212, the demux 214, the audio decoder 216, and the video decoder 218 to form the pipeline 204. The data content is processed by the pipeline 204 and presented on the viewing device 104.

[0028] In operation 304, metadata for a set of one or more content of interest is prefetched. In example embodiments, the cache manager 206 predicts content of interest of a user and prefetches the metadata for the content of interest. The prefetched data is then stored to the cache 208. The metadata may comprise, but is not limited to, one or more URLs where the chunks of content are available, one or more URL for

Pinterest Ex. 1004 Page 282 of 371

different bit rates, license data (e.g., where to obtain a license from), and codec information.

[0029] In operation 306, the player 202 receives an indication to switch to a new piece of content for playback. The indication may be received from a control device of the user (e.g., a remote controller). In some embodiments, the user may scroll through an EPG or be viewing a catalog or watchlist, and selects a new piece of content for viewing.

[0030] In operation 308, the digital receiver 102 maintains the bitrate when switching playback to the new piece of content. In example embodiments, when transitioning playback from an ongoing playback operation to a new playback operation, the source element 212 uses a heuristic bitrate derived for playback of the first piece of content for playback of the new piece of content. Thus, the source element 212 attempts to maintain or preserve the bitrate for playback as opposed to starting a new playback from the lowest possible bitrate. If the new piece of content cannot be delivered at that bitrate, then the source element 212 will lower the bitrate. As such, example embodiments, will start the download of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing). This allows playback of the new content at a most optimal bitrate instantly instead of having to heuristically re-compute the optimal bitrate starting from the lowest possible bitrate. Conventionally, the derivation of the optimal bitrate usually requires downloading several segments or chunks of content data resulting in a gradual improvement of picture quality. However, example embodiments that use the previous derived heuristic bitrate maintain the same level of image quality as that of the previous playback from a very beginning of playback for the new content.

[0031] In operation 310, a pipeline preservation process is performed to determine whether to maintain at least a portion of the pipeline used to playback the first piece of content for use with the playback of the new piece of content. Furthermore, if the pipeline is to be maintained or preserve, a determination is made as to whether all the resources of the pipeline should be preserved or only a portion of the pipeline preserved (e.g., only some of the resources are kept and others are released). The pipeline preservation process will be discussed in more detail in connection with FIG. 4.

[0032] FIG. 4 is a flow diagram of an example method 400 for preserving a content delivery pipeline in accordance with example embodiments. In example embodiments,

Pinterest Ex. 1004 Page 283 of 371

the method 400 is performed in part or in whole by the player 202 with respect the resources of the pipeline 204. Accordingly, the method 400 is described by way of example with reference to the player 202 and the pipeline 204. However, it shall be appreciated that at least some of the operations of the method 400 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 400 is not intended to be limited to the player 202 and the pipeline 204.

[0033] In operation 402, in response to receiving the indication to switch playback to new content, the cache manager 206 accesses the prefetched metadata stored in the cache 208 for the new content. The prefetched metadata for the new content may comprise one or more URLs where the new content is available, one or more URLs for different bit rates associated with the new content, license data for the new content, and codec information for the new content. The prefetched metadata may also indicate whether the new content is of a same type as the first piece of content. For example, the first piece of content and the new content may both be in a HTTP Live Streaming (HLS) format or both be in a Dynamic Adaptive Streaming over HTTP (DASH) format.

[0034] In operation 404, the player 202 determines whether the first piece of content and the new content are of the same content type. If the first piece of content and the new content are not of the same type (e.g., first piece of content is in HLS format and the new content is in DASH format), then the resources of the pipeline 204 (e.g., the source element 212, the demux 214, the audio decoder 216, and the video decoder 218) are released in operation 406. Releasing all the resources of the pipeline 204 essentially deconstructs the pipeline 204. The player 202 them creates a new pipeline by acquiring other resources that are applicable to the content type of the new content.

[0035] If in operation 404 the player 202 determines that the first piece of content and the new content are of the same content type (e.g., both are HLS format), then in operation 408, codec information is detected for the new content. In example embodiments, the player 202 examines the prefetched metadata for the new content for the codec information. The codec information indicates types of decoders needed for the new content.

[0036] In operation 410, a determination is made by the player 202 as to whether the types of decoders needed for the new content is the same as the decoders currently in the pipeline 204 for the first piece of content. If the types of decoders needed is the same,

Pinterest Ex. 1004 Page 284 of 371

then in operation 412 the entire pipeline 204 is preserved. In other words, the resources of the pipeline 204 are maintained and continued to be used to playback the new content.

[0037] However, if in operation 410 the player 202 determines that the new content needs different decoders, then in operation 414, the decoders (e.g., the audio decoder 216 and the video decoder 208) are released. Subsequently in operation 416, a remaining portion of the pipeline 204 (e.g., the source element 212 and the demux 214) are preserved or maintained. In these embodiments, the player 202 acquires a new set of decoders (e.g., a new audio decoder and a new video decoder) applicable to the new content, and adds the new set of decoders to the preserved portion of the pipeline 204.

[0038] While example embodiments are discussed with respect to pipeline and bitrate preservation applicable to both DASH and HLS, example embodiments for preservation of bitrate and the pipeline is applicable for any type of content that is adaptive in nature (e.g., where the content bitrate can change based on bandwidth).

[0039] FIG. 5 is a block diagram illustrating components of a machine 500, according to some example embodiments, able to read instructions 524 from a machine-storage medium 522 (e.g., a non-transitory machine-storage medium, a machine-readable storage medium, a computer-readable storage medium, or any suitable combination thereof) and perform any one or more of the methodologies discussed herein, in whole or in part. Specifically, FIG. 5 shows the machine 500 in the example form of a computer device (e.g., a computer) within which the instructions 524 (e.g., software, a program, an application, an applet, an app, or other executable code) for causing the machine 500 to perform any one or more of the methodologies discussed herein may be executed, in whole or in part.

[0040] For example, the instructions 524 may cause the machine 500 to execute the flow diagrams of FIGs. 3 and 4. The instructions 524 can transform the general, non-programmed machine 500 into a particular machine (e.g., specially configured machine) programmed to carry out the described and illustrated functions in the manner described.

[0041] In alternative embodiments, the machine 500 operates as a standalone device or may be connected (e.g., networked) to other machines. The machine 500 may be a server computer, a client computer, a personal computer (PC), a tablet computer, a laptop computer, a netbook, a set-top box (e.g. STB), a personal digital assistant (PDA),

Pinterest Ex. 1004 Page 285 of 371

a cellular telephone, a smartphone, a web appliance, a network router, a network switch, a network bridge, a power adapter, or any machine 500 capable of executing the instructions 524, sequentially or otherwise, that specify actions to be taken by that machine 500. Further, while only a single machine 500 is illustrated, the term "machine" shall also be taken to include a collection of machines that individually or jointly execute the instructions 524 to perform any one or more of the methodologies discussed herein.

[0042] The machine 500 includes a processor 502 (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), an application specific integrated circuit (ASIC), a radio-frequency integrated circuit (RFIC), or any suitable combination thereof), a main memory 504, and a static memory 506, which are configured to communicate with each other via a bus 508. The processor 502 may contain microcircuits that are configurable, temporarily or permanently, by some or all of the instructions 524 such that the processor 502 is configurable to perform any one or more of the methodologies described herein, in whole or in part. For example, a set of one or more microcircuits of the processor 502 may be configurable to execute one or more modules (e.g., software modules) described herein.

[0043] The machine 500 may further include a graphics display 510 (e.g., a plasma display panel (PDP), a light emitting diode (LED) display, a liquid crystal display (LCD), a projector, a cathode ray tube (CRT), or any other display capable of displaying graphics or video). The machine 500 may also include an alphanumeric input device 512 (e.g., a keyboard or keypad), a cursor control device 514 (e.g., a mouse, a touchpad, a trackball, a joystick, a motion sensor, an eye tracking device, or other pointing instrument), a storage unit 516, a signal generation device 518 (e.g., a sound card, an amplifier, a speaker, a headphone jack, or any suitable combination thereof), and a network interface device 520.

[0044] The storage unit 516 includes the machine-storage medium 522 (e.g., a tangible machine-readable storage medium) on which are stored the instructions 524 embodying any one or more of the methodologies or functions described herein. The instructions 524 may also reside, completely or at least partially, within the main memory 504, within the processor 502 (e.g., within the processor's cache memory), or both, before or during execution thereof by the machine 500. Accordingly, the main

Pinterest Ex. 1004 Page 286 of 371

memory 504 and the processor 502 may be considered machine-storage media 522 (e.g., tangible and non-transitory machine-storage media).

[0045] In some example embodiments, the machine 500 may be a portable computing device and have one or more additional input components (e.g., sensors or gauges). Examples of such input components include an image input component (e.g., one or more cameras), an audio input component (e.g., a microphone), a direction input component (e.g., a compass), a location input component (e.g., a global positioning system (GPS) receiver), an orientation component (e.g., a gyroscope), a motion detection component (e.g., one or more accelerometers), an altitude detection component (e.g., an altimeter), and a gas detection component (e.g., a gas sensor). Inputs harvested by any one or more of these input components may be accessible and available for use by any of the modules described herein.

EXECUTABLE INSTRUCTIONS AND MACHINE-STORAGE MEDIUM

[0046] The various memories (i.e., 504, 506, and/or memory of the processor(s) 502) and/or storage unit 516 may store one or more sets of instructions and data structures (e.g., software) 524 embodying or utilized by any one or more of the methodologies or functions described herein. These instructions, when executed by processor(s) 502 cause various operations to implement the disclosed embodiments.

[0047] As used herein, the terms "machine-storage medium," "device-storage medium," "computer-storage medium" (referred to collectively as "machine-storage medium 522") mean the same thing and may be used interchangeably in this disclosure. The terms refer to a single or multiple storage devices and/or media (e.g., a centralized or distributed database, and/or associated caches and servers) that store executable instructions and/or data, as well as cloud-based storage systems or storage networks that include multiple storage apparatus or devices. The terms shall accordingly be taken to include, but not be limited to, solid-state memories, and optical and magnetic media, including memory internal or external to processors. Specific examples of machine-storage media, computer-storage media, and/or device-storage media 522 include non-volatile memory, including by way of example semiconductor memory devices, e.g., erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), FPGA, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks;

Pinterest Ex. 1004 Page 287 of 371

and CD-ROM and DVD-ROM disks. The terms machine-storage media, computer-storage media, and device-storage media 522 specifically exclude carrier waves, modulated data signals, and other such media, at least some of which are covered under the term "signal medium" discussed below.

SIGNAL MEDIUM

[0048] The term "signal medium" or "transmission medium" shall be taken to include any form of modulated data signal, carrier wave, and so forth. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a matter as to encode information in the signal.

COMPUTER READABLE MEDIUM

[0049] The terms "machine-readable medium," "computer-readable medium" and "device-readable medium" mean the same thing and may be used interchangeably in this disclosure. The terms are defined to include both machine-storage media and signal media. Thus, the terms include both storage devices/media and carrier waves/modulated data signals.

[0050] The instructions 524 may further be transmitted or received over a communications network 526 using a transmission medium via the network interface device 520 and utilizing any one of a number of well-known transfer protocols (e.g., HTTP). Examples of communication networks 526 include a local area network (LAN), a wide area network (WAN), the Internet, mobile telephone networks, plain old telephone service (POTS) networks, and wireless data networks (e.g., WiFi, LTE, and WiMAX networks). The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding, or carrying instructions 524 for execution by the machine 500, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

[0051] Throughout this specification, plural instances may implement components, operations, or structures described as a single instance. Although individual operations of one or more methods are illustrated and described as separate operations, one or more of the individual operations may be performed concurrently, and nothing requires that the operations be performed in the order illustrated. Structures and functionality presented as separate components in example configurations may be implemented as a

Pinterest Ex. 1004 Page 288 of 371

combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements fall within the scope of the subject matter herein.

[0052] Certain embodiments are described herein as including logic or a number of components, modules, or mechanisms. Modules may constitute either software modules (e.g., code embodied on a machine-storage medium 522 or in a transmission signal) or hardware modules. A "hardware module" is a tangible unit capable of performing certain operations and may be configured or arranged in a certain physical manner. In various example embodiments, one or more computer systems (e.g., a standalone computer system, a client computer system, or a server computer system) or one or more hardware modules of a computer system (e.g., a processor 502 or a group of processors 502) may be configured by software (e.g., an application or application portion) as a hardware module that operates to perform certain operations as described herein.

[0053] In some embodiments, a hardware module may be implemented mechanically, electronically, or any suitable combination thereof. For example, a hardware module may include dedicated circuitry or logic that is permanently configured to perform certain operations. For example, a hardware module may be a special-purpose processor, such as a field-programmable gate array (FPGA) or an ASIC. A hardware module may also include programmable logic or circuitry that is temporarily configured by software to perform certain operations. For example, a hardware module may include software encompassed within a general-purpose processor or other programmable processor. It will be appreciated that the decision to implement a hardware module mechanically, in dedicated and permanently configured circuitry, or in temporarily configured circuitry (e.g., configured by software) may be driven by cost and time considerations.

[0054] Accordingly, the phrase "hardware module" should be understood to encompass a tangible entity, be that an entity that is physically constructed, permanently configured (e.g., hardwired), or temporarily configured (e.g., programmed) to operate in a certain manner or to perform certain operations described herein. As used herein, "hardware-implemented module" refers to a hardware module. Considering embodiments in which hardware modules are temporarily configured (e.g.,

Pinterest Ex. 1004 Page 289 of 371

programmed), each of the hardware modules need not be configured or instantiated at any one instance in time. For example, where a hardware module comprises a general-purpose processor configured by software to become a special-purpose processor, the general-purpose processor may be configured as respectively different special-purpose processors (e.g., comprising different hardware modules) at different times. Software may accordingly configure a processor, for example, to constitute a particular hardware module at one instance of time and to constitute a different hardware module at a different instance of time.

[0055] The various operations of example methods described herein may be performed, at least partially, by one or more processors that are temporarily configured (e.g., by software) or permanently configured to perform the relevant operations. Whether temporarily or permanently configured, such processors may constitute processor-implemented modules that operate to perform one or more operations or functions described herein. As used herein, "processor-implemented module" refers to a hardware module implemented using one or more processors.

[0056] Similarly, the methods described herein may be at least partially processor-implemented, a processor being an example of hardware. For example, at least some of the operations of a method may be performed by one or more processors or processor-implemented modules.

