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(54) Title: METHODS AND APPARATUSES FOR STREAMING CONTENT

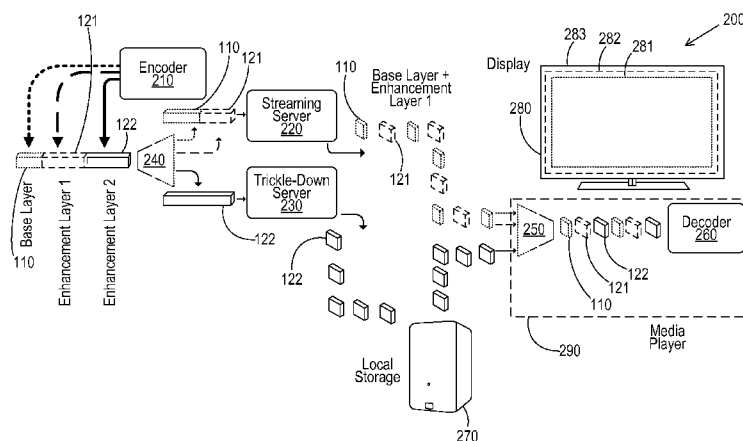


FIG. 2

(57) Abstract: Methods and apparatuses for streaming content including a base layer and an enhancement layer. According to one implementation, a first stream is fetched including the base layer from an internet server storing the base layer. A second stream is fetched including the enhancement layer from a local storage with the local storage being in communication with a media player through a local area network or a bus. The base layer and the enhancement layer are combined to render the content at a higher resolution than just the base layer.

METHODS AND APPARATUSES FOR STREAMING CONTENT

BACKGROUND

[0001] Current adaptive streaming solutions compensate for a best-effort internet by providing high viewer quality when internet bandwidth is available, and providing lower viewer quality when internet bandwidth is reduced, such as due to congestion. As video resolutions and bit-rates increase, current adaptive streaming solutions are less able to consistently deliver high resolution video without fluctuations in quality.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[0002] The features and advantages of the embodiments of the present disclosure will become more apparent from the detailed description set forth below when taken in conjunction with the drawings. The drawings and the associated descriptions are provided to illustrate embodiments of the disclosure and not to limit the scope of what is claimed.

[0003] FIG. 1A illustrates layers of the Scalable Video Coding (SVC) standard;

[0004] FIG. 1B illustrates a diagram of a video delivery system according to one implementation of the present disclosure;

[0005] FIG. 2 illustrates a diagram of a video delivery system according to one implementation of the present disclosure;

[0006] FIG. 3 illustrates a diagram of a video delivery system according to one implementation of the present disclosure;

[0007] FIG. 4 illustrates a diagram of a video delivery system according to one implementation of the present disclosure;

[0008] FIG. 5 illustrates a flowchart of an encoding process according to one implementation of the present disclosure; and

[0009] FIG. 6 illustrates a flowchart of a decoding process according to one implementation of the present disclosure.

DETAILED DESCRIPTION

[0010] In the following detailed description, numerous specific details are set forth to provide a full understanding of the present disclosure. It will be apparent, however, to one of ordinary skill in the art that the various implementations disclosed may be practiced without some of these specific details. In other instances, well-known structures and techniques have not been shown in detail to avoid unnecessarily obscuring the various implementations.

[0011] FIG. 1A illustrates a layered coding scheme such as Scalable Video Coding (SVC), an extension of the H.264/AVC coding standard. Although the present disclosure discusses the SVC standard, the present disclosure is not limited to SVC, as other layered coding schemes may be used. SVC is a standard for encoding high-quality video bit-stream containing one or more subset bit-streams or layers. A new layer is derived by dropping packets from the larger video bit-stream, reducing the required bandwidth for the layer. The layer can represent a lower resolution, such as lower spatial resolution (smaller screen), lower temporal resolution (lower frame rate), or lower quality video signal. The lowest resolution layer, or base layer (layer 0), is also fully interoperable with AVC. To render a layer, a decoder requires the base layer as well as layers in between.

[0012] As seen in FIG. 1A, a bit-stream 100 may comprise a base layer 110 and enhancement layers 120. To render, for example, an enhancement layer N 123, the decoder requires the base layer 110 and an enhancement layer 1 121, an enhancement layer 2 122, and so on up to the enhancement layer N 123. Similarly, rendering an enhancement layer N+1 124 requires the enhancement layer N 123 down to the enhancement layer 1 121, and the base layer 110. As more enhancement layers 120 are rendered, the video quality is higher. For example, additional layers can increase the resolution (e.g., from Standard Definition to High Definition or 4K), increase the frame rate or bit rate, reduce visual artifacts, add 3D information or the like. However, only the base layer 110 is required to render video at its lowest quality (e.g., bit-rate or resolution).

[0013] The base layer 110 and the enhancement layers 120 are streamed through a best-effort internet or similar network. When the network encounters congestion or bandwidth is otherwise limited, the enhancement layers 120 may be

discarded to ensure the base layer 110 is streamed without interruption. However, the video quality suffers degradation as the enhancement layers 120 are unavailable.

[0014] Conventionally, to stream high bit-rate video file, the high bit-rate video file is re-encoded into two different bit-rates, e.g., medium and low bit-rates. The three files (i.e. high, medium, and low bit-rates) are split into shorter segments, such as two second pieces. Depending on network congestion, the appropriate piece is streamed. For example, during high network congestion, the low bit-rate piece may be streamed. However, the video quality becomes highly dependent upon network congestion.

[0015] FIG. 1B illustrates a video delivery system 150 which takes advantage of the scalability of SVC or other layered protocol stream to mitigate the vagaries of the internet. The video delivery system 150 may be compatible with other layered coding schemes and is not limited to the SVC standard. Rather than streaming the base layer 110 and the enhancement layers 120 through the internet, the layers are delivered from at least two sources.

[0016] FIG. 1B depicts a cloud server 160 or online server, a local area network (LAN) 190, a local storage 170, and a media player 180. The media player 180 may be a computer, smartphone, media streaming device, Blu-Ray player, or other device having a processor capable of re-multiplexing SVC layers or layers of another layered stream protocol. Alternatively, the media player 180 may be a specialized device or component of a larger device. The media player 180 may further include a memory 183, an output interface 184, and a processor 186. The cloud server 160 may be a streaming server or other computer capable of streaming data to the media player 180 through a network connection 165 and received by a network interface 181 of the media player 180. The network connection 165 may be established through the internet or a similar network, and may be wired or wireless.