EXAMPLES

[0057] Example 1 is a method for optimizing a content change process. The method comprises causing playback, by a digital receiver, of a first piece of content; receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0058] In example 2, the subject matter of example 1 can optionally include determining whether the new piece of content is of a same type as the first piece of content, and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0059] In example 3, the subject matter of examples 1-2 can optionally include wherein the determining whether to preserve comprises detecting codec information for

Pinterest Ex. 1004 Page 290 of 371

the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0060] In example 4, the subject matter of examples 1-3 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0061] In example 5, the subject matter of examples 1-4 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0062] Example 6 is a system optimizing a content change process. The system includes one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0063] In example 7, the subject matter of example 6 can optionally include determining whether the new piece of content is of a same type as the first piece of content, and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0064] In example 8, the subject matter of examples 6-7 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0065] In example 9, the subject matter of examples 6-8 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0066] In example 10, the subject matter of examples 6-9 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types

Pinterest Ex. 1004 Page 291 of 371

indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0067] Example 11 is machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content, and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0068] In example 12, the subject matter of example 11 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0069] In example 13, the subject matter of examples 11-12 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0070] In example 14, the subject matter of examples 11-13 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0071] In example 15, the subject matter of examples 11-14 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0072] Some portions of the subject matter discussed herein may be presented in terms of algorithms or symbolic representations of operations on data stored as bits or binary digital signals within a machine memory (e.g., a computer memory). Such algorithms or symbolic representations are examples of techniques used by those of ordinary skill in the data processing arts to convey the substance of their work to others skilled in the art. As used herein, an "algorithm" is a self-consistent sequence of operations or similar processing leading to a desired result. In this context, algorithms and operations involve physical manipulation of physical quantities. Typically, but not

Pinterest Ex. 1004 Page 292 of 371

necessarily, such quantities may take the form of electrical, magnetic, or optical signals capable of being stored, accessed, transferred, combined, compared, or otherwise manipulated by a machine. It is convenient at times, principally for reasons of common usage, to refer to such signals using words such as "data," "content," "bits," "values," "elements," "symbols," "characters," "terms," "numbers," "numerals," or the like. These words, however, are merely convenient labels and are to be associated with appropriate physical quantities.

[0073] Unless specifically stated otherwise, discussions herein using words such as "processing," "computing," "calculating," "determining," "presenting," "displaying," or the like may refer to actions or processes of a machine (e.g., a computer) that manipulates or transforms data represented as physical (e.g., electronic, magnetic, or optical) quantities within one or more memories (e.g., volatile memory, non-volatile memory, or any suitable combination thereof), registers, or other machine components that receive, store, transmit, or display information. Furthermore, unless specifically stated otherwise, the terms "a" or "an" are herein used, as is common in patent documents, to include one or more than one instance. Finally, as used herein, the conjunction "or" refers to a non-exclusive "or," unless specifically stated otherwise.

[0074] Although an overview of the inventive subject matter has been described with reference to specific example embodiments, various modifications and changes may be made to these embodiments without departing from the broader scope of embodiments of the present invention. For example, various embodiments or features thereof may be mixed and matched or made optional by a person of ordinary skill in the art. Such embodiments of the inventive subject matter may be referred to herein, individually or collectively, by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept if more than one is, in fact, disclosed.

[0075] The embodiments illustrated herein are believed to be described in sufficient detail to enable those skilled in the art to practice the teachings disclosed. Other embodiments may be used and derived therefrom, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. The Detailed Description, therefore, is not to be taken in a limiting sense, and the scope of various embodiments is defined only by the appended claims, along with the full range of equivalents to which such claims are entitled.

Pinterest Ex. 1004 Page 293 of 371

[0076] Moreover, plural instances may be provided for resources, operations, or structures described herein as a single instance. Additionally, boundaries between various resources, operations, modules, engines, and data stores are somewhat arbitrary, and particular operations are illustrated in a context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within a scope of various embodiments of the present invention. In general, structures and functionality presented as separate resources in the example configurations may be implemented as a combined structure or resource. Similarly, structures and functionality presented as a single resource may be implemented as separate resources. These and other variations, modifications, additions, and improvements fall within a scope of embodiments of the present invention as represented by the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

Pinterest Ex. 1004 Page 294 of 371

CLAIMS

What is claimed is:

1. A method comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

2. The method of claim 1, further comprising:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

3. The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

4. The method of claim 3, further comprising preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

5. The method of claim 3, further comprising:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 295 of 371

6. A system comprising:

one or more hardware processors; and

a storage device storing instructions that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

7. The system of claim 6, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

8. The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

9. The system of claim 8, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

10. The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 296 of 371

11. A machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

12. The machine-readable medium of claim 11, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

13. The machine-readable medium of claim 12, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

14. The machine-readable medium of claim 13, wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

15. The machine-readable medium of claim 13, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

Pinterest Ex. 1004 Page 297 of 371

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 298 of 371

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2050-354WO1	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 18/46723	International filing date *(day/month/year)* 14 August 2018 (14.08.2018)	(Earliest) Priority Date *(day/month/year)* 08 September 2017 (08.09.2017)
Applicant OPENTV, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 8 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 3

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

Pinterest Ex. 1004 Page 299 of 371

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/46723

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04W 28/02 (2018.01)
CPC - H04W 28/02; H04W 12/06; H04W 28/10; H04N 19/463; H04N 19/30

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)
See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2011/0296047 A1 (Orr) 01 December 2011 (01.12.2011), para [0024]-[0026], [0029], [0031]-[0033], [0035]-[0037], [0039].	1-2, 6-7, 11-12 --- 3-5, 8-10, 13-15
Y	US 2017/0244924 A1 (Sony Corporation) 24 August 2017 (24.08.2017), para [0040]-[0042].	3-5, 8-10, 13-15
A	US 2009/0254657 A1 (Melnyk et al.) 08 October 2009 (08.10.2009), entire document.	1-15
A	US 2010/0158101 A1 (Wu et al.) 24 June 2010 (24.06.2010), entire document.	1-15
A	US 8,532,171 B1 (Narayanan et al.) 10 September 2013 (10.09.2013), entire document.	1-15

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent 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
26 September 2018	22 OCT 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: MONIQUE M. PERDOK
SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	22 OCT 2018

Applicant's or agent's file reference	FOR FURTHER ACTION
2050-354WO1	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 18/46723	14 August 2018 (14.08.2018)	08 September 2017 (08.09.2017)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04W 28/02 (2018.01)
CPC - H04W 28/02; H04W 12/06; H04W 28/10; H04N 19/463; H04N 19/30

Applicant OPENTV, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	26 September 2018	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 18/46723

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to **any nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Pinterest Ex. 1004 Page 302 of 371

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No

PCT/US 18/46723

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1 Statement

Novelty (N)	Claims	3-5, 8-10, 13-15	YES
	Claims	1-2, 6-7, 11-12	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-15	NO
Industrial applicability (IA)	Claims	1-15	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1-2, 6-7, 11-12 lack novelty under PCT Article 33(2) as being anticipated by US 2011/0296047 A1 to Orr.

Regarding claim 1, Orr discloses a method (method of playing media; para [0031]- "Referring now to FIG. 4, a process is depicted for operation of the computing device of FIG. 1 according to one or more embodiments. Process 400 may be performed by a media player application of a computing device and may be initiated by detection of a user selection of the media player application for playback of one or more media files at block 405"), comprising:

causing playback, by a digital receiver, of a first piece of content (media player playback first media; para [0032]- "Following detection of a user selection at block 405, the computing device may then initiate playback of the user selection at block 410, wherein a first media file is played. Playback by the media player application may include output of audio and/or video data depending on the type of media. In one exemplary embodiment, playback may include a graphical display associated with output levels of audio data. In another embodiment, a visual display and associated audio data may be output based on video data"; para [0033]- "In one embodiment, playback at block 410 may include loading a first media file, reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e.g., bit depth, bit rate, etc.) Further, playback of block 410 may include converting and sending audio data to the media player application");

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content (receiving selection of second media file; para [0035]- "Selection of a media file by the media player application may be based on one or more sources selected by the user and may further be selected based on one or more user preferences. The media player application may be configured to store user preferences for determining media files to subsequently load. Similarly, the media player application can select one or more media files based on media file type"; para [0036]- "At block 420, the application of the computing device may then load data for a second media file at the time period determined at block 405. This pre-loaded data may relate to only a portion of the second media file. In one embodiment, a buffer portion is pre-loaded, the buffer portion relating to only the initial period of the playback for the second media file. As will be discussed in more detail below with reference to FIGS. 5A-5C, the buffer portion may be pre-loaded in the time interval between the time period and the end time of the first media file. It may also be appreciated that header data associated with the media file may additionally be decoded during preloading of the buffer data in order to determine an endpoint of the media file for subsequent determinations of endpoints. The application may additionally buffer data for one or more additional media files); and

in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content (initiate playback of second media file using already prepared media player application with same audio characteristics including same bit rate"; para [0037]- "At block 425, the application can initiate playback of the second media file following termination of the first media file. By initiating data for the second media file, a seamless transition may be provided for playback wherein data from the second file is played immediately following the first media file without a delay between output of the media file data. In certain embodiments, initiating playback of the second media file at block 425 may be based on the media player application that is already on as described above with reference to block 410. Playback at block 425 may additionally include converting and sending media data to an already prepared media player application. The application can then continue playback of the second media file following termination of the buffer period at block 430. By way of example, the second media file may be loaded after the endpoint of the first media file and during playback of the previously decoded buffer portion. The remaining portion of the second media file may then be output seamlessly following the buffer portion. Accordingly, media files may be seamlessly output by the computing device"; para [0033]- "In one embodiment, playback at block 410 may include loading a first media file, reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e.g., bit depth, bit rate, etc.) Further, playback of block 410 may include converting and sending audio data to the media player application"; para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats. For audio data, media files may be converted to a single audio format, such as 16 bit data at 44.1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback")

---see continuation on supplemental page---

Pinterest Ex. 1004 Page 303 of 371

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No

PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of
Box No V 2 Citations and Explanations

Regarding claim 2, Orr discloses the method of claim 1 Orr discloses further comprising determining whether the new piece of content is of a same type as the first piece of content (if first media file and second media file are audio files then they are same format, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device Although not shown in FIG 4, process 400 may additionally include displaying output level data of the second media file, during playback of the first media file") and

based on the new piece of content being the same type as the first piece of content determining whether to preserve at least a portion of a playback pipeline (same pipeline is preserved if same audio files are played, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data, media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device")

Regarding claim 6, Orr discloses a system (computer system, para [0025]- "Referring now to the figures, FIG 3 depicts a simplified block diagram of a computing device according to one or more embodiments of the invention In one embodiment, computing device 300 relates to a media player, such as one or more of a personal media player and media player application") comprising

one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors (processors and instructions in memory, para [0025]- "As shown in FIG 3, computing device 300 includes processor 305, memory 310, input/output (I/O) interface 315, and display 320 Processor 305 may be configured to control operation of computing device 300 based on one or more computer executable instructions stored in memory 310, including a media player application for seamless playback of one or more media files Memory 310 may relate to one of RAM and ROM memories and may be configured to store one or more media files, and computer executable instructions for operation of computing device 300 As will be described below in more detail with respect to FIG 8, processor 300 may be configured to perform one or more media player application functions for seamless playback of media files") to perform operations comprising

causing playback, by a digital receiver, of a first piece of content (playback first media file, para [0026]- "Based on a user selection of I/O interface 315, processor 305 may be configured to run and/or select a media player application for playback of one or more media files For example, a user selection may initiate playback of one or more media files stored by memory 310 and/or stored by one or more devices coupled to device 300 via I/O interface 315", para [0032]- "Following detection of a user selection at block 405, the computing device may then initiate playback of the user selection at block 410, wherein a first media file is played Playback by the media player application may include output of audio and/or video data depending on the type of media In one exemplary embodiment, playback may include a graphical display associated with output levels of audio data In another embodiment, a visual display and associated audio data may be output based on video data", para [0033]- "In one embodiment, playback at block 410 may include loading a first media file, reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e g , bit depth, bit rate, etc) Further, playback of block 410 may include converting and sending audio data to the media player application"),

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content (para [0029]- "Computing device 300 may be configured to interoperate with one or more external devices for playback of media files stored on the external devices (e g , portable hard drives, removable memory portable media players, etc) In certain embodiments, device 300 may be configured to wirelessly receive one or more media files from a computing device via I/O interface 315 I/O interface 315 may include one or more ports for receiving media data, including ports for removable memory", para [0035]- "Selection of a media file by the media player application may be based on one or more sources selected by the user and may further be selected based on one or more user preferences The media player application may be configured to store user preferences for determining media files to subsequently load Similarly, the media player application can select one or more media files based on media file type"),

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content (initiate playback of second media file using already prepared media player application with same audio characteristics including same bitrate, para [0037]- "At block 425, the application can initiate playback of the second media file following termination of the first media file By initiating data for the second media file, a seamless transition may be provided for playback wherein data from the second file is played immediately following the first media file without a delay between output of the media file data In certain embodiments, initiating playback of the second media file at block 425 may be based on the media player application that is already on as described above with reference to block 410 Playback at block 425 may additionally include converting and sending media data to an already prepared media player application The application can then continue playback of the second media file following termination of the buffer period at block 430 By way of example, the second media file may be loaded after the endpoint of the first media file and during playback of the previously decoded buffer portion The remaining portion of the second media file may then be output seamlessly following the buffer portion Accordingly, media files may be seamlessly output by the computing device", para [0033]- "In one embodiment, playback at block 410 may include loading a first media file reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e g , bit depth bit rate etc) Further, playback of block 410 may include converting and sending audio data to the media player application")

---see continuation on supplemental page---

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No
PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of
Box No V 2 Citations and Explanations

Regarding claim 7, Orr discloses the system of claim 6 Orr discloses wherein the operations further comprise determining whether the new piece of content is of a same type as the first piece of content (if first media file and second media file are audio files then they are same format, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data, media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device Although not shown in FIG 4 process 400 may additionally include displaying output level data of the second media file, during playback of the first media file") and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline (same pipeline is preserved, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data, media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device")

Regarding claim 11, Orr discloses a machine-readable medium storing instructions that when executed by one or more hardware processors of a machine (processor readable medium, para [0024]- "When implemented in software, the elements of the invention are essentially the code segments to perform the necessary tasks The code segments can be stored in a processor readable medium, which may include any medium that can store or transfer information Examples of the processor readable mediums include an electronic circuit, a semiconductor memory device, a read-only memory (ROM) a flash memory or other non-volatile memory, a floppy diskette, a CD-ROM, an optical disk, a hard disk") cause the machine to perform operations comprising

causing playback, by a digital receiver, of a first piece of content (playback first media file, para [0026]- "Based on a user selection of I/O interface 315, processor 305 may be configured to run and/or select a media player application for playback of one or more media files For example, a user selection may initiate playback of one or more media files stored by memory 310 and/or stored by one or more devices coupled to device 300 via I/O interface 315", para [0032]- "Following detection of a user selection at block 405, the computing device may then initiate playback of the user selection at block 410, wherein a first media file is played Playback by the media player application may include output of audio and/or video data depending on the type of media In one exemplary embodiment, playback may include a graphical display associated with output levels of audio data In another embodiment, a visual display and associated audio data may be output based on video data", para [0033]- "In one embodiment, playback at block 410 may include loading a first media file, reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e g , bit depth, bit rate, etc) Further, playback of block 410 may include converting and sending audio data to the media player application"),