[0017] The LAN 190 includes the local storage 170 and the media player 180. The local storage 170 streams data to the media player 180 through a local connection 175 and received by a local interface 182. The local storage 170 may be a network-attached-storage (NAS) having a controller 172 and a memory 171 which can include one or more drives for storing data, e.g., Hard Disk Drive (HDD), Solid State Drive (SSD), or hybrid drive (SSHD). The local storage 170 is connected to

the media player 180 through the local connection 175. The local connection 175 may be a wired or wireless connection through the LAN 190. In other implementations, the local storage 170 may be one or more data storage devices (DSDs), such as an external hard drive or flash drive, connected to the media player 180 through the local connection 175, which may be a USB (universal serial bus) connection, Thunderbolt connection, or other bus connection. In yet other implementations, the memory 171 may include a removable memory media, such as optical media (CD, DVD, Blu-Ray, etc.) capable of storing data which is read by the media player 180 through the local connection 175. In such implementations, the media player 180, the local connection 175, and the local interface 182 may form part of an optical drive or other device for reading the media of memory 171.

[0018] Because the base layer 110 is the only required layer and also the lowest bit-rate, the base layer 110 can generally be streamed through a best-effort internet or other similar network without stuttering or otherwise being interrupted. The enhancement layers 120, which are not required for video content playback, often require more bandwidth than the base layer 110 to stream without pauses or interruptions. When streaming video content through a congested network, the enhancement layers are dropped, and the viewer experiences a degradation of video quality.

[0019] To reduce the fluctuations in video quality afforded by conventional adaptive streaming solutions, the enhancement layers 120 are streamed separately from the base layer 110. Specifically, the enhancement layers 120 are streamed through the local connection 175, which is usually a more reliable and/or less expensive connection than the network connection 165. Thus, the enhancement layers 120 will not be dropped due to congestion on the network connection 165. In other words, a level of congestion on the network connection 165 does not affect the ability to stream the enhancement layers 120 via the local connection 175. The processor 186 may then act as a re-multiplexer to remux the two streams. An output 185, which may be an encoded SVC stream or other layered stream, may be output through the output interface 184. In other implementations, the processor 186 may also decode the layered stream such that the output 185 is a video signal.

[0020] In certain implementations, the cloud server 160 streams the base layer 110 with one or more lower enhancement layers 120, such as the enhancement layer 1 121 and/or the enhancement layer 2 122. In other implementations, the local storage 170 may further comprise a plurality of local storage devices such that the enhancement layers 120 are streamed from more than one source.

[0021] The base layer 110 remains hosted on an internet server, allowing the content producer/provider to maintain control over its access. The enhancement layers 120 are distributed a priori to consumer storage devices. For example, the enhancement layers 120 may be preloaded onto the local storage 170 from the factory, or may be downloaded during off-peak hours. Thus, the enhancement layers 120 are made available independent of internet congestion. In addition, the enhancement layers 120 may be partitioned to store more layers in the cloud server 160 and less on the local storage 170, or vice versa.

[0022] FIG. 2 depicts a video delivery system 200. Prior to hosting a video stream, an encoder 210 (e.g., an SVC encoder) encodes video content into the base layer 110, the enhancement layer 1 121, and the enhancement layer 2 122. A demultiplexor (demux) 240 multiplexes the layers, sending the base layer 110 and the enhancement layer 1 121 to a streaming server 220, and the enhancement layer 2 122 to a trickle-down server 230. A local storage (e.g., NAS) 270 downloads the enhancement layer 2 122 from the trickle-down server 230. The local storage 270 may download the enhancement layer 2 122 from the trickle-down server 230 during off-peak hours or at a rate slower than an acceptable streaming speed.

[0023] To playback the video content, the streaming server 220 streams the base layer 110 and the enhancement layer 1 121 to a re-multiplexor (remux) 250 of a media player 290, and the local storage 270 streams the enhancement layer 2 122 to the remux 250. The remux 250 re-multiplexes the base layer 110, the enhancement layer 1 121, and the enhancement layer 2 122 and outputs the re-multiplexed stream to a decoder 260 (e.g., an SVC decoder). The decoder 260 then decodes the stream for output on a display 280, such as a television, computer monitor, or mobile device screen.

[0024] When the enhancement layer 2 122 is available, a high resolution 283 can be output on the display 280. The enhancement layer 2 122 may not be available if

the local storage 270 has not yet downloaded the enhancement layer 2 122. When the enhancement layer 2 122 is not available, the quality degrades to a medium resolution 282, but the degradation is graceful such that the overall workings and performance of the system is not drastically affected. If only the base layer 110 is available, then the display 280 outputs a lower resolution 281 or otherwise lower quality video.

[0025] FIG. 3 depicts a video surveillance system 300. A camera 330 records video, which is encoded by an encoder 310 (e.g., an SVC encoder) into the base layer 110, the enhancement layer 1 121, and the enhancement layer 2 122. A demux 340 de-multiplexes the stream and delivers the base layer 110 to a cloud server 320 and the enhancement layer 1 121 and the enhancement layer 2 122 to a local storage 370 (e.g., a NAS). The encoder 310 and/or the demux 340 may be integrated with the camera 330, or may be separate.

[0026] Storing the base layer 110 on the cloud server 320 allows a user to access the surveillance video remotely. For higher resolution video, the user can access the enhancement layers 120 stored on the local storage 370. The number of layers stored on the cloud server 320 may be predicated on the cost of cloud storage.

[0027] FIG. 4 depicts a video delivery system 400. A cloud server 420 streams the base layer 110 to a remux 450 of a media player 430. A local storage 470 (e.g., a NAS), pre-loaded with the enhancement layer 1 121 and the enhancement layer 2 122, streams the enhancement layer 1 121 and the enhancement layer 2 122 to the remux 450. A decoder 410 (e.g., an SVC decoder) takes the remixed stream and outputs video to a display 480.

[0028] Because the base layer 110 is stored on the cloud server 420, access to the video content can be controlled by the cloud server 420. The enhancement layers 120 are completely dependent on the base layer 110 and cannot be played without the corresponding base layer 110. Therefore, even if the local storage 470 were compromised, the base layer 110 may remain secure on the cloud server 420. The content owner may host the base layer 110 on a secure server to protect the video content from piracy.

[0029] FIG. 5 depicts a flowchart 500 of a video encoding process, as may be performed by the video surveillance system 300, for example. At 510, the video

content, which may be generated by the camera 330, is encoded into an SVC stream or other layered protocol stream. A demux, such as the demux 340, demuxes the layered stream into base and enhancement layers.

[0030] At 520, the base layer is stored on an internet server, such as the cloud server 320. In certain implementations, one or more lower enhancement layers may be stored with the base layer on the internet server. At 530, at least one enhancement layer is transmitted to a local storage, such as the local storage 370.

[0031] FIG. 6 depicts a flowchart 600 of a video decoding process, as may be performed by the video delivery system 400, for example. At 610, a media player, such as the media player 430, fetches a first stream including a base layer from an internet server, such as the cloud server 420, storing the base layer. In certain implementations, the internet server may store lower enhancement layers, and the first stream further includes the lower enhancement layers. At 620, the media player fetches a second stream including an enhancement layer from a local storage, such as the local storage 470, storing the enhancement layer. In this regard, fetching the second stream can include accessing the enhancement layer from a memory which can include a removable memory media. In such implementations, the removable memory media may include an optical media such as a DVD or CD-ROM.

[0032] At 630, a remux, such as the remux 450, combines the base layer and the enhancement layer into an SVC stream or other layered protocol stream. At 640, a decoder, such as the decoder 410, decodes the layered stream to render the video content, which is then displayed on a display such as the display 480.

[0033] Those of ordinary skill in the art will appreciate that the various illustrative logical blocks, modules, and processes described in connection with the examples disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. Furthermore, the foregoing processes can be embodied on a computer readable medium which causes a processor or computer to perform or execute certain functions.

[0034] To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, and modules have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design

constraints imposed on the overall system. Those of ordinary skill in the art may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present disclosure.

[0035] The various illustrative logical blocks, units, modules, and controllers described in connection with the examples disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0036] The activities of a method or process described in connection with the examples disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. The steps of the method or algorithm may also be performed in an alternate order from those provided in the examples. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable media, an optical disk, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an Application Specific Integrated Circuit (ASIC).

[0037] The foregoing description of the disclosed example implementations is provided to enable any person of ordinary skill in the art to make or use the implementations in the present disclosure. Various modifications to these examples will be readily apparent to those of ordinary skill in the art, and the principles

disclosed herein may be applied to other examples without departing from the spirit or scope of the present disclosure. The described implementations are to be considered in all respects only as illustrative and not restrictive and the scope of the disclosure is, therefore, indicated by the following claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

CLAIMS

What is claimed is:

1. A method for a media player to stream content including a base layer and an enhancement layer, the method comprising:

fetching a first stream comprising the base layer from an internet server storing the base layer;

fetching a second stream comprising the enhancement layer from a local storage storing the enhancement layer, wherein the local storage is in communication with the media player through a local area network or a bus; and

combining the base layer and the enhancement layer to render the content.

2. The method of claim 1, wherein the local storage is a network-attached-storage (NAS).

3. The method of claim 1, wherein the local storage comprises a plurality of data storage devices.

4. The method of claim 1, wherein the first stream further comprises a low level enhancement layer, the low level enhancement layer having a lower resolution than a resolution of the enhancement layer from the local storage.

5. The method of claim 1, further comprising storing the enhancement layer on the local storage, wherein the enhancement layer is stored on the local storage before fetching the first stream from the internet server.

6. The method of claim 5, wherein the enhancement layer is stored on the local storage as part of a manufacturing process of the local storage.

7. The method of claim 5, wherein the enhancement layer is stored on the local storage by downloading the enhancement layer via the internet.

8. The method of claim 1, wherein fetching the second stream includes accessing the enhancement layer from a removable memory media.

9. The method of claim 1, wherein fetching the second stream includes accessing the enhancement layer from an optical media.

10. A method for storing content including a base layer and a plurality of enhancement layers, the method comprising:

storing the base layer on an internet server; and

transmitting at least one enhancement layer of the plurality of enhancement layers to a local storage, the at least one enhancement layer transmitted separately from the base layer, wherein the local storage is in communication with a media player through a local area network or a bus;

wherein the base layer and the at least one enhancement layer can be combined to render the content at a higher resolution than a resolution of the base layer by itself.

11. The method of claim 10, further comprising transmitting the base layer from the internet server to the media player, wherein the base layer is transmitted at a different time than when the at least one enhancement layer is transmitted to the local storage.

12. The method of claim 10, wherein the local storage comprises a plurality of data storage devices.

13. The method of claim 10, further comprising storing an enhancement layer of the plurality of enhancement layers on the internet server with the base layer.

14. The method of claim 10, further comprising transmitting the at least one enhancement layer via the internet for storage on the local storage.

15. A media player for streaming content including a base layer and an enhancement layer, the media player comprising:

at least one interface for receiving the base layer and the enhancement layer;
and

a processor configured to:

fetch a first stream comprising the base layer from an internet server storing the base layer;

fetch a second stream comprising the enhancement layer from a local storage storing the enhancement layer, wherein the local storage is in communication with the media player through a local area network or a bus;
and

combine the base layer and the enhancement layer to render the content.

16. The media player of claim 15, wherein the local storage is a network-attached-storage (NAS).

17. The media player of claim 15, wherein the local storage comprises a plurality of data storage devices.

18. The media player of claim 15, wherein the first stream further comprises a low level enhancement layer, the low level enhancement layer having a lower resolution than a resolution of the enhancement layer from the local storage.

19. The media player of claim 15, wherein the enhancement layer is stored on the local storage before fetching the first stream from the internet server.

20. The media player of claim 15, wherein the enhancement layer is stored on the local storage as part of a manufacturing process of the local storage.

21. The media player of claim 15, wherein the enhancement layer is stored on the local storage by downloading the enhancement layer via the internet.

22. The media player of claim 15, wherein fetching the second stream includes accessing the enhancement layer from a removable memory media.

23. The media player of claim 15, wherein fetching the second stream includes accessing the enhancement layer from an optical media.