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content (para [0029]- "Computing device 300 may be configured to interoperate with one or more external devices for playback of media files stored on the external devices (e g , portable hard drives, removable memory, portable media players, etc) In certain embodiments, device 300 may be configured to wirelessly receive one or more media files from a computing device via I/O interface 315 I/O interface 315 may include one or more ports for receiving media data, including ports for removable memory"; para [0035]- "Selection of a media file by the media player application may be based on one or more sources selected by the user and may further be selected based on one or more user preferences The media player application may be configured to store user preferences for determining media files to subsequently load Similarly, the media player application can select one or more media files based on media file type"),

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content (initiate playback of second media file using already prepared media player application with same audio characteristics including same bitrate, para [0037]- "At block 425, the application can initiate playback of the second media file following termination of the first media file By initiating data for the second media file, a seamless transition may be provided for playback wherein data from the second file is played immediately following the first media file without a delay between output of the media file data In certain embodiments, initiating playback of the second media file at block 425 may be based on the media player application that is already on as described above with reference to block 410 Playback at block 425 may additionally include converting and sending media data to an already prepared media player application The application can then continue playback of the second media file following termination of the buffer period at block 430 By way of example, the second media file may be loaded after the endpoint of the first media file and during playback of the previously decoded buffer portion The remaining portion of the second media file may then be output seamlessly following the buffer portion Accordingly, media files may be seamlessly output by the computing device", para [0033]- "In one embodiment, playback at block 410 may include loading a first media file, reading at least a portion of the media data in to a buffer, and turning the media player application on for playback at pre-described audio characteristics (e g , bit depth, bit rate, etc) Further, playback of block 410 may include converting and sending audio data to the media player application")

---see continuation on supplemental page---

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No
PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of
Box No V 2 Citations and Explanations

Regarding claim 12, Orr discloses the machine readable medium of claim 11 Orr discloses further wherein the operations further comprises determining whether the new piece of content is of a same type as the first piece of content (if first media file and second media file are audio files then they are same format, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data, media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device Although not shown in FIG 4, process 400 may additionally include displaying output level data of the second media file, during playback of the first media file") and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline (same pipeline is preserved, para [0039]- "Another advantage of the media player application may be conversion of media files to a standard file format by the application, wherein the first and second media files are associated with different file formats For audio data, media files may be converted to a single audio format, such as 16 bit data at 44 1 kHz stereo by the media player application This can facilitate providing continuous data and removing possible sources of delay during playback In certain embodiment, it may be required to convert media files to a single output stream to allow for playback of an audio device")

Claims 3-5, 8-10, 13-15 lack an inventive step under PCT Article 33(3) as being obvious over Orr in view of US 2017/0244924 A1 to Sony Corporation (hereinafter Sony)

Regarding claim 3, Orr discloses the method of claim 2 Orr does not disclose wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information

Sony in the related art of content playback reducing switching delay discloses detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content(detect codec for new content, para [0040]- "FIG 2 is a flow chart that shows an operation of the reception apparatus 100 for storing codec mode information according to one example At step S200, the reception apparatus 100 begins receiving a selected service, for example by tuning to a channel to receive a broadcast signal (or data stream) carrying the service For example, the reception apparatus 100 tunes to the channel in response to a user channel selection or during an initial channel scan At step S202, the reception apparatus 100 determines one or more codec modes for processing the content provided by the service on that channel The one or more codec modes may be signaled in metadata received with the service"), and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information (para [0041] - "Thus, the reception apparatus 100 is able to reduce a delay in switching to content provided by a service or channel in the future by beginning to configure itself to process that service's or channel's content as soon as the service or channel is selected, without the need to extract and processing metadata for that service or channel Further, in certain embodiments, the table is organized based on the codec mode information For example, services or channels that use the same codec mode(s) are grouped together, as further described below", para [0042]- "FIG 3 is a flow chart that shows an operation of the reception apparatus 100 for processing content according to one example At step S300, the reception apparatus 100 receives a service or channel selection from the user For example, the user may input a channel number, which is associated with the service, using a remote control or using the channel up or channel down buttons of the remote control to select a channel The remote control sends control signals to the reception apparatus 100 indicating the channel selection of the user At step S302, the reception apparatus 100 tunes to the channel selected at step S300 to receive a broadcast signal (or data stream) The reception apparatus 100 identifies the one or more codec modes associated with the channel For example, the reception apparatus 100 may use the table stored in the reception apparatus 100 to identify the one or more codec modes As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table, the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

It would have been obvious to a person having ordinary skill in the art to modify the method of Orr with the teaching of determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information as disclosed by Sony as this would have provided the advantage for preparing the appropriate decoders for new contents without causing delay (para [0040]-[0042])

---see continuation on supplemental page---

Pinterest Ex. 1004 Page 306 of 371

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No
PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of
Box No V 2 Citations and Explanations

Regarding claim 4, Orr in view of Sony discloses the method of claim 3 Sony discloses further comprising preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information (para [0042]- "In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

Regarding claim 5, Orr in view of Sony discloses the method of claim 3 Sony discloses further comprising releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information, and obtaining a new audio decoder and a new video decoder based on the codec information (para [0042]- "As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

Regarding claim 8, Orr discloses the system of claim 7 Orr does not disclose wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information

Sony in the related art discloses the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content (detect codec for new content, para [0040]- "FIG 2 is a flow chart that shows an operation of the reception apparatus 100 for storing codec mode information according to one example At step S200, the reception apparatus 100 begins receiving a selected service, for example by tuning to a channel to receive a broadcast signal (or data stream) carrying the service For example, the reception apparatus 100 tunes to the channel in response to a user channel selection or during an initial channel scan At step S202, the reception apparatus 100 determines one or more codec modes for processing the content provided by the service on that channel The one or more codec modes may be signaled in metadata received with the service (e g , in the broadcast signal) For example, the metadata may identify the one or more encoding formats (e g , audio and/or video encoding formats) used to encode the content and/or one or more codecs for decoding the one or more encoding formats In one example, the audio codec mode may include any one or a combination of AC-3, AC-4, MPEG-H, and AAC The video codec mode may include MPEG-2, AVC, and HEVC"); and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information (para [0041] - "Thus, the reception apparatus 100 is able to reduce a delay in switching to content provided by a service or channel in the future by beginning to configure itself to process that service's or channel's content as soon as the service or channel is selected, without the need to extract and processing metadata for that service or channel Further, in certain embodiments, the table is organized based on the codec mode information For example, services or channels that use the same codec mode(s) are grouped together, as further described below", para [0042]- "FIG 3 is a flow chart that shows an operation of the reception apparatus 100 for processing content according to one example At step S300, the reception apparatus 100 receives a service or channel selection from the user For example, the user may input a channel number, which is associated with the service, using a remote control or using the channel up or channel down buttons of the remote control to select a channel The remote control sends control signals to the reception apparatus 100 indicating the channel selection of the user At step S302, the reception apparatus 100 tunes to the channel selected at step S300 to receive a broadcast signal (or data stream) The reception apparatus 100 identifies the one or more codec modes associated with the channel For example, the reception apparatus 100 may use the table stored in the reception apparatus 100 to identify the one or more codec modes As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table, the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

It would have been obvious to a person having ordinary skill in the art to modify the system of Orr with the teaching of determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information as disclosed by Sony as this would have provided the advantage for preparing the appropriate decoders for new contents without causing delay (para [0040]-[0042])

---see continuation on supplemental page---

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No
PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of
Box No V 2 Citations and Explanations
Regarding claim 9, Orr in view of Sony discloses the system of claim 8 Sony discloses wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information (para [0042]- "In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

Regarding claim 10, Orr in view of Sony discloses the system of claim 8 Sony discloses wherein the operations further comprise releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information, and obtaining a new audio decoder and a new video decoder based on the codec information (para [0042]- "As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table, the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

Regarding claim 13, Orr discloses the machine-readable medium of claim 12 Orr does not disclose wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information
Sony in the related art discloses detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content (detecting codec in new content, para [0040]- "FIG 2 is a flow chart that shows an operation of the reception apparatus 100 for storing codec mode information according to one example At step S200, the reception apparatus 100 begins receiving a selected service, for example by tuning to a channel to receive a broadcast signal (or data stream) carrying the service For example, the reception apparatus 100 tunes to the channel in response to a user channel selection or during an initial channel scan At step S202, the reception apparatus 100 determines one or more codec modes for processing the content provided by the service on that channel The one or more codec modes may be signaled in metadata received with the service (e g , in the broadcast signal) For example, the metadata may identify the one or more encoding formats (e g , audio and/or video encoding formats) used to encode the content and/or one or more codecs for decoding the one or more encoding formats In one example, the audio codec mode may include any one or a combination of AC-3, AC-4, MPEG-H, and AAC The video codec mode may include MPEG-2, AVC, and HEVC"), and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information (para [0041] - "Thus, the reception apparatus 100 is able to reduce a delay in switching to content provided by a service or channel in the future by beginning to configure itself to process that service's or channel's content as soon as the service or channel is selected, without the need to extract and processing metadata for that service or channel Further, in certain embodiments, the table is organized based on the codec mode information For example, services or channels that use the same codec mode(s) are grouped together, as further described below", para [0042]- "FIG. 3 is a flow chart that shows an operation of the reception apparatus 100 for processing content according to one example At step S300, the reception apparatus 100 receives a service or channel selection from the user For example, the user may input a channel number, which is associated with the service, using a remote control or using the channel up or channel down buttons of the remote control to select a channel The remote control sends control signals to the reception apparatus 100 indicating the channel selection of the user At step S302, the reception apparatus 100 tunes to the channel selected at step S300 to receive a broadcast signal (or data stream) The reception apparatus 100 identifies the one or more codec modes associated with the channel For example, the reception apparatus 100 may use the table stored in the reception apparatus 100 to identify the one or more codec modes As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table. the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

It would have been obvious to a person having ordinary skill in the art to modify the medium of Orr with the teaching of determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content, and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information as disclosed by Sony as this would have provided the advantage for preparing the appropriate decoders for new contents without causing delay (para [0040]-[0042])
---see continuation on supplemental page--

Pinterest Ex. 1004 Page 308 of 371

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No
PCT/US 18/46723

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of
Box No V 2 Citations and Explanations

Regarding claim 14, On in view of Sony discloses the machine-readable medium of claim 13 Sony discloses wherein the operations further comprise preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information (para [0042]- "As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table, the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata")

Regarding claim 15, On in view of Sony discloses the machine-readable medium of claim 13 Sony discloses wherein the operations further comprise
releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information, and obtaining a new audio decoder and a new video decoder based on the codec information (para [0042]- "As described previously herein, an indication of the one or more codec modes associated with each channel and/or service is stored in the table according to the methodology shown in FIG 2 Further, in response to determining that an indication of the one or more codec modes associated with the channel is not stored in the table, the reception apparatus 100 may extract, or otherwise determine, the one or more codec modes from the metadata In one embodiment, even when the indication of the one or more codec modes is stored, the reception apparatus 100 processes the metadata to confirm whether the stored information is accurate either during or before the reception apparatus 100 configures itself based on the previously indicated one or more codec modes At step S304, the reception apparatus 100 processes the content for presentation to the user For example, the reception apparatus loads one or more codecs, or performs routing, according to the one or more codec modes identified at step S302 to decode the broadcast signal Then, the content is displayed to the user")

Claims 1-15 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry

Pinterest Ex. 1004 Page 309 of 371

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Filer:	Garrett M. Hall/Farah O'Sullivan
Attorney Docket Number:	2050.354US1

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
NATIONAL STAGE FEE	1631	1	300	300
NATL STAGE SEARCH FEE - U.S. WAS THE ISA	1641	1	140	140
NATIONAL STAGE EXAM - ALL OTHER CASES	1633	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

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

Electronic Acknowledgement Receipt	
EFS ID:	38805868
Application Number:	16645598
International Application Number:	PCT/US2018/046723
Confirmation Number:	7292
Title of Invention:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
First Named Inventor/Applicant Name:	Amarendra N. Gogoi
Customer Number:	44367
Filer:	Garrett M. Hall/Farah O'Sullivan
Filer Authorized By:	Garrett M. Hall
Attorney Docket Number:	2050.354US1
Receipt Date:	09-MAR-2020
Filing Date:	
Time Stamp:	13:50:13
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1200
RAM confirmation Number	E202039D51440342
Deposit Account	190743
Authorized User	Farah O'Sullivan
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.17 (Patent application and reexamination processing fees) 37 CFR 1.19 (Document supply fees)	

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SIGNED_2050-354US1_App.pdf	1354941 b8a0168dc567cb5613dda301dcb07fa5562ff23c	yes	57

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal of New Application	1	1
Transmittal of New Application	2	4
Application Data Sheet	5	11
Oath or Declaration filed	12	12
Power of Attorney	13	13
Preliminary Amendment	14	14
Specification	15	15
Claims	16	20
Applicant Arguments/Remarks Made in an Amendment	21	21
Abstract	22	22
Documents submitted with 371 Applications	23	23
Specification	24	44
Claims	45	48
Drawings-only black and white line drawings	49	53
Documents submitted with 371 Applications	54	54

	Transmittal Letter		55	56	
	Information Disclosure Statement (IDS) Form (SB08)		57	57	
Warnings:					
Information:					
2	Foreign Reference	TW201931861A.pdf	290164 5fc3f89bec93698216cb9a8eae16284110f762ce	no	3
Warnings:					
Information:					
3	Foreign Reference	WO2019050660A1.pdf	4030257 22dc14bf9ad610b3b3c281e155b217d170926ed0	no	27
Warnings:					
Information:					
4	Non Patent Literature	2050354WO1_P210_10222018.pdf	383258 d3c95fc343c2994f41fc2628228400c1fb4967f1	no	2
Warnings:					
Information:					
5	Non Patent Literature	2050354WO1_P237_10222018.pdf	2732515 23480a463ebdfb04b7177d26d706cd4831fc8a7c	no	9
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	35072 c0b11be08e0b5b7aaffc6cdfd27e6400f34046a7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	8826207		

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.

Amended PTO/AIA/82B(07-13)
Approved for use through 11/30/2014. OMB 0651-0035
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.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 44367

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above mentioned Customer Number.
OR
☐ The address associated with Customer Number:
OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

OpenTV, Inc.

☐ Inventor or Joint Inventor (title not required below)
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	Sue Chernesky		
Title	SVP, IP & Innovation		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Amarendra N. Gogoi *et al.*	Examiner: Unknown
Serial No.:	Unknown	Group Art Unit: Unknown
Filed:	Herewith	Docket No.: 2050.354US1
Customer No.:	44367	Confirmation No.: Unknown
Title:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

PRELIMINARY AMENDMENT

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

Prior to taking up this application for examination, please enter the following amendments.

IN THE SPECIFICATION

Please amend paragraph **[0001]** of the specification as follows:

[0001] This application is a U.S. National Stage filing from PCT Application No. PCT/US2018/046723, filed on August 14, 2018, which claims priority to Indian Application Serial No. 201741031917, filed on September 8, 2017, which [[is]]are incorporated herein by reference in [[its]]their ~~entirety~~entireties.

IN THE CLAIMS

Please amend the claims as follows, which were presented in an Article 34 amendment filed in PCT Application No. PCT/US2018/046723:

1. (Currently Amended) A method comprising:

causing playback, by a digital receiver, of a first piece of content at a first bitrate;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; [[and]]

in response to the receiving of the selection, transitioning to the new piece of content by initiating playback of the new piece of content using ~~maintaining, by a processor of the digital receiver, a~~ the first bitrate used for playback of the first piece of content; ~~to initiate playback of the new piece of content~~;

detecting whether the new content can maintain playback at the first bitrate; and

in response to the detecting that the new content cannot continue playback at the first bitrate, adjusting the first bitrate.

2. (Currently Amended) The method of claim 1, further comprising:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to play back the first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

3. (Currently Amended) The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether [[an]]the audio decoder and the [[a]] video decoder in the playback pipeline are of the types indicated by the codec information.

4. (Currently Amended) The method of claim 3, further comprising preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

5. (Currently Amended) The method of claim 3, further comprising:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

6. (Currently Amended) A system comprising:

one or more hardware processors; and

a storage device storing instructions that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content at a first bitrate;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; [[and]]

in response to the receiving of the selection, transitioning to the new piece of content by initiating playback of the new piece of content using the first ~~maintaining a~~ bitrate used for playback of the first piece of content; ~~to initiate playback of the new piece of content~~

detecting whether the new content can maintain playback at the first bitrate; and

in response to the detecting that the new content cannot continue playback at the first bitrate, adjusting the first bitrate.

7. (Currently Amended) The system of claim 6, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to play back the

first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

8. (Currently Amended) The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content;

determining whether [[an]]the audio decoder and [[a]]the video decoder in the playback pipeline are of the types indicated by the codec information.

9. (Currently Amended) The system of claim 8, wherein the operations further comprise preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

10. (Currently Amended) The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

11. (Currently Amended) A machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, transitioning to the new piece of content by initiating playback of the new piece of content using the first ~~maintaining a~~ bitrate used for playback of the first piece of content ~~to initiate playback of the new piece of content~~

detecting whether the new content can maintain playback at the first bitrate; and

in response to the detecting that the new content cannot continue playback at the first bitrate, adjusting the first bitrate.

12. (Currently Amended) The machine-readable medium of claim 11, wherein the operations further comprise:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline used to playback the first piece of content, the preserving of at least the portion of the playback pipeline comprising preserving one or more of a source element, a demultiplexer, an audio decoder, or a video decoder.

13. (Currently Amended) The machine-readable medium of claim 12, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether the[[an]] audio decoder and [[a]]the video decoder in the playback pipeline are of the types indicated by the codec information.

14. (Currently Amended) The machine-readable medium of claim 13, wherein the operations further comprise preserving the entire playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being the types indicated by the codec information.

15. (Currently Amended) The machine-readable medium of claim 13, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the playback pipeline in response to the audio decoder and the video decoder in the playback pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

16. (New) The method of claim 1, wherein:

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated; and

the adjusting comprises increasing the first bitrate.

17. (New) The method of claim 1, wherein:

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking longer than anticipated; and

the adjusting comprises decreasing the first bitrate.

18. (New) The system of claim 6, wherein:

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated; and

the adjusting comprises increasing the first bitrate.

19. (New) The system of claim 6, wherein:

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download is taking longer than anticipated; and

the adjusting comprises decreasing the first bitrate.

20. (New) The machine-readable medium of claim 11 wherein:

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download of the new content is taking less time than anticipated and the adjusting comprises increasing the first bitrate; or

the detecting whether the new content can maintain playback at the first bitrate comprises determining that download is taking longer than anticipated and the adjusting comprises decreasing the first bitrate.

REMARKS

The specification has been amended to add a statement of the claim of priority as the first paragraph in the specification. No new matter has been added by these amendments to the specification.

The claims were previously amended in an Article 34 amendment filed in International Application PCT/US2018/046723.

Applicant respectfully submit that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's' representative at (408) 278-4057 to facilitate prosecution of this application.

If necessary, please charge any additional fees or deficiencies, or credit any overpayments to Deposit Account No. 19-0743.

Respectfully Submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, Minnesota 55402
(408) 278-4057

Date March 9, 2020 By /Susan Yee/
Susan Yee
Reg. No. 41,388

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/46723

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H04W 28/02 (2018.01)
CPC - H04W 28/02; H04W 12/06; H04W 28/10; H04N 19/463; H04N 19/30

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)
See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2011/0296047 A1 (Orr) 01 December 2011 (01.12.2011), para [0024]-[0026], [0029], [0031]-[0033], [0035]-[0037], [0039].	1-2, 6-7, 11-12 ---------- 3-5, 8-10, 13-15
Y	US 2017/0244924 A1 (Sony Corporation) 24 August 2017 (24.08.2017), para [0040]-[0042].	3-5, 8-10, 13-15
A	US 2009/0254657 A1 (Mehnyk et al.) 08 October 2009 (08.10.2009), entire document.	1-15
A	US 2010/0158101 A1 (Wu et al.) 24 June 2010 (24.06.2010), entire document.	1-15
A	US 8,532,171 B1 (Narayanan et al.) 10 September 2013 (10.09.2013), entire document.	1-15

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent 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
26 September 2018	22 OCT 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA /210 (second sheet) (January 2015)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Amarendra N. Gogoi et al.	Examiner:	Unknown
Serial No.:	Unknown	Group Art Unit:	Unknown
Filed:	Herewith	Docket:	2050.354US1
Customer No.:	44367	Confirmation No.:	Unknown
Title:	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION		

INFORMATION DISCLOSURE STATEMENT

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

In compliance with the duty imposed by 37 C.F.R. § 1.56, and in accordance with 37 C.F.R. §§ 1.97 *et. seq.*, the enclosed materials are brought to the attention of the Examiner for consideration in connection with the above-identified patent application. Applicant respectfully requests that this Information Disclosure Statement be entered and the documents listed on the attached PTO 1449 Form be considered by the Examiner and made of record. Pursuant to the provisions of MPEP 609, Applicant requests that a copy of the PTO 1449 Form, initialed as being considered by the Examiner, be returned to the Applicant with the next official communication.

Pursuant to 37 C.F.R. § 1.98(a)(2), copies of cited U.S. Patents and Published Applications, and Non-Published Applications identifiable by USPTO Serial Number, are no longer required to be provided to the Office. Applicant acknowledges the requirement to submit copies of foreign patent documents and non-patent literature in accordance with 37 C.F.R § 1.98(a)(2).

The Examiner is invited to contact the undersigned at the telephone number indicated if there are any questions regarding this communication.

Respectfully submitted,

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(408) 278-4057

Date March 9, 2020 By /Susan Yee/
Susan Yee
SY:fo Reg. No. 41,388

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 March 2019 (14.03.2019)

W IP O | PCT

(10) International Publication Number
WO 2019/050660 A1

(51) International Patent Classification:
H04W 28/02 (2009.01)

(21) International Application Number:
PCT/US20 18/046723

(22) International Filing Date:
14 August 2018 (14.08.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20174103 1917 08 September 2017 (08.09.2017) IN

(71) Applicant: **OPENTV, INC.** [US/US]; 275 Sacramento Street, San Francisco, California 941 11 (US).

(72) Inventors: **GOGOI, Amarendra N.;** 275 Sacramento Street, San Francisco, California 941 11 (US). **GUPTA, Sanjay Kumar;** RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN). **SWAMI, Ravikant;** RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore 560 048 (IN).

(74) Agent: **PERDOK, Monique M.** et al; Schwegman Lundberg & Woessner, P.A., P.O. Box 2938, Minneapolis, Minnesota 55402 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) **Title:** BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

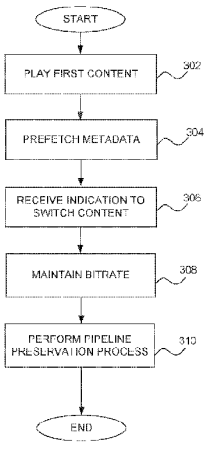


FIG. 3

(57) **Abstract:** Systems and methods for optimizing a content change process are provided. In example embodiments, a digital receiver causes playback of a first piece of content. The digital receiver receives a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

WO 2019/050660 A1

[Continued on next page]

Published:
— *with international search report (Art. 21(3))*

BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION

CLAIM OF PRIORITY

[0001] This application claims priority to India Application Serial No. 201741031917, filed on September 8, 2017, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure generally relates to machines configured to the technical field of special-purpose machines that optimizes a content change process (e.g., channel change) including computerized variants of such special-purpose machines and improvements to such variants, and to the technologies by which such special-purpose machines become improved compared to other special-purpose machines that facilitate optimizing content changes. In particular, the present disclosure addresses systems and methods for preserving a download bitrate and a content playback pipeline during a content change process.

BACKGROUND

[0003] Conventionally, during a switch in content (e.g., caused by a channel change or a selection of a different piece of content), a delay occurs as certain information is obtained before the new piece of content (e.g., program, movie, show) is rendered and displayed. Additionally, for adaptive bitrate streaming content, the content typically starts streaming or download at a low (or lowest) bitrate before slowly increasing in bitrate until an optimum bitrate is achieved. This results in initial video or images being grainy. Furthermore, the delay may be increased by a need to build a content playback pipeline each time a change in content occurs.

Pinterest Ex. 1004 Page 330 of 371

BRIEF DESCRIPTION OF DRAWINGS

[0004] Various ones of the appended drawings merely illustrate example embodiments of the present invention and cannot be considered as limiting its scope.

[0005] FIG. 1 is a diagram illustrating an example environment for optimizing content changes;

[0006] FIG. 2 is a block diagram illustrating an example embodiment of components within a digital receiver in accordance with an example embodiment.

[0007] FIG. 3 is a flow diagram of a method for optimizing a content change process in accordance with example embodiments.

[0008] FIG. 4 is a flow diagram of a method for preserving a content deliver}' pipeline in accordance with example embodiments.

[0009] FIG. 5 is a diagrammatic representation of a machine in an example form of a computing system within which a set of instructions may be executed for causing the machine to perform any one or more of the methodologies discussed herein, according to an example embodiment.

Pinterest Ex. 1004 Page 331 of 371

PET AILED DESCRIPTION

[0010] The description that follows includes systems, methods, techniques, instruction sequences, and computing machine program products that embody illustrative embodiments of the present inventive subject matter. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide an understanding of various embodiments of the inventive subject matter. It will be evident, however, to those skilled in the art, that embodiments of the inventive subject matter may be practiced without some or other of these specific details. In general, well-known instruction instances, protocols, structures, and techniques have not been shown in detail. Examples merely typify possible variations. Unless explicitly stated otherwise, structures (e.g., structural components, such as modules) are optional and may be combined or subdivided, and operations (e.g., in a procedure, algorithm, or other function) may van,' in sequence or be combined or subdivided.

[0011] Example embodiments described herein provide systems and methods for optimizing content changes or switch in content being viewed, such as through a channel change or selection of a different piece of content from a watchlist. In some embodiments, the system uses navigational context (e.g., the way a user is interacting with an application) to identify content of (potential) interest to a viewer. The system then prefetches metadata for the content of interest from a content provider and stores the metadata to local cache. The metadata comprises preconditions for rendering and display of a piece of content that include a minimum set of data that a system can obtain without having to decrypt the content. The prefetched metadata may be used, in example embodiments, to determine whether to preserve at least a portion of a content playback pipeline (also referred to herein as a "content deliver pipeline" or simply a "pipeline").

[0012] Conventionally, a same piece of content is broken up into segments (e.g., 10 second segments) and each segment is available in various bitrates. A low bitrate may be grainy, while a high bitrate will normally have better image quality. Typically, when playback of a new piece of content starts, the system does not know the quality of the network bandwidth. As a result, in order to start playback as quickly as possible, conventional systems start with a lowest bitrate. Thus, every time a user switches from one content to the next content, the playback will start with the lowest bitrate and slowly increase or improve according the capability of the network. In contrast, example

Pinterest Ex. 1004 Page 332 of 371

embodiments, preserve a previous bitrate when switching to a new piece of content. That is, when a user selects a new piece of content to playback (e.g., switching from a previous piece of content to the new piece of content), example embodiments maintain or preserve a (heuristically determined) bitrate used for streaming or downloading the previous piece of content when initiating the playback of the new piece of content. This allows for starting playback as quickly as possible while also providing better image quality from the start.

[0013] Furthermore, in conventional systems, a switch or transition in content typically causes a previous content delivery pipeline to be deconstructed (e.g., resources previous acquired are released). Subsequently, a new pipeline is created for the new piece of content (e.g., new resources are acquired). In contrast, example embodiments may maintain or preserve a portion (or an entire) content delivery pipeline (e.g., comprising a source element, a demultiplexer ("demux"), a video decoder, and an audio decoder) used to obtain the previous piece of content instead of reconstructing a pipeline (e.g., destroying the content delivery pipeline and building a new content delivery pipeline). The preservation of the pipeline also allows for playback of the new content as quickly as possible.

[0014] As a result, one or more of the methodologies described herein facilitate solving the technical problem of optimizing content change (e.g., reducing time for a change in channel or loading of new content) regardless of the delivery channel - whether the content is broadcast (e.g., IPTV and multicast) or over-the-top (OTT). The methodologies include causing playback, by a digital receiver, of a first piece of content and receiving a selection of a new piece of content for playback during the playback of the first piece of content. In response to the receiving of the selection, the digital receiver maintains a bitrate used for playback of the first piece of content to initiate playback of the new piece of content. The methodologies further include determining whether to preserve at least a portion of a playback pipeline when switching to playback of the new piece of content. In some embodiments, preservation of at least a portion of the playback pipeline comprises determining whether to retrain an audio decoder and a video decoder of the pipeline when switching to playback of the new piece of content. Accordingly, one or more of the methodologies discussed herein improves upon latency during content changes while maintaining image quality. It is noted that content changes include a selection of a piece of content for viewing (e.g., from a content access

Pinterest Ex. 1004 Page 333 of 371

page such as a favorites grid or via a programming guide) as well as channel changes (e.g., linear channels changes).