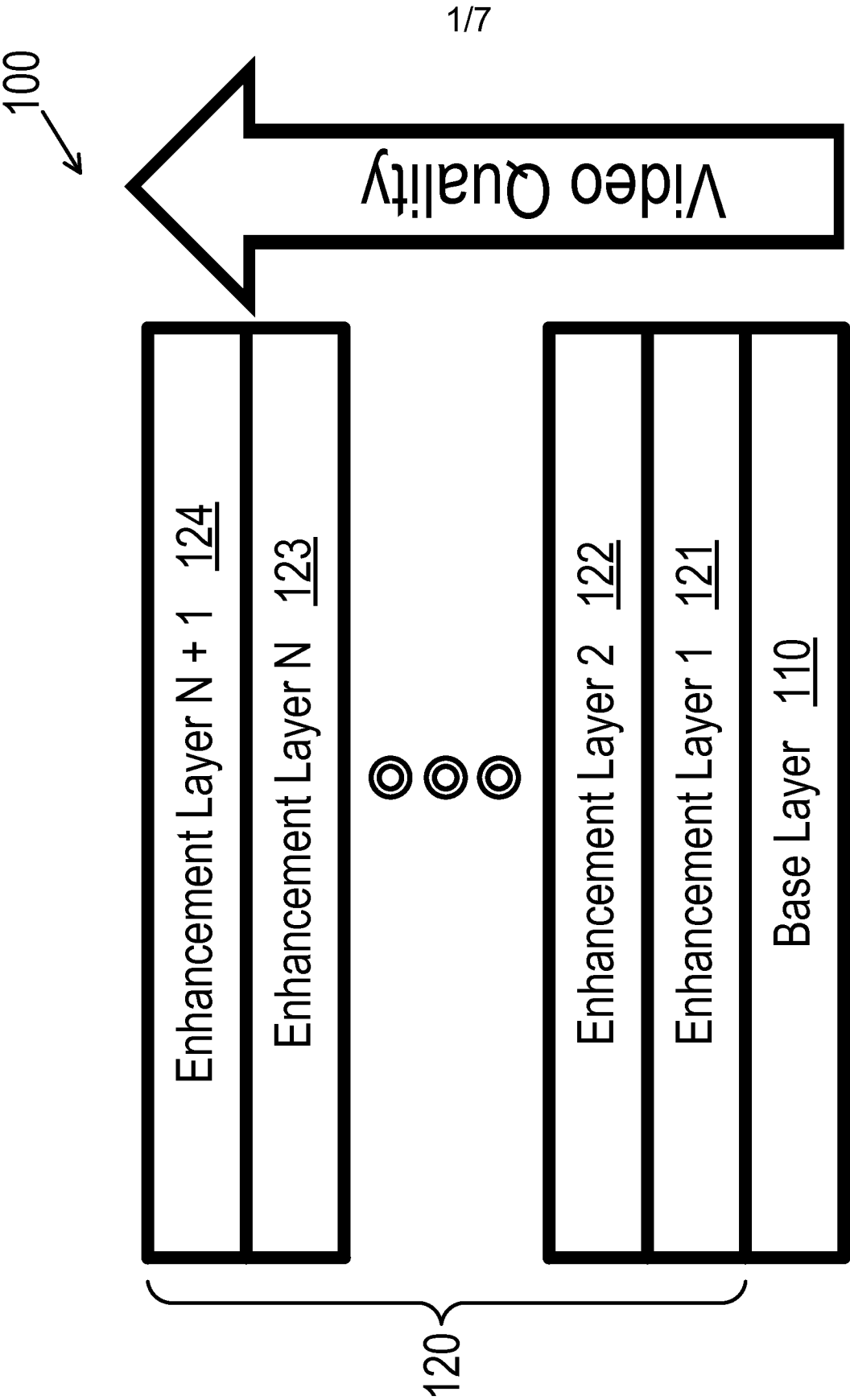


FIG. 1A

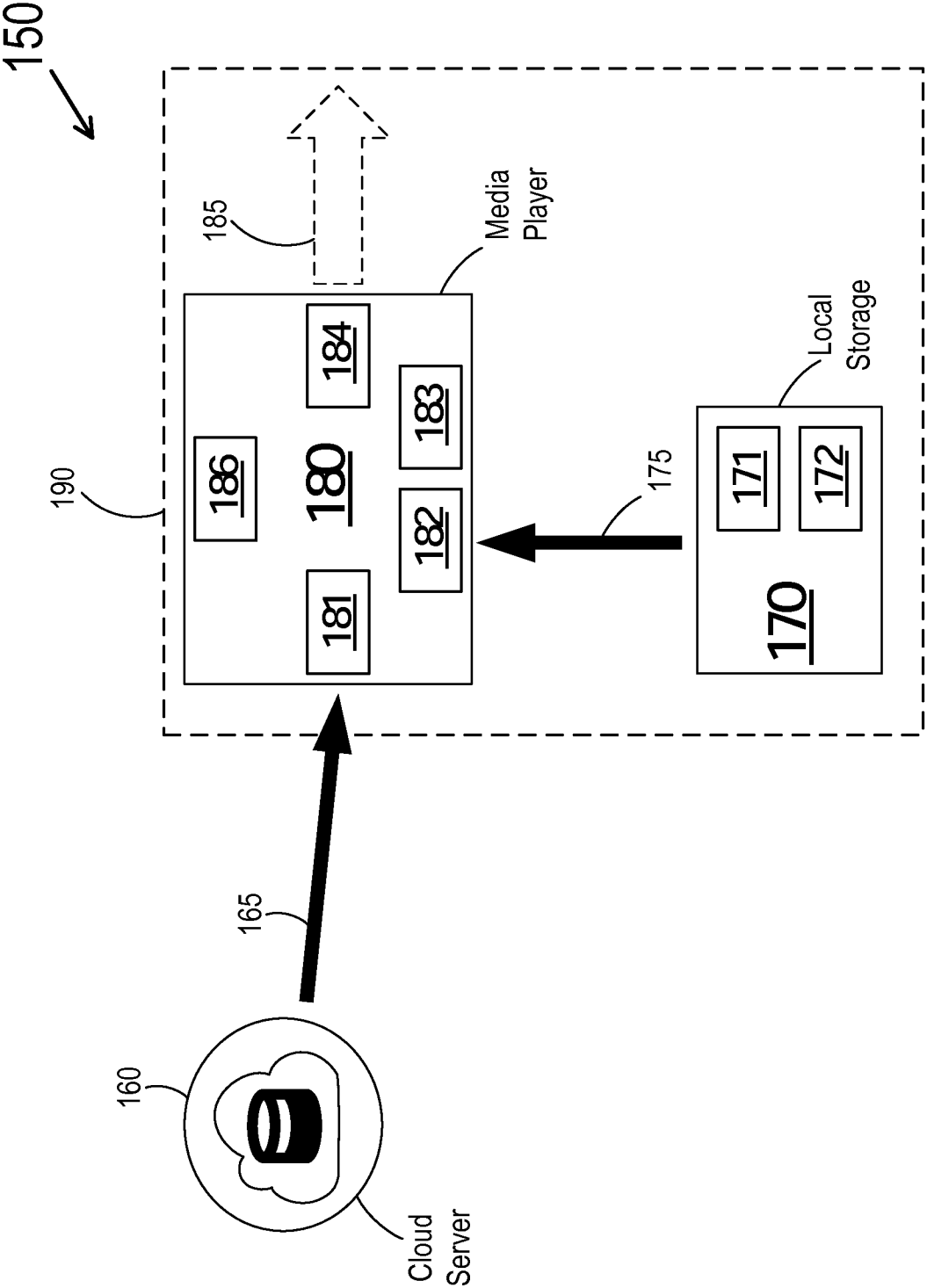


FIG. 1B

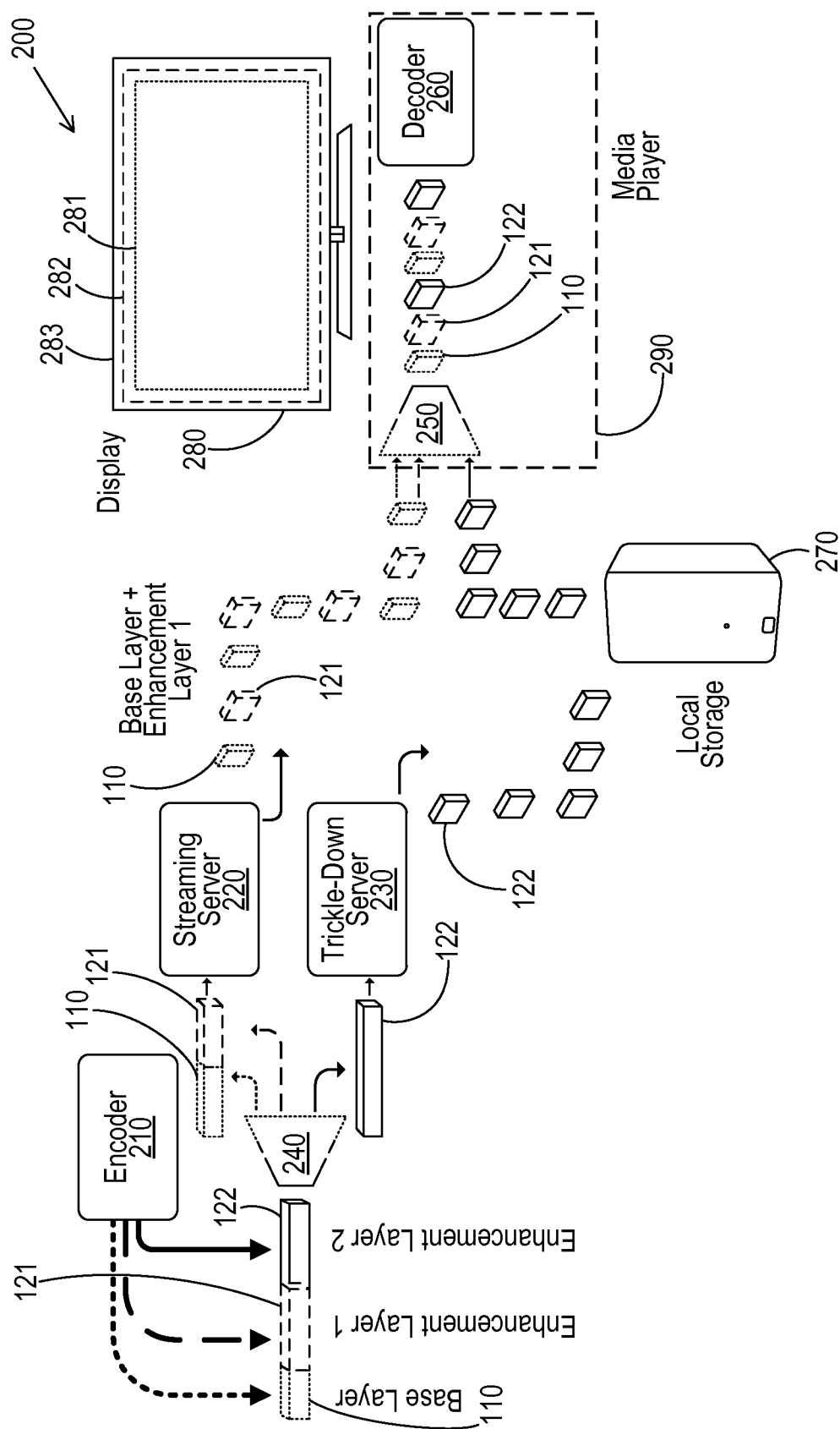