[0015] With reference to FIG. 1, an embodiment of an example environment 100 that enables optimizing content changes (e.g., reducing latency during channel changes or selection of a piece of content for viewing) is shown. In example embodiments, a digital receiver 102 of a user provides access to digital content and manages content change operations. In one embodiment, the digital receiver 102 is a set-top box. The digital receiver 102 is coupled to a viewing device 104 (e.g., a television or monitor) on which the user can view the digital content. In some embodiments, the digital receiver 102 (e.g., operations of the digital receiver 102) may be combined with the viewing device 104 (e.g., a smart television, a tablet, or smartphone). The components of the digital receiver 102 used to perform operations of example embodiments will be discussed in more detail in connection with FIG. 2 below.

[0016] In some embodiments, the digital receiver 102 accesses (e.g., pulls, receives, retrieves) content via a network 106 from a content distribution network (CDN) server 108. The CDN server 108 may obtain the content from one or more content providers 110 (e.g., servers of the content providers 110). In example embodiments, the CDN server 108 may be associated with a third party service (e.g., Netflix, Hulu, YouTube, Amazon,) that stores and provides content, such as, for example but not limited to, over-the-top (OTT) content, video-on-demand (VOD) content, Internet content, or broadcast content to the digital receiver 102 via the network 106. The content comprises text, images, audio, and/or video content (e.g., movies, television shows, videos), and in some embodiments comprise live (e.g., in real-time) content. In some embodiments, the content providers 110 provide content, over the network 106 directly to the digital receiver 102 for display on the viewing device 104.

[0017] One or more portions of the network 106 may be an ad hoc network, an intranet, an extranet, a virtual private network (VPN), a local area network (LAN), a wireless LAN (WLAN), a wide area network (WAN), a wireless WAN (WWAN), a metropolitan area network (MAN), a portion of the Internet, a portion of the Public Switched Telephone Network (PSTN), a cellular telephone network, a wireless network, a WiFi network, a WiMax network, a satellite network, a cable network, a broadcast network, another type of network, or a combination of two or more such networks. Any one or more portions of the network 106 may communicate information via a

Pinterest Ex. 1004 Page 334 of 371

transmission or signal medium. As used herein, "transmission medium" refers to any intangible (e.g., transitory) medium that is capable of communicating (e.g., transmitting) instructions for execution by a machine (e.g., by one or more processors of such a machine), and includes digital or analog communication signals or other intangible media to facilitate communication of such software.

[0018] It is noted that the environment 100 shown in FIG. 1 is merely an example. For instance, any number of CDN servers 108 and content providers 110 may be embodied within the environment 100. Additionally, some components of the environment 100 may be combined. For example, the functions of the digital receiver 102 may be embodied within the viewing device 104 to form a single device, such as a smart television, tablet, smartphone, or any other device that is capable of obtaining, rendering, and displaying content. Moreover, the functions described herein for any single system or machine may be subdivided among multiple systems or machines.

[0019] Any of the systems or machines (e.g., databases, devices, servers) shown in, or associated with, FIG. 1 may be, include, or otherwise be implemented in a speeial-purpose (e.g., specialized or otherwise non-generic) computer that has been modified (e.g., configured or programmed by software, such as one or more software modules of an application, operating system, firmware, middleware, or other program) to perform one or more of the functions described herein for that system or machine. For example, a special-purpose computer system able to implement any one or more of the methodologies described herein is discussed below with respect to FIG. 5, and such a special-purpose computer may accordingly be a means for performing any one or more of the methodologies discussed herein. Within the technical field of such special-purpose computers, a special-purpose computer that has been modified by the structures discussed herein to perform the functions discussed herein is technically improved compared to other special-purpose computers that lack the structures discussed herein or are otherwise unable to perform the functions discussed herein. Accordingly, a special-purpose machine configured according to the systems and methods discussed herein provides an improvement to the technology of similar special-purpose machines.

[0020] FIG. 2 is a block diagram illustrating an example embodiment of components within the digital receiver 102 in accordance with an example embodiment. In example embodiments, the digital receiver 102 manages access to content streamed over the network 106. In particular, the digital receiver 102 prefetches metadata, preserves a

Pinterest Ex. 1004 Page 335 of 371

bitrate used for playback (e.g., streaming or downloading) of a previous piece of content when initiating the playback of a new piece of content, and preserves at least a portion of a content delivery pipeline. To enable these operations, the digital receiver 102 comprises a player 202, a content delivery pipeline 204 (also referred to as "pipeline"), a cache manager 206, and a cache 208, all of which may be configured to communicate with each other (e.g., over a bus, shared memory, or a switch). The digital receiver 102 comprises other components (not shown) that are not pertinent to operations of example embodiments.

[0021] The player 202 is configured to manage the pipeline 204. In example embodiments, the player 204 instantiates (e.g., constructs) the pipeline 204 when a first piece of content is selected for display. A different pipeline may be constructed for each type of content. For example, the player 202 constructs a HTTP Live Streaming (HLS) pipeline for HLS content and constructs a Dynamic Adaptive Streaming over HTTP (DASH) pipeline for DASH content. The player 204 also decides whether to maintain at least a portion of the pipeline 204 or construct a new pipeline when a switch in content occurs (e.g., channel change or selection of new content for viewing). An example method for managing the preservation of the pipeline is discussed in further detail in connection with FIG. 4 below.

[0022] The pipeline 204 is constructed by the player 202 by acquiring appropriate resources for obtaining and processing content data in order to playback selected content. The resources of the pipeline 204 comprise a source element 212, a demultiplexer ("demux") 214, an audio decoder 216, and a video decoder 218. The source element 212 manages the downloading of content data for the selected piece of content. The source element 212 also manages bitrate adaptation at the digital receiver 102. Specifically, the source element 212 remembers a last bitrate that is used for playback of a current/previous piece of content, and continues to use that bitrate for playback of the new content. As such, if the last bitrate is high, the source element 212 will start with the same high bitrate for the new content. If the new content cannot be playback at that bitrate, then the source element 212 will lower the bitrate. For example, if the downloading of the content takes less time than anticipated, there is spare bandwidth and the bitrate can be increased. Conversely, if the download is taking longer than anticipated, then the bitrate is decreased. As such, example embodiments,

Pinterest Ex. 1004 Page 336 of 371

will start the playback of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing).

[0023] The demux demultiplexes the content data obtained from the CDN server 108 or the content provider 110 to obtain an audio signal and a video signal. The audio signal is transmitted to the audio decoder 216 for processing, while the video signal is transmitted to the video decoder 218 for processing. The results from the audio and video decoders 216 and 218 are output (e.g., transmitted) to the viewing device 104 for presentation to the user.

[0024] The cache manager 206 manages the prefetching of metadata for content that may potentially be selected for playback. In some embodiments, the cache manager 206 predicts content the user may be interested in viewing. For example, a user may be navigating a linear list of channels or programs (e.g., an electronic programming guide; "EPG") in a particular direction (e.g., up or down). In this embodiment, the cache manager 206 predicts a next set of content based on the direction of navigation on the linear list. In another example, the user may be viewing a video-on-demand (VoD) catalog or a watchlist of a user. If the user requests information or hovers over a selection for a piece of content, the cache manager 206 uses this as prediction that the piece of content is of interest to the user. Alternatively, the cache manager may consider all (or some) pieces of content in viewable portion of the catalog or watchlist as content of interest. In any of these cases, the cache manager 206 prefetches the metadata for the content of interest, and stores the prefetched data to the cache 208. The metadata may comprise, for example, one or more uniform resource locators (UHLs) where the chunks of content are available, URLs for different bit rates, license data (e.g., where to obtain a license from), and codec information. The codec information will be used by the player 202 to determine whether to preserve at least a portion of the pipeline 204, as will be discussed further below. If the user subsequently selects content for which the metadata is already prefetched, then the metadata can be accessed from the cache 208 instead of having to be retrieved over the network 106 from the CDN server 108 or the content provider 110 after selection. This will assist in the reduction of latency in playback.

[0025] Any one or more of the components (e.g., modules, decoders, resources) described herein may be implemented using hardware alone (e.g., one or more processors of a machine) or a combination of hardware and software. For example, any

Pinterest Ex. 1004 Page 337 of 371

component described herein may physically include an arrangement of one or more of the processors or configure a processor (e.g., among one or more processors of a machine) to perform the operations described herein for that module. Accordingly, different components described herein may include and configure different arrangements of the processors at different points in time or a single arrangement of the processors at different points in time. Each component described herein is an example of a means for performing the operations described herein for that component. Moreover, any two or more of these components may be combined into a single component, and the functions described herein for a single component may be subdivided among multiple components. Furthermore, according to various example embodiments, components described herein as being implemented within a single machine, database, or device may be distributed across multiple machines, databases, or devices.

[0026] FIG. 3 is a flow diagram of an example method 300 for optimizing content change in accordance with example embodiments. In example embodiments, the method 300 is performed in part or in whole by components of the digital receiver 102. Accordingly, the method 300 is described by way of example with reference to the digital receiver 102. However, it shall be appreciated that at least some of the operations of the method 300 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 300 is not intended to be limited to the digital receiver 102.

[0027] In operation 302, a first piece of content is caused to be played by the viewing device 104. In example embodiments, the player 202 constructs the pipeline 204 for obtaining and processing the content data for the first piece of content. In particular, the player 202 acquires the source element 212, the demux 214, the audio decoder 216, and the video decoder 218 to form the pipeline 204. The data content is processed by the pipeline 204 and presented on the viewing device 104.

[0028] In operation 304, metadata for a set of one or more content of interest is prefetched. In example embodiments, the cache manager 206 predicts content of interest of a user and prefetches the metadata for the content of interest. The prefetched data is then stored to the cache 208. The metadata may comprise, but is not limited to, one or more URLs where the chunks of content are available, one or more URL for

Pinterest Ex. 1004 Page 338 of 371

different bit rates, license data (e.g., where to obtain a license from), and codec information.

[0029] In operation 306, the player 202 receives an indication to switch to a new piece of content for playback. The indication may be received from a control device of the user (e.g., a remote controller). In some embodiments, the user may scroll through an EPG or be viewing a catalog or watchlist, and selects a new piece of content for viewing.

[0030] In operation 308, the digital receiver 102 maintains the bitrate when switching playback to the new piece of content. In example embodiments, when transitioning playback from an ongoing playback operation to a new playback operation, the source element 212 uses a heuristic bitrate derived for playback of the first piece of content for playback of the new piece of content. Thus, the source element 212 attempts to maintain or preserve the bitrate for playback as opposed to starting a new playback from the lowest possible bitrate. If the new piece of content cannot be delivered at that bitrate, then the source element 212 will lower the bitrate. As such, example embodiments, will start the download of the new content at the previous/last bitrate instead of starting at a lower or lowest bitrate (and slowly increasing). This allows playback of the new content at a most optimal bitrate instantly instead of having to heuristically re-compute the optimal bitrate starting from the lowest possible bitrate. Conventionally, the derivation of the optimal bitrate usually requires downloading several segments or chunks of content data resulting in a gradual improvement of picture quality. However, example embodiments that use the previous derived heuristic bitrate maintain the same level of image quality as that of the previous playback from a very beginning of playback for the new content.

[0031] In operation 310, a pipeline preservation process is performed to determine whether to maintain at least a portion of the pipeline used to playback the first piece of content for use with the playback of the new piece of content. Furthermore, if the pipeline is to be maintained or preserve, a determination is made as to whether all the resources of the pipeline should be preserved or only a portion of the pipeline preserved (e.g., only some of the resources are kept and others are released). The pipeline preservation process will be discussed in more detail in connection with FIG. 4.

[0032] FIG. 4 is a flow diagram of an example method 400 for preserving a content delivery pipeline in accordance with example embodiments. In example embodiments,

Pinterest Ex. 1004 Page 339 of 371

the method 400 is performed in part or in whole by the player 202 with respect the resources of the pipeline 204. Accordingly, the method 400 is described by way of example with reference to the player 202 and the pipeline 204. However, it shall be appreciated that at least some of the operations of the method 400 may be deployed on various other hardware configurations or be performed by similar components residing elsewhere in the environment 100. Therefore, the method 400 is not intended to be limited to the player 202 and the pipeline 204.

[0033] In operation 402, in response to receiving the indication to switch playback to new content, the cache manager 206 accesses the prefetched metadata stored in the cache 208 for the new content. The prefetched metadata for the new content may comprise one or more URLs where the new content is available, one or more URLs for different bit rates associated with the new content, license data for the new content, and codec information for the new content. The prefetched metadata may also indicate whether the new content is of a same type as the first piece of content. For example, the first piece of content and the new content may both be in a HTTP Live Streaming (HLS) format or both be in a Dynamic Adaptive Streaming over HTTP (DASH) format.

[0034] In operation 404, the player 202 determines whether the first piece of content and the new content are of the same content type. If the first piece of content and the new content are not of the same type (e.g., first piece of content is in HLS format and the new content is in DASH format), then the resources of the pipeline 204 (e.g., the source element 212, the demux 214, the audio decoder 216, and the video decoder 218) are released in operation 406. Releasing ail the resources of the pipeline 204 essentially deconstructs the pipeline 204. The player 202 them creates a new pipeline by acquiring other resources that are applicable to the content type of the new content.

[0035] If in operation 404 the player 202 determines that the first piece of content and the new content are of the same content type (e.g., both are HLS format), then in operation 408, codec information is detected for the new content. In example embodiments, the player 202 examines the prefetched metadata for the new content for the codec information. The codec information indicates types of decoders needed for the new content.

[0036] In operation 410, a determination is made by the player 202 as to whether the types of decoders needed for the new content is the same as the decoders currently in the pipeline 204 for the first piece of content. If the types of decoders needed is the same,

Pinterest Ex. 1004 Page 340 of 371

then in operation 412 the entire pipeline 204 is preserved. In other words, the resources of the pipeline 204 are maintained and continued to be used to playback the new content.

[0037] However, if in operation 410 the player 202 determines that the new content needs different decoders, then in operation 414, the decoders (e.g., the audio decoder 216 and the video decoder 208) are released. Subsequently in operation 416, a remaining portion of the pipeline 204 (e.g., the source element 212 and the dernux 214) are preserved or maintained. In these embodiments, the player 202 acquires a new set of decoders (e.g., a new audio decoder and a new video decoder) applicable to the new content, and adds the new set of decoders to the preserved portion of the pipeline 204.

[0038] While example embodiments are discussed with respect to pipeline and bitrate preservation applicable to both DASH and HLS, example embodiments for preservation of bitrate and the pipeline is applicable for any type of content that is adaptive in nature (e.g., where the content bitrate can change based on bandwidth).