FIG. 2

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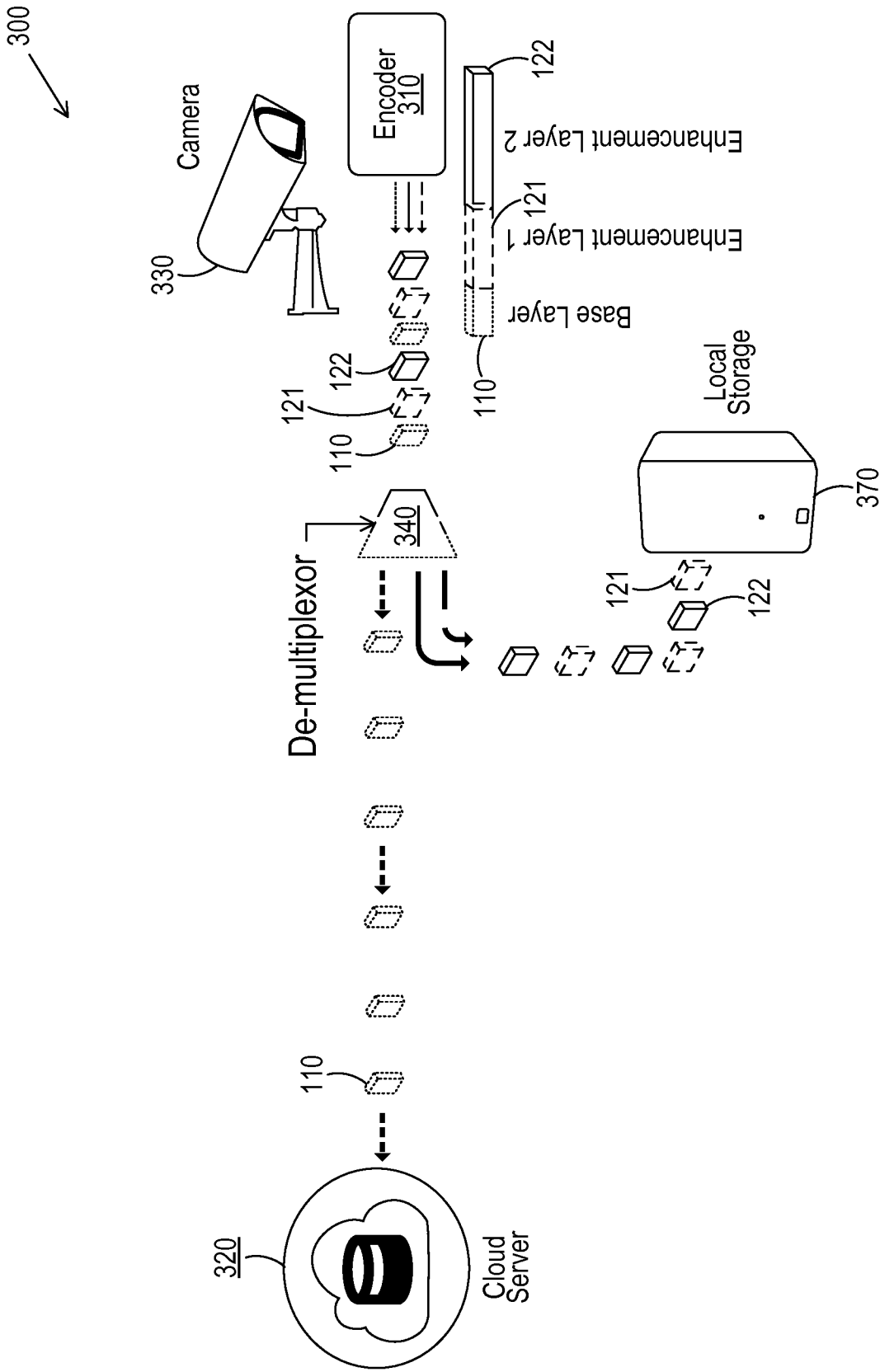


FIG. 3

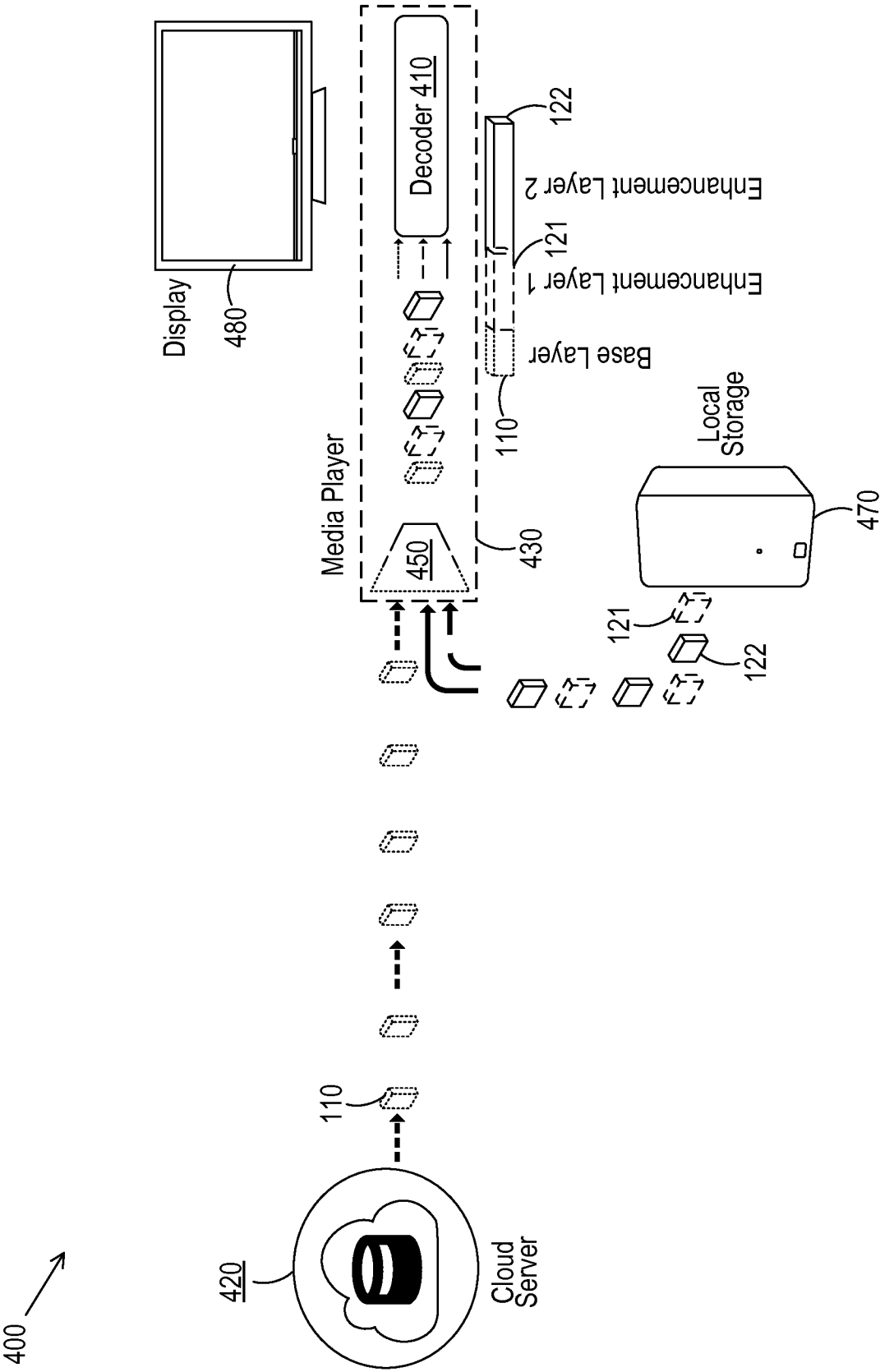


FIG. 4

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500

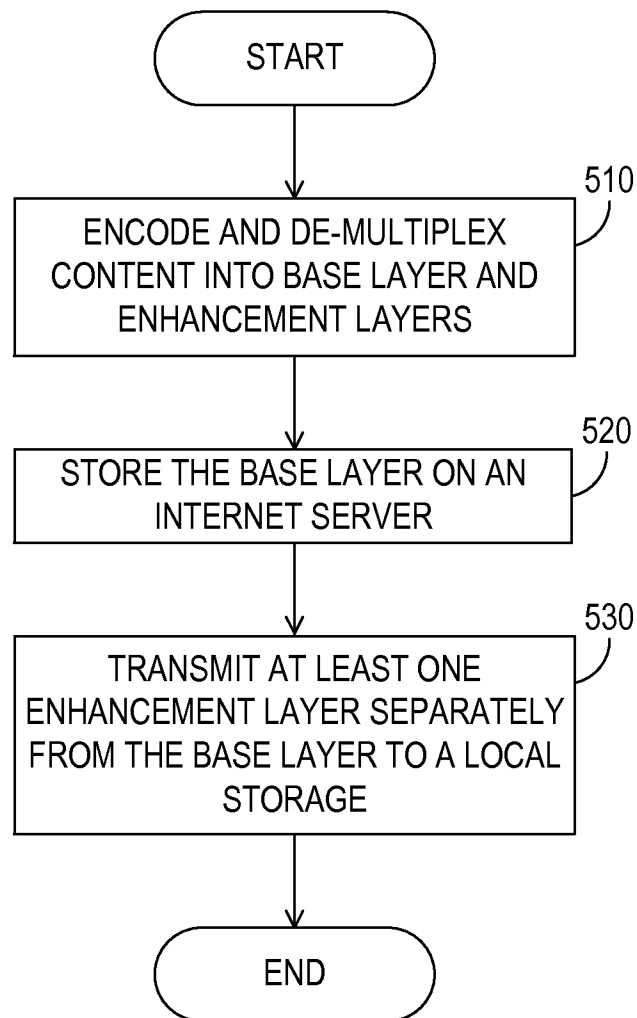


FIG. 5

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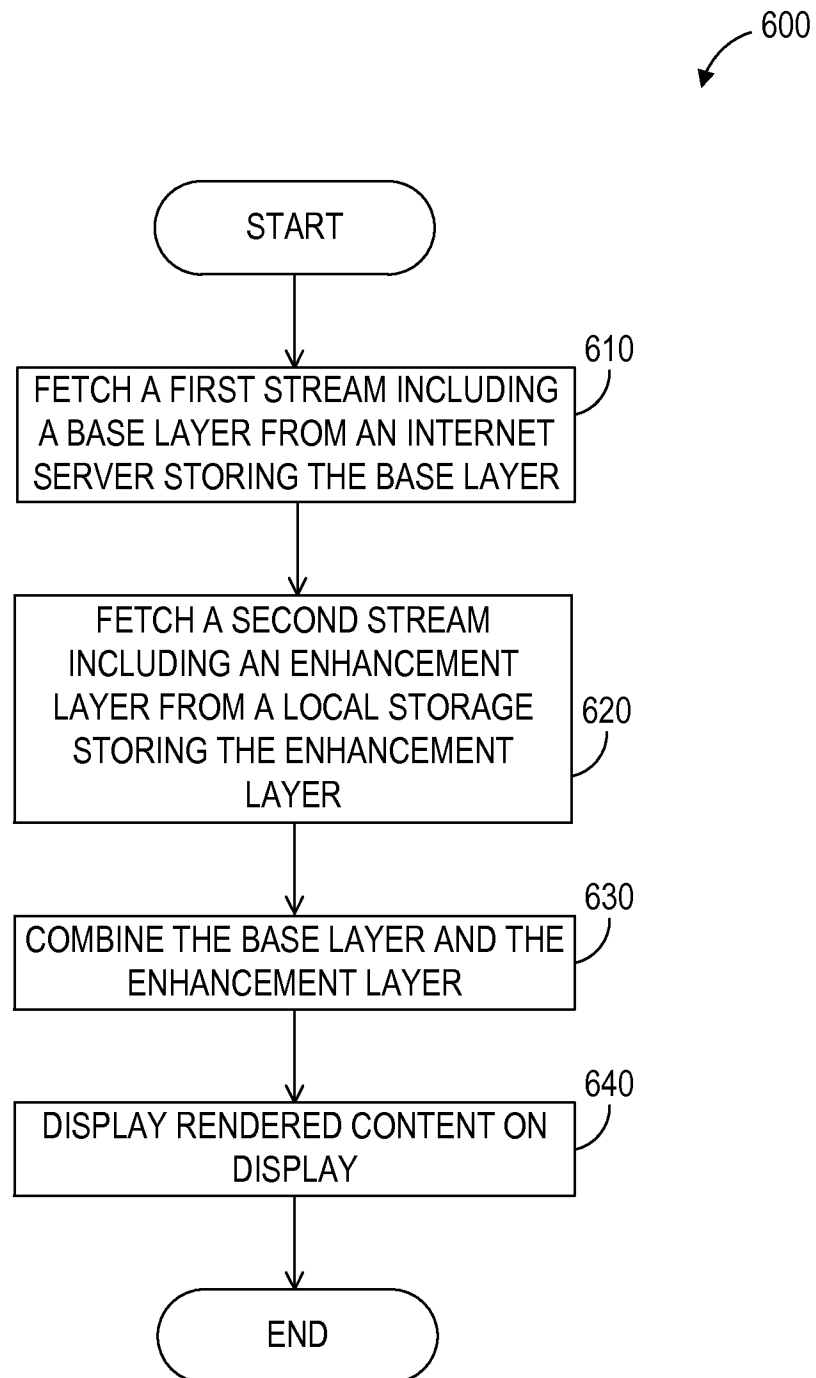


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/040391**A. CLASSIFICATION OF SUBJECT MATTER****H04N 21/2343(2011.01)i, H04N 21/23(2011.01)i, H04N 21/433(2011.01)i**

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)

H04N 21/2343; H04N 7/173; H04N 7/15; H04N 7/26; H04N 7/32; H04N 11/02; H04W 40/00; H04N 21/433

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: base layer, enhancement layer, fetch, local storage, combining, separately transmit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011-0164686 A1 (XIUPING LU et al.) 07 July 2011 See paragraphs 7, 19-44; and figs. 2-6.	1-5, 7-9, 15-19 , 21-23
Y		10-14
A		6, 20
Y	US 2012-0257675 A1 (BOB WANG et al.) 11 October 2012 See paragraphs 10-21; and fig. 1.	10-14
A	US 2006-0200848 A1 (PAUL BALDINE-BRUNEL et al.) 07 September 2006 See paragraphs 13-20; and figs. 1-3.	1-23
A	US 2009-0295905 A1 (REHA CIVANLAR et al.) 03 December 2009 See paragraphs 30-54; and figs. 1-3.	1-23
A	US 2011-0299448 A1 (ROBERT C. MEIER et al.) 08 December 2011 See paragraphs 53-56; and figs. 9, 10.	1-23



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

23 September 2014 (23.09.2014)

Date of mailing of the international search report