[0039] FIG. 5 is a block diagram illustrating components of a machine 500, according to some example embodiments, able to read instructions 524 from a machine-storage medium 522 (e.g., a non-transitory machine-storage medium, a machine-readable storage medium, a computer-readable storage medium, or any suitable combination thereof) and perform any one or more of the methodologies discussed herein, in whole or in part. Specifically, FIG. 5 shows the machine 500 in the example form of a computer device (e.g., a computer) within which the instructions 524 (e.g., software, a program, an application, an applet, an app, or other executable code) for causing the machine 500 to perform any one or more of the methodologies discussed herein may be executed, in whole or in part.

[0040] For example, the instructions 524 may cause the machine 500 to execute the flow diagrams of FIGs. 3 and 4. The instructions 524 can transform the general, non-programmed machine 500 into a particular machine (e.g., specially configured machine) programmed to carry out the described and illustrated functions in the manner described.

[0041] In alternative embodiments, the machine 500 operates as a standalone device or may be connected (e.g., networked) to other machines. The machine 500 may be a server computer, a client computer, a personal computer (PC), a tablet computer, a laptop computer, a netbook, a set-top box (e.g. STB), a personal digital assistant (PDA),

Pinterest Ex. 1004 Page 341 of 371

a cellular telephone, a smartphone, a web appliance, a network router, a network switch, a network bridge, a power adapter, or any machine 500 capable of executing the instructions 524, sequentially or otherwise, that specify actions to be taken by that machine 500. Further, while only a single machine 500 is illustrated, the term "machine" shall also be taken to include a collection of machines that individually or jointly execute the instructions 524 to perform any one or more of the methodologies discussed herein.

[0042] The machine 500 includes a processor 502 (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), an application specific integrated circuit (ASIC), a radio-frequency integrated circuit (RFIC), or any suitable combination thereof), a main memory 504, and a static memory 506, which are configured to communicate with each other via a bus 508. The processor 502 may contain microcircuits that are configurable, temporarily or permanently, by some or all of the instructions 524 such that the processor 502 is configurable to perform any one or more of the methodologies described herein, in whole or in part. For example, a set of one or more microcircuits of the processor 502 may be configurable to execute one or more modules (e.g., software modules) described herein.

[0043] The machine 500 may further include a graphics display 510 (e.g., a plasma display panel (PDP), a light emitting diode (LED) display, a liquid crystal display (LCD), a projector, a cathode ray tube (CRT), or any other display capable of displaying graphics or video). The machine 500 may also include an alphanumeric input device 512 (e.g., a keyboard or keypad), a cursor control device 514 (e.g., a mouse, a touchpad, a trackball, a joystick, a motion sensor, an eye tracking device, or other pointing instrument), a storage unit 516, a signal generation device 518 (e.g., a sound card, an amplifier, a speaker, a headphone jack, or any suitable combination thereof), and a network interface device 520.

[0044] The storage unit 516 includes the machine-storage medium 522 (e.g., a tangible machine-readable storage medium) on which are stored the instructions 524 embodying any one or more of the methodologies or functions described herein. The instructions 524 may also reside, completely or at least partially, within the main memory 504, within the processor 502 (e.g., within the processor's cache memory), or both, before or during execution thereof by the machine 500. Accordingly, the main

Pinterest Ex. 1004 Page 342 of 371

memory 504 and the processor 502 may be considered machine-storage media 522 (e.g., tangible and non-transitory machine-storage media).

[0045] In some example embodiments, the machine 500 may be a portable computing device and have one or more additional input components (e.g., sensors or gauges). Examples of such input components include an image input component (e.g., one or more cameras), an audio input component (e.g., a microphone), a direction input component (e.g., a compass), a location input component (e.g., a global positioning system (GPS) receiver), an orientation component (e.g., a gyroscope), a motion detection component (e.g., one or more acceierometers), an altitude detection component (e.g., an altimeter), and a gas detection component (e.g., a gas sensor). Inputs han'ested by any one or more of these input components may be accessible and available for use by any of the modules described herein.

EXECUTABLE INSTRUCTIONS AND MACHINE-STORAGE MEDIUM

[0046] The various memories (i.e., 504, 506, and/or memory of the processor(s) 502) and/or storage unit 516 may store one or more sets of instructions and data structures (e.g., software) 524 embodying or utilized by any one or more of the methodologies or functions described herein. These instructions, when executed by processors) 502 cause various operations to implement the disclosed embodiments.

[0047] As used herein, the terms "machine-storage medium," "device-storage medium," "computer-storage medium" (referred to collectively as "machine-storage medium 522") mean the same thing and may be used interchangeably in this disclosure. The terms refer to a single or multiple storage devices and/or media (e.g., a centralized or distributed database, and/or associated caches and servers) that store executable instructions and/or data, as well as cloud-based storage systems or storage networks that include multiple storage apparatus or devices. The terms shall accordingly be taken to include, but not be limited to, solid-state memories, and optical and magnetic media, including memory internal or external to processors. Specific examples of machine-storage media, computer-storage media, and/or device- storage media 522 include non-volatile memory, including by way of example semiconductor memory devices, e.g., erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), FPGA, and flash memory devices, magnetic disks such as internal hard disks and removable disks; magneto-optical disks;

Pinterest Ex. 1004 Page 343 of 371

and CD-ROM and DVD-ROM: disks. The terms machine-storage media, computer-storage media, and device-storage media 522 specifically exclude carrier waves, modulated data signals, and other such media, at least some of which are covered under the term "signal medium" discussed below.

SIGNAL MEDIUM:

[0048] The term "signal medium" or "transmission medium" shall be taken to include any form of modulated data signal, carrier wave, and so forth. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a matter as to encode information in the signal.

COMPUTER READABLE MEDIUM

[0049] The terms "machine-readable medium," "computer-readable medium" and "device-readable medium" mean the same thing and may be used interchangeably in this disclosure. The terms are defined to include both machine-storage media and signal media. Thus, the terms include both storage devices/media and carrier waves/modulated data signals.

[0050] The instructions 524 may further be transmitted or received over a communications network 526 using a transmission medium via the network interface device 520 and utilizing any one of a number of well-known transfer protocols (e.g., HTTP). Examples of communication networks 526 include a local area network (LAN), a wide area network (WAN), the Internet, mobile telephone networks, plain old telephone service (POTS) networks, and wireless data networks (e.g., WiFi, LTE, and WiMAX networks). The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding, or carrying instructions 524 for execution by the machine 500, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

[0051] Throughout this specification, plural instances may implement components, operations, or structures described as a single instance. Although individual operations of one or more methods are illustrated and described as separate operations, one or more of the individual operations may be performed concurrently, and nothing requires that the operations be performed in the order illustrated. Structures and functionality presented as separate components in example configurations may be implemented as a

Pinterest Ex. 1004 Page 344 of 371

combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements fall within the scope of the subject matter herein.

[0052] Certain embodiments are described herein as including logic or a number of components, modules, or mechanisms. Modules may constitute either software modules (e.g., code embodied on a machine-storage medium 522 or in a transmission signal) or hardware modules. A "hardware module" is a tangible unit capable of performing certain operations and may be configured or arranged in a certain physical manner. In various example embodiments, one or more computer systems (e.g., a standalone computer system, a client computer system, or a server computer system) or one or more hardware modules of a computer system (e.g., a processor 502 or a group of processors 502) may be configured by software (e.g., an application or application portion) as a hardware module that operates to perform certain operations as described herein.

[0053] In some embodiments, a hardware module may be implemented mechanically, electronically, or any suitable combination thereof. For example, a hardware module may include dedicated circuitry or logic that is permanently configured to perform certain operations. For example, a hardware module may be a special-purpose processor, such as a field-programmable gate array (FPGA) or an ASIC. A hardware module may also include programmable logic or circuitry that is temporarily configured by software to perform certain operations. For example, a hardware module may include software encompassed within a general-purpose processor or other programmable processor. It will be appreciated that the decision to implement a hardware module mechanically, in dedicated and permanently configured circuitry, or in temporarily configured circuitry (e.g., configured by software) may be driven by cost and time considerations.

[0054] Accordingly, the phrase "hardware module" should be understood to encompass a tangible entity, be that an entity that is physically constructed, permanently configured (e.g., hardwired), or temporarily configured (e.g., programmed) to operate in a certain manner or to perform certain operations described herein. As used herein, "hardware-implemented module" refers to a hardware module. Considering embodiments in which hardware modules are temporarily configured (e.g.,

Pinterest Ex. 1004 Page 345 of 371

programmed), each of the hardware modules need not he configured or instantiated at any one instance in time. For example, where a hardware module comprises a general-purpose processor configured by software to become a special-purpose processor, the general-purpose processor may be configured as respectively different special-purpose processors (e.g., comprising different hardware modules) at different times. Software may accordingly configure a processor, for example, to constitute a particular hardware module at one instance of time and to constitute a different hardware module at a different instance of time.

[0055] The various operations of example methods described herein may be performed, at least partially, by one or more processors that are temporarily configured (e.g., by software) or permanently configured to perform the relevant operations. Whether temporarily or permanently configured, such processors may constitute processor-implemented modules that operate to perform one or more operations or functions described herein. As used herein, "processor-implemented module" refers to a hardware module implemented using one or more processors.

[0056] Similarly, the methods described herein may be at least partially processor-implemented, a processor being an example of hardware. For example, at least some of the operations of a method may be performed by one or more processors or processor-implemented modules.

EXAMPLES

[0057] Example 1 is a method for optimizing a content change process. The method comprises causing playback, by a digital receiver, of a first piece of content, receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0058] In example 2, the subject matter of example 1 can optionally include determining whether the new piece of content is of a same type as the first piece of content, and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0059] In example 3, the subject matter of examples 1-2 can optionally include wherein the determining whether to preserve comprises detecting codec information for

Pinterest Ex. 1004 Page 346 of 371

the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0060] In example 4, the subject matter of examples 1-3 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0061] In example 5, the subject matter of examples 1-4 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0062] Example 6 is a system optimizing a content change process. The system includes one or more hardware processors and a storage device storing instructions that configure the one or more hardware processors to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content; and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0063] In example 7, the subject matter of example 6 can optionally include determining whether the new piece of content is of a same type as the first piece of content, and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0064] In example 8, the subject matter of examples 6-7 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0065] In example 9, the subject matter of examples 6-8 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0066] In example 10, the subject matter of examples 6-9 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types

Pinterest Ex. 1004 Page 347 of 371

indicated by the codec information; and obtaining a new audio decoder and a new video decoder based on the codec information.

[0067] Example 11 is machine-readable medium storing instructions that when executed by one or more hardware processors of a machine, cause the machine to perform operations comprising causing playback of a first piece of content; receiving a selection of a new piece of content for playback during the playback of the first piece of content, and in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

[0068] In example 12, the subject matter of example 11 can optionally include determining whether the new piece of content is of a same type as the first piece of content; and based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

[0069] In example 13, the subject matter of examples 11-12 can optionally include wherein the determining whether to preserve comprises detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

[0070] In example 14, the subject matter of examples 11-13 can optionally include preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

[0071] In example 15, the subject matter of examples 11-14 can optionally include releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information;, and obtaining a new audio decoder and a new video decoder based on the codec information.

[0072] Some portions of the subject matter discussed herein may be presented in terms of algorithms or symbolic representations of operations on data stored as bits or binary digital signals within a machine memory (e.g., a computer memory). Such algorithms or symbolic representations are examples of techniques used by those of ordinary skill in the data processing arts to convey the substance of their work to others skilled in the art. As used herein, an "algorithm" is a self-consistent sequence of operations or similar processing leading to a desired result. In this context, algorithms and operations involve physical manipulation of physical quantities. Typically, but not

Pinterest Ex. 1004 Page 348 of 371

necessarily, such quantities may take the form of electrical, magnetic, or optical signals capable of being stored, accessed, transferred, combined, compared, or otherwise manipulated by a machine. It is convenient at times, principally for reasons of common usage, to refer to such signals using words such as "data," "content," "bits," "values," "elements," "symbols," "characters," "terms," "numbers," "numerals," or the like. These words, however, are merely convenient labels and are to be associated with appropriate physical quantities.

[0073] Unless specifically stated otherwise, discussions herein using words such as "processing," "computing," "calculating," "determining," "presenting," "displaying," or the like may refer to actions or processes of a machine (e.g., a computer) that manipulates or transforms data represented as physical (e.g., electronic, magnetic, or optical) quantities within one or more memories (e.g., volatile memory, non-volatile memon,', or any suitable combination thereof), registers, or other machine components that receive, store, transmit, or display information. Furthermore, unless specifically stated otherwise, the terms "a" or "an" are herein used, as is common in patent documents, to include one or more than one instance. Finally, as used herein, the conjunction "or" refers to a non-exclusive "or," unless specifically stated otherwise.

[0074] Although an overview of the inventive subject matter has been described with reference to specific example embodiments, various modifications and changes may be made to these embodiments without departing from the broader scope of embodiments of the present invention. For example, various embodiments or features thereof may be mixed and matched or made optional by a person of ordinary skill in the art. Such embodiments of the inventive subject matter may be referred to herein, individually or collectively, by the term "invention" merely for convenience and without intending to voluntarily limit the scope of this application to any single invention or inventive concept if more than one is, in fact, disclosed.

[0075] The embodiments illustrated herein are believed to be described in sufficient detail to enable those skilled in the art to practice the teachings disclosed. Other embodiments may be used and derived therefrom, such that structural and logical substitutions and changes may be made without departing from the scope of this disclosure. The Detailed Description, therefore, is not to be taken in a limiting sense, and the scope of various embodiments is defined only by the appended claims, along with the full range of equivalents to which such claims are entitled.

Pinterest Ex. 1004 Page 349 of 371

[0076] Moreover, plural instances may be provided for resources, operations, or structures described herein as a single instance. Additionally, boundaries between various resources, operations, modules, engines, and data stores are somewhat arbitrary, and particular operations are illustrated in a context of specific illustrative configurations. Other allocations of functionality are envisioned and may fall within a scope of various embodiments of the present invention. In general, structures and functionality presented as separate resources in the example configurations may be implemented as a combined structure or resource. Similarly, structures and functionality presented as a single resource may be implemented as separate resources. These and other variations, modifications, additions, and improvements fall within a scope of embodiments of the present invention as represented by the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

Pinterest Ex. 1004 Page 350 of 371

CLAIMS

What is claimed is:

1. A method comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining, by a processor of the digital receiver, a bitrate used for playback of the first piece of content to initiate playback of the new piece of content.

2. The method of claim 1, further comprising:

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to preserve at least a portion of a playback pipeline.

3. The method of claim 2, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

4. The method of claim 3, further comprising preserving the entire pipeline in response to the audio decoder and the video decoder in the pipeline being the types indicated by the codec information.