23 September 2014 (23.09.2014)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011-0164686 A1	07/07/2011	CN 102160375 A	17/08/2011
		EP 2361479 A1	31/08/2011
		EP 2361479 A4	22/05/2013
		JP 2012-503419 A	02/02/2012
		KR 10-2011-0069006 A	22/06/2011
		WO 2010-033164 A1	25/03/2010
US 2012-0257675 A1	11/10/2012	CN 102740071 A	17/10/2012
		EP 2512138 A2	17/10/2012
		EP 2512138 A3	03/07/2013
US 2006-0200848 A1	07/09/2006	CA 2390715 A1	18/12/2002
		CA 2390715 C	06/11/2007
		EP 1271954 A2	02/01/2003
		EP 1271954 A3	03/12/2003
		JP 04309098 B2	05/08/2009
		JP 2003-102008 A	04/04/2003
		US 2004-0261113 A1	23/12/2004
		US 7958532 B2	07/06/2011
		US 8621532 B2	31/12/2013
US 2009-0295905 A1	03/12/2009	AU 2006-321552 A1	14/06/2007
		AU 2006-330074 A1	05/07/2007
		AU 2006-330074 B2	24/12/2009
		AU 2006-330457 A1	05/07/2007
		AU 2006-330457 B2	14/07/2011
		AU 2006-346224 A1	02/05/2008
		AU 2006-346225 B1	18/02/2010
		AU 2006-346226 B1	16/07/2009
		AU 2006-346226 B8	25/03/2010
		AU 2007-214423 A1	23/08/2007
		AU 2007-214423 B2	28/07/2011
		AU 2007-223300 A1	13/09/2007
		AU 2007-230602 A1	04/10/2007
		AU 2007-234543 A1	11/10/2007
		AU 2007-303445 A1	10/04/2008
		AU 2007-309044 A1	02/05/2008
		AU 2007-309044 B2	28/04/2011
		AU 2007-311178 A1	24/04/2008
		AU 2008-204833 A1	17/07/2008
		AU 2009-225308 A1	05/11/2009
		AU 2009-225308 B2	21/07/2011
		CA 2615346 A1	20/01/2007
		CA 2615346 C	29/01/2013
		CA 2615352 A1	20/01/2007
		CA 2615352 C	12/02/2013
		CA 2615459 A1	20/01/2007
		CA 2615459 C	18/09/2012
		CA 2616266 A1	05/07/2007