5. The method of claim 3, further comprising:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 351 of 371

6. A system comprising:

one or more hardware processors, and

a storage device storing **instructions** that configure the one or more hardware processors to perform operations comprising:

causing playback, by a digital receiver, of a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content **for** playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a bitrate used for playback of the first piece of content to initiate playback **of the** new piece of content.

7. The system **of** claim 6, wherein the operations further comprise:

determining whether the new piece of content is **of** a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to **preserve at** least a portion of a playback pipeline.

8. The system of claim 7, wherein the determining whether to preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by **the** codec information.

9. The system of claim 8, wherein the operations further comprise preserving the entire pipeline in response to **the** audio decoder and **the** video decoder **in the** pipeline being the types indicated **by** the codec information.

10. The system of claim 8, wherein the operations further comprise:

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 352 of 371

11. A machine-readable medium storing **instructions** that when executed by one or more hardware processors of a machine, cause the machine to **perform** operations comprising:

causing playback, by a digital receiver, **of** a first piece of content;

receiving, by the digital receiver, a selection of a new piece of content for playback during the playback of the first piece of content; and

in response to the receiving of the selection, maintaining a **bitrate** used for playback of the first piece of content to initiate playback of the new piece of content.

12. The machine-readable medium of claim 11, wherein the operations further comprise;

determining whether the new piece of content is of a same type as the first piece of content; and

based on the new piece of content being the same type as the first piece of content, determining whether to **preserve at** least a portion of a playback pipeline.

13. The machine-readable medium of claim 12, wherein **the** determining whether **to** preserve comprises:

detecting codec information for the new piece of content, the codec information indicating types of decoders needed for the new content; and

determining whether an audio decoder and a video decoder in the pipeline are of the types indicated by the codec information.

14. The machine-readable medium of claim 13, wherein **the** operations further comprise **preserving** the entire pipeline **in** response to the audio decoder and the video decoder **in the** pipeline being the types indicated by **the** codec information.

15. The machine-readable medium of claim 13, wherein the operations further comprise;

releasing the audio decoder and the video decoder in the pipeline in response to the audio decoder and the video decoder in the pipeline being different than the types indicated by the codec information; and

Pinterest Ex. 1004 Page 353 of 371

obtaining a new audio decoder and a new video decoder based on the codec information.

Pinterest Ex. 1004 Page 354 of 371

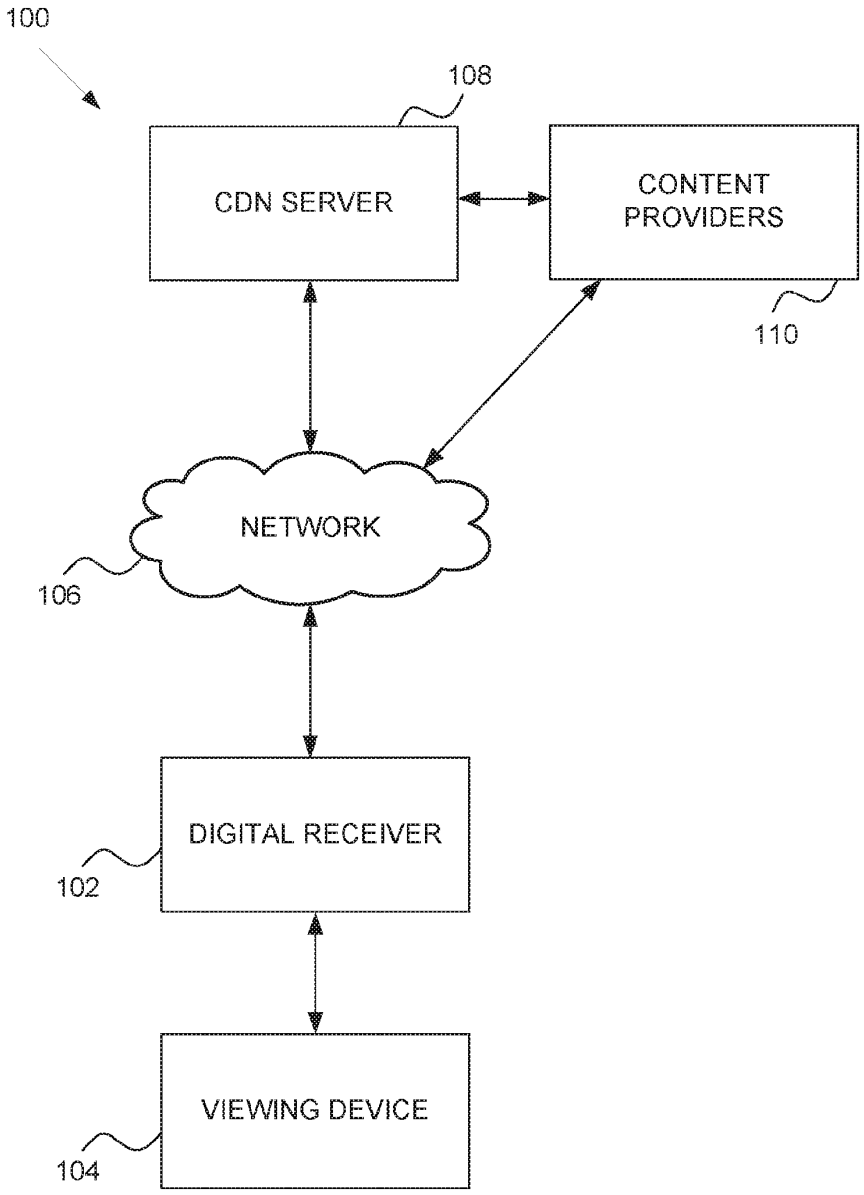

100
108
CDN SERVER
CONTENT PROVIDERS
110
NETWORK
106
DIGITAL RECEIVER
102
VIEWING DEVICE
104

FIG. 1

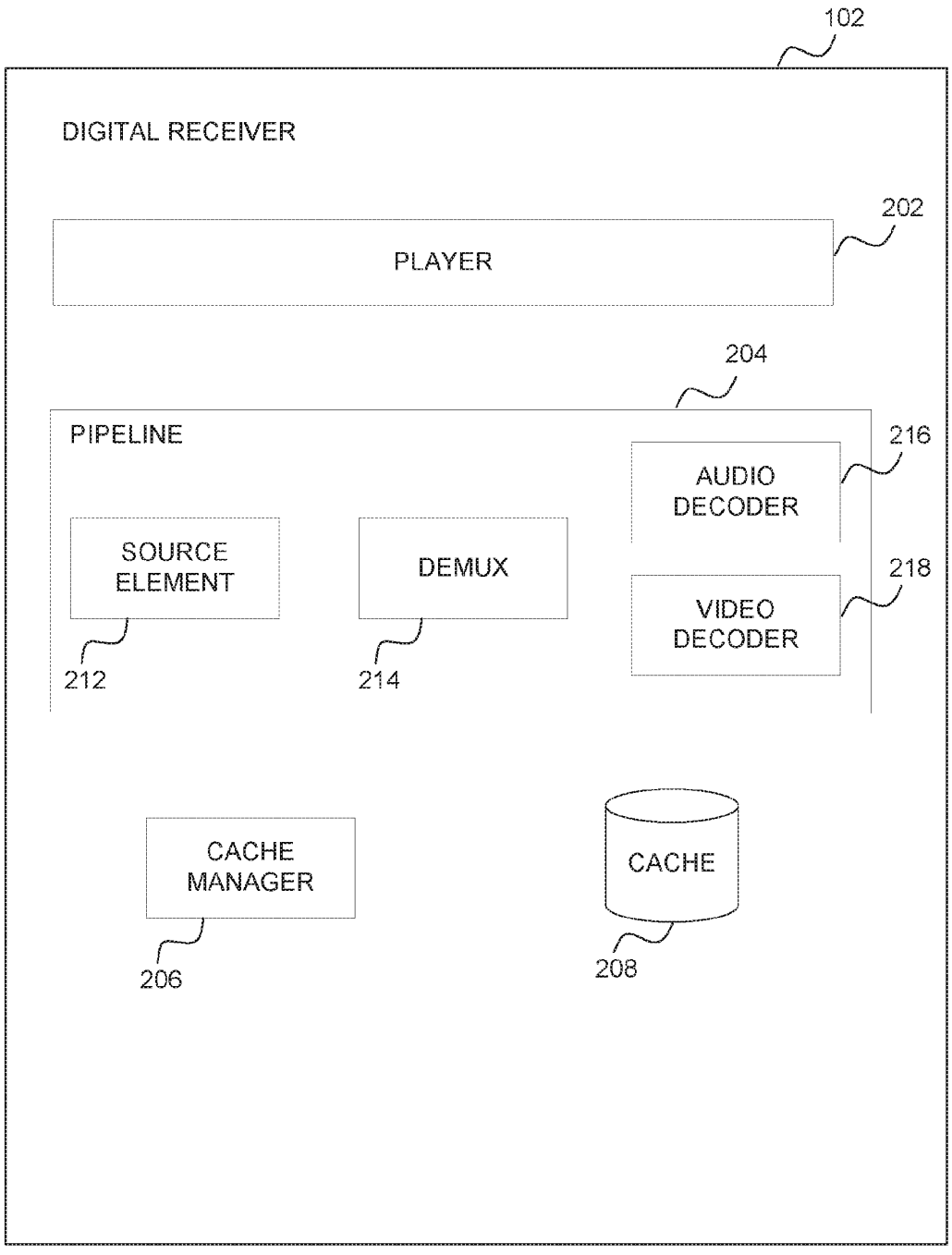

102
DIGITAL RECEIVER
202
PLAYER
204
PIPELINE
216
AUDIO DECODER
218
VIDEO DECODER
SOURCE ELEMENT
212
DEMUX
214
CACHE MANAGER
206
CACHE
208

FIG. 2

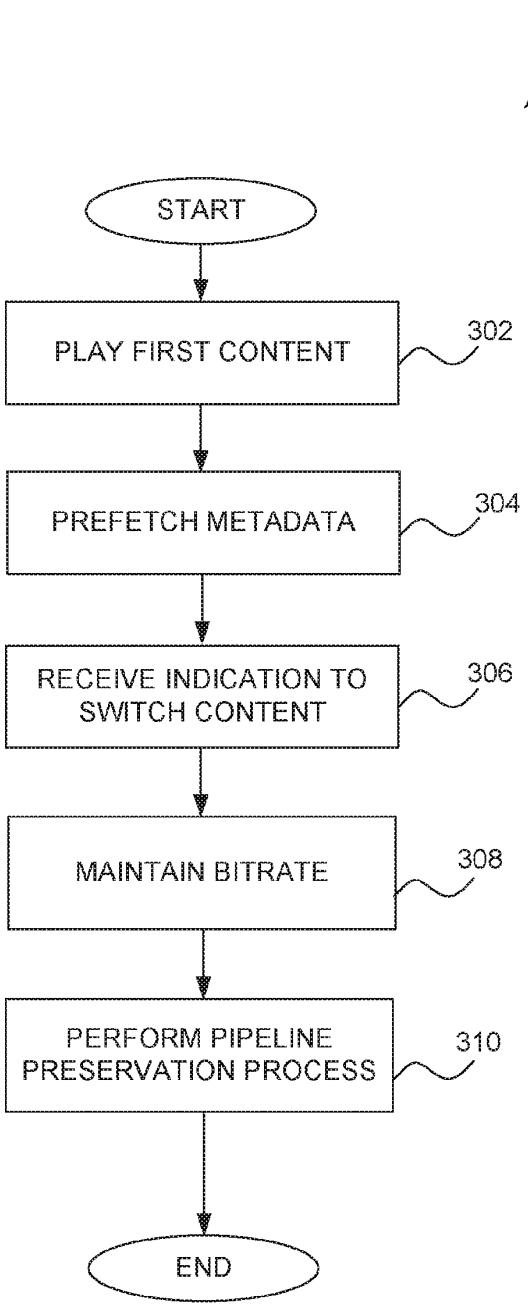

300
START
PLAY FIRST CONTENT
302
PREFETCH METADATA
304
RECEIVE INDICATION TO SWITCH CONTENT
306
MAINTAIN BITRATE
308
PERFORM PIPELINE PRESERVATION PROCESS
310
END

FIG. 3

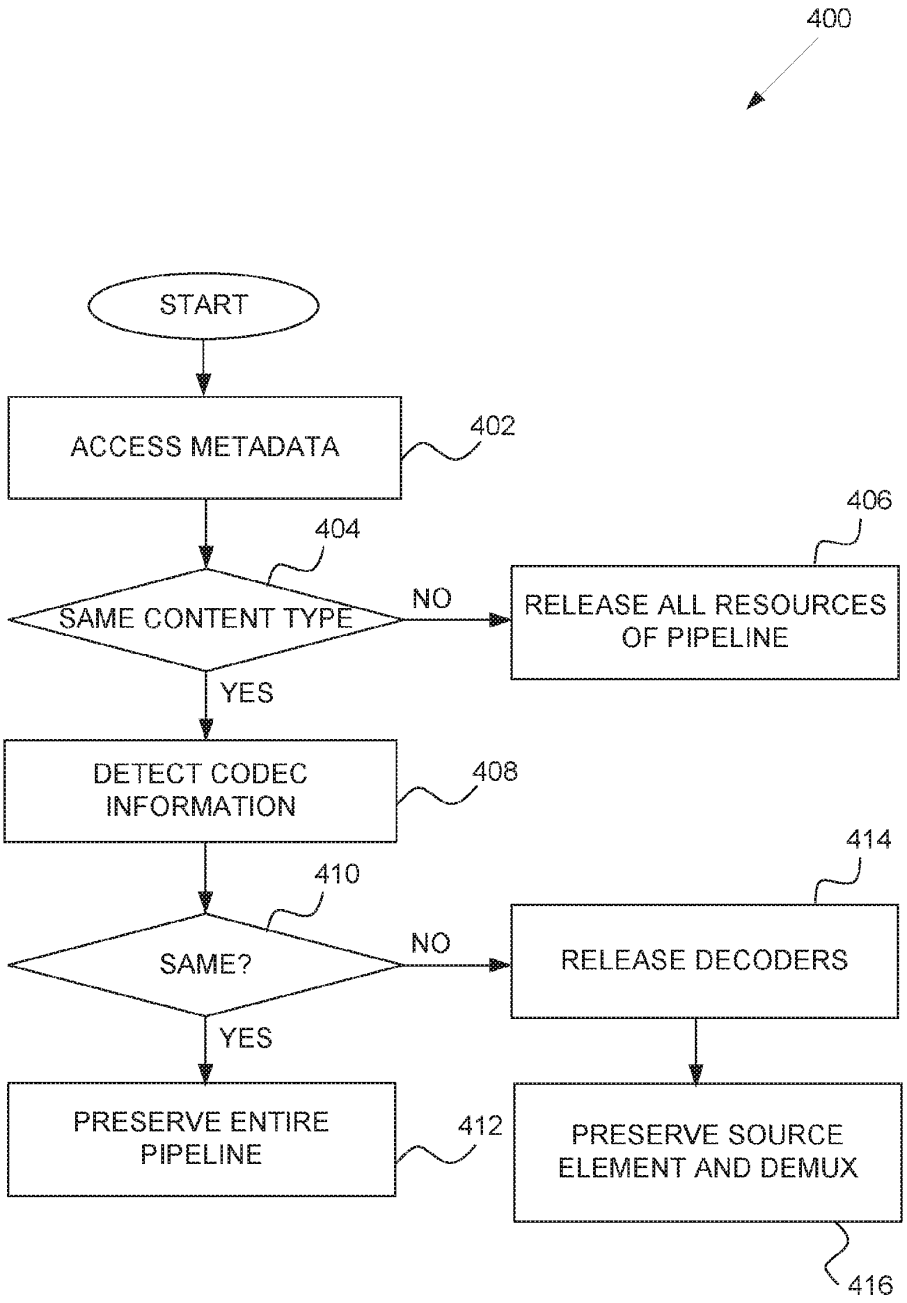

400
START
ACCESS METADATA
402
404
SAME CONTENT TYPE
NO
406
RELEASE ALL RESOURCES OF PIPELINE
YES
DETECT CODEC INFORMATION
408
410
SAME?
NO
414
RELEASE DECODERS
YES
PRESERVE ENTIRE PIPELINE
412
PRESERVE SOURCE ELEMENT AND DEMUX
416