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/040391

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CA 2633366 A1	05/07/2007
		CA 2633819 A1	14/06/2007
		CA 2644753 A1	13/09/2007
		CA 2647823 A1	04/10/2007
		CA 2662812 A1	10/04/2008
		CA 2662812 C	11/02/2014
		CA 2666601 A1	24/04/2008
		CA 2667194 A1	02/05/2008
		CA 2667194 C	25/06/2013
		CA 2674710 A1	17/07/2008
		CA 2763089 A1	04/10/2007
		CA 2779498 A1	20/01/2007
		CA 2796882 A1	20/01/2007
		CN 101341746 A	07/01/2009
		CN 101341746 B	30/11/2011
		CN 101366213 A	11/02/2009
		CN 101371312 A	18/02/2009
		CN 101411080 A	15/04/2009
		CN 101411080 B	01/05/2013
		CN 101421936 A	29/04/2009
		CN 101427573 A	06/05/2009
		CN 101427573 B	03/07/2013
		CN 101502109 A	05/08/2009
		CN 101502109 B	28/11/2012
		CN 101507209 A	12/08/2009
		CN 101507267 A	12/08/2009
		CN 101507267 B	14/09/2011
		CN 101523371 A	02/09/2009
		CN 101523371 B	25/04/2012
		CN 101573883 A	04/11/2009
		CN 101601296 A	09/12/2009
		CN 101601296 B	15/01/2014
		CN 101611551 A	23/12/2009
		CN 102036070 A	27/04/2011
		CN 102036071 A	27/04/2011
		CN 102036071 B	02/04/2014
		CN 102318202 A	11/01/2012
		CN 102318202 B	04/06/2014
		EP 1922850 A1	21/05/2008
		EP 1922850 A4	29/06/2011
		EP 1952631 A1	06/08/2008
		EP 1964124 A2	03/09/2008
		EP 1966917 A2	10/09/2008
		EP 1985116 A2	29/10/2008
		EP 1989877 A2	12/11/2008
		EP 1997236 A2	03/12/2008
		EP 2008369 A2	31/12/2008
		EP 2044710 A1	08/04/2009
		EP 2069951 A2	17/06/2009
		EP 2080275 A2	22/07/2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/040391

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		EP 2082576 A2	29/07/2009
		EP 2102988 A2	23/09/2009
		EP 2360843 A2	24/08/2011
		EP 2360843 A3	03/04/2013
		EP 2372922 A1	05/10/2011
		JP 04921488 B2	25/04/2012
		JP 04967020 B2	04/07/2012
		JP 05155323 B2	06/03/2013
		JP 05265383 B2	14/08/2013
		JP 05351761 B2	27/11/2013
		JP 05455648 B2	26/03/2014
		JP 2009-507450 A	19/02/2009
		JP 2009-508454 A	26/02/2009
		JP 2009-518981 A	07/05/2009
		JP 2009-518996 A	07/05/2009
		JP 2009-521880 A	04/06/2009
		JP 2009-540625 A	19/11/2009
		JP 2009-540629 A	19/11/2009
		JP 2009-543386 A	03/12/2009
		JP 2009-544176 A	10/12/2009
		JP 2009-545204 A	17/12/2009
		JP 2010-506461 A	25/02/2010
		JP 2010-507346 A	04/03/2010
		JP 2010-507937 A	11/03/2010
		JP 2010-516200 A	13/05/2010
		JP 2012-239184 A	06/12/2012
		JP 2013-102524 A	23/05/2013
		JP 2013-123238 A	20/06/2013
		JP 2013-128308 A	27/06/2013
		JP 2013-141284 A	18/07/2013
		JP 2013-229923 A	07/11/2013
		US 2008-0101470 A1	01/05/2008
		US 2008-0117930 A1	22/05/2008
		US 2008-0130658 A1	05/06/2008
		US 2008-0158339 A1	03/07/2008
		US 2008-0159180 A1	03/07/2008
		US 2008-0159384 A1	03/07/2008
		US 2008-0211901 A1	04/09/2008
		US 2009-0116562 A1	07/05/2009
		US 2010-0067581 A1	18/03/2010
		US 2010-0215053 A1	26/08/2010
		US 2012-0002728 A1	05/01/2012
		US 2012-320146 A1	20/12/2012
		US 7593032 B2	22/09/2009
		US 7643560 B2	05/01/2010
		US 7701851 B2	20/04/2010
		US 7933294 B2	26/04/2011
		US 7948886 B2	24/05/2011
		US 8279260 B2	02/10/2012
		US 8289370 B2	16/10/2012

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/040391

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 8396134 B2	12/03/2013
		US 8594202 B2	26/11/2013
		US 8681865 B2	25/03/2014
		WO 2007-067990 A2	14/06/2007
		WO 2007-067990 A3	10/04/2008
		WO 2007-075196 A1	05/07/2007
		WO 2007-076486 A2	05/07/2007
		WO 2007-076486 A3	13/12/2007
		WO 2007-095640 A2	23/08/2007
		WO 2007-095640 A3	17/04/2008
		WO 2007-103889 A2	13/09/2007
		WO 2007-103889 A3	28/02/2008
		WO 2007-112384 A2	04/10/2007
		WO 2007-112384 A3	28/08/2008
		WO 2007-115133 A2	11/10/2007
		WO 2007-115133 A3	23/10/2008
		WO 2008-042852 A2	10/04/2008
		WO 2008-042852 A3	31/07/2008
		WO 2008-048886 A2	24/04/2008
		WO 2008-048886 A3	16/10/2008
		WO 2008-051181 A1	02/05/2008
		WO 2008-051995 A2	02/05/2008
		WO 2008-051995 A3	24/12/2008
		WO 2008-060262 A1	22/05/2008
		WO 2008-073610 A1	19/06/2008
		WO 2008-073881 A2	19/06/2008
		WO 2008-073881 A3	28/08/2008
		WO 2008-082375 A2	10/07/2008
		WO 2008-082375 A3	31/12/2008
		WO 2008-086423 A2	17/07/2008
		WO 2008-086423 A3	02/10/2008
US 2011-0299448 A1	08/12/2011	US 8374113 B2	12/02/2013