FIG. 4

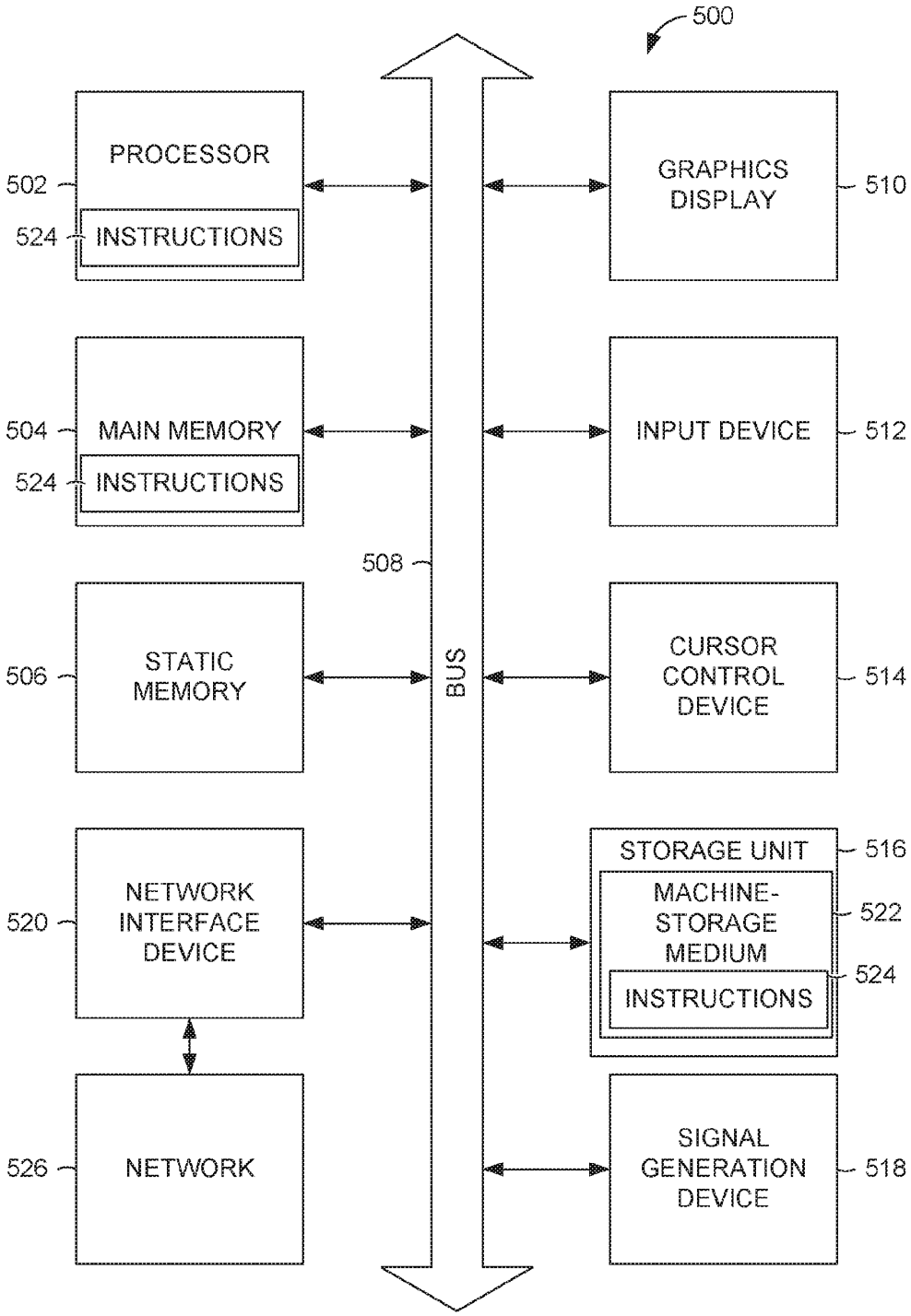

500
PROCESSOR
502
INSTRUCTIONS
524
MAIN MEMORY
504
INSTRUCTIONS
524
STATIC MEMORY
506
NETWORK INTERFACE DEVICE
520
NETWORK
526
508
BUS
GRAPHICS DISPLAY
510
INPUT DEVICE
512
CURSOR CONTROL DEVICE
514
STORAGE UNIT
516
MACHINE-STORAGE MEDIUM
522
INSTRUCTIONS
524
SIGNAL GENERATION DEVICE
518

FIG. 5

Modified PTO-1390 (05-13/06-13)
Approved for use through 6/30/2013. OMB 0651-0021
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.

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		Attorney Docket No. **2050.354US1**
		U.S. Application No. (if known, see 37 CFR 1.5) **Unknown**
International Application No. **PCT/US2018/046723**	International Filing Date **14 August 2018**	Priority Date Claimed **8 September 2017**
Title of Invention **BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION**		
First Named Inventor **Amarendra N. Gogoi**		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.
2. ☒ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))
   a. ☒ is attached.
   b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).

Items 5 to 8 below concern amendments made in the international phase.

PCT Article 19 and 34 amendments

5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).

Cancellation of amendments made in the international phase

8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.

8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.

NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).

The following items 9 to 17 concern a document(s) or information included.

9. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
10. ☒ A preliminary amendment.
11. ☒ An Application Data Sheet under 37 CFR 1.76.
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ☒ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.3 and 37 CFR 1.821-1.825.
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: _____
16. ☐ 37 CFR 3.73(c) Statement (when there is an Assignee).

Pinterest Ex. 1004 Page 360 of 371

Modified PTO-1390 (05-13/06-13)
Approved for use through 6/30/2013. OMB 0651-0021
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.

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY DOCKET No.
Unknown	**PCT/US2018/046723**	**2050.354US1**

17. Other items or information: Form 1449 (1 pg), and copies of cited references (4).

The following fees have been submitted.	CALCULATIONS	PTO USE ONLY
18. ☒ Basic national fee (37 CFR 1.492(a)) **$300**	$ 300.00	
19. ☒ Examination Fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** All other situations..... **$760**	$ $760.00	
20. ☒ Search Fee (37 CFR 1.492(b)) If the written opinion of the ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33 (1)-(4) ..... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ..... **$140** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ..... **$520** All other situations..... **$660**	$ $140.00	
TOTAL OF 18, 19 and 20 =	**$ $1,200.00**	

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) 37 CFR 1.492(j)).
Fee for each additional 50 sheets of paper or fraction thereof..... **$400**

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole number)	RATE	
29 - 100 =	0/ 50 =	0	x **$400**	$ $0.00

Surcharge of **$140.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h))	$ $0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20 -20 =	0	x **$100**	$ $0.00	
Independent claims	3 - 3 =	0	x **$460**	$ $0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			**+ $820**	$ $0.00	

Processing fee of **$140.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). **+**	$	
TOTAL OF ABOVE CALCULATIONS =	**$ $1,200.00**	
☐ Applicant asserts small entity status. See 37 CFR 1.27. Fees above are reduced by ½.		
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Fees above are reduced by ¾ . Applicant must attach form PTO/SB/15A or B or equivalent		
TOTAL NATIONAL FEE =	**$**	
Fees for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property **+**	$ $0.00	
TOTAL FEES ENCLOSED =	**$ $1,200.00**	
	Amount to be refunded:	$
	Amount to be charged	**$ $1,200.00**

Pinterest Ex. 1004 Page 361 of 371

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.

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 19-0743 in the amount of $ 1,200.00 to cover the above fees.

c. ☒ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment to Deposit Account No. 19-0743 as follows:

i. ☒ any required fee

ii. ☐ any required fee except for excess claims fees required under 37 CFR 1.492(d) and multiple dependent claim fee required under 37 CFR 1.492(f)

d. ☐ Fees are to be charged to a credit card. **WARNING**: Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR.** To protect your information, it is recommended paying fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

The address associated with Customer No. 44367

/ Susan Yee / March 9, 2020
SIGNATURE/ DATE

Susan Yee
NAME

41,388
REGISTRATION NUMBER

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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: Amarendra N. Gogoi

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Amarendra	N.	Gogoi	

Residence Information (Select One) ☒ **US Residency** ☐ **Non US Residency** ☐ **Active US Military Service**

City	Fremont	State/Province	CA	Country of Residence	United States of America

Mailing Address of Inventor:

Address 1	275 Sacramento Street		
Address 2			
City	San Francisco	State/Province	CA
Postal Code	94111	Country	United States of America

Inventor 2: Sanjay Kumar Gupta

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Sanjay	Kumar	Gupta	

Residence Information (Select One) ☐ **US Residency** ☒ **Non US Residency** ☐ **Active US Military Service**

City	Bangalore	State/Province		Country of Residence	India

Mailing Address of Inventor:

Address 1	275 Sacramento Street		
Address 2			
City	San Francisco	State/Province	CA
Postal Code	94111	Country	United States of America

Pinterest Ex. 1004 Page 363 of 371

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

Inventor 3: Ravikant Swami

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ravikant		Swami	

Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service

City	Bangalore	State/Province		Country of Residence	India

Mailing Address of Inventor:

Address 1	275 Sacramento Street		
Address 2			
City	San Francisco	State/Province	CA
Postal Code	94111	Country	United States of America

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	44367
Email Address	request@slwip.com

Application Information:

Title of the Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION		
Attorney Docket Number	2050.354US1	Small Entity Status Claimed ☐	
Application Type	Non-Provisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

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

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.**

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). Entereither Customer Number or complete the Representative Name section below. If bothsections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	44367		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this 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(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
This application	a 371 of international	PCT/US2018/046723	2018-08-14

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

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(d). 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(h)(1) and (2). Under the POX 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).

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Access Code (if applicable)
201741031917	India	2017-09-08	

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

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.

Modified PTO/AIA/14 (12-13)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

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: OpenTV, Inc.

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.

☒ 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:

☐ Deceased	☐ Legally incapacitated

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here: ☒

Organization Name: OpenTV, Inc.

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information:

Address 1	275 Sacramento Street		
Address 2			
City	San Francisco	**State/Province**	CA
Country	United States of America	**Postal Code**	94111
Phone Number			
Email Address			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	2050.354US1
	Application Number	Unknown
Title of Invention	BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION	

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.

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.

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.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			

Signature:

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	/Susan Yee/			Date (YYYY-MM-DD)	2020-03-09
First Name	Susan	Last Name	Yee	Registration Number	41,388

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 22313-14**

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)

The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

Declaration of inventorship (Rules 4.17(iv) and 51*bis*.1(a)(iv))
for the purposes of the designation of the United States of America:

I hereby declare that I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/US2018/046723 (if furnishing declaration pursuant to Rule 26*ter*).

I hereby declare that the above-identified international application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name: Amarendra N. Gogoi

Residence: Fremont, CA, United States of America
(city and either US state, if applicable, or country)

Mailing Address: 275 Sacramento Street, San Francisco, CA 94111, United States of America

Inventor's Signature: Amarendra Gogoi Date: Sept. 4th, 2018
(The signature must be that of the inventor, not that of the agent)

Name: Sanjay Kumar Gupta

Residence: Bangalore, India
(city and either US state, if applicable, or country)

Mailing Address: RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore, 560 048, India

Inventor's Signature: Sanjay Gupta Date: September 03, 2018
(The signature must be that of the inventor, not that of the agent)

Name: Ravikant Swami

Residence: Bangalore, India
(city and either US state, if applicable, or country)

Mailing Address: RMZ Centennial, Unit 301 & 302, Tower C, 3rd Floor, Mahadevapura Post, ITPL Road, Bangalore, 560 048, India

Inventor's Signature: Ravikant Swami Date: Sep-03-2018
(The signature must be that of the inventor, not that of the agent)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Pinterest Ex. 1004 Page 370 of 371

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Amarendra N. Gogoi et al.
Title: BITRATE AND PIPELINE PRESERVATION FOR CONTENT PRESENTATION
Attorney Docket No.: 2050.354US1
Customer No.: 44367

PATENT APPLICATION TRANSMITTAL

MAIL STOP PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We are transmitting herewith the following attached items and information (as indicated with an "X"):

X Transmittal Letter (Form PTO-1390) to the DO/EO/US concerning a **PCT-U.S. National Stage filing under 35 U.S.C. 371** (3 pgs).
X Application Data Sheet (7 pgs).
X Copy of signed Declaration (1 pg) from prior application.
X Power of Attorney (1 pg).
X Preliminary Amendment 8 pgs).
X Copy of International Application No. PCT/US2018/046723 as published (Int'l Publ. No. WO 2019/050660, including specification (33 pages including 5 sheets of drawings).
X Information Disclosure Statement (2 pgs), Form 1449 (1 pg), and copies of cited references (4).
X Prior application is assigned to OpenTV, Inc.
X Incorporation by Reference herein in their entireties: *The entire disclosures of the prior applications are considered as being part of the disclosure of the accompanying application and are hereby incorporated by reference therein in their entireties.*
X Authorization to charge Deposit Account 19-0743 in the amount of $1,200.00

Please charge any additional required fees or credit overpayment to Deposit Account No. 19-0743.

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
Customer Number 44367

By: /Susan Yee/
Susan Yee
Reg. No. 41,388

Date of Deposit: March 9, 2020
This paper or fee is being filed on the date indicated above using the USPTO's electronic filing system EFS-Web, and is addressed to MAIL STOP PCT, P.O. Box 1450, Alexandria, VA 22313-1450.