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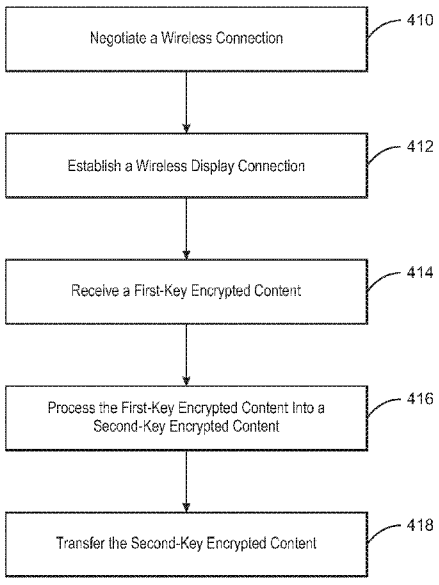
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(54) Title: WIRELESS DISPLAY STREAMING OF PROTECTED CONTENT

(57) Abstract: A system and method of wireless display, including a transmitter processing a first encrypted content into a second encrypted content without decoding, and transferring the second encrypted content over a wireless display connection to a receiver.



400A
FIG. 4A

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WIRELESS DISPLAY STREAMING OF PROTECTED CONTENT

Cross Reference to Related Application

[0001] The present application claims the benefit of the filing date of United States Patent Application Serial No. 15/199,868, by Changliang Wang, entitled "Wireless Display Streaming of Protected Content," filed June 30, 2016, and which is incorporated herein by reference.

Technical Field

[0002] The present techniques relate generally to wireless display, and more particularly, to streaming of content via wireless display.

Background Art

[0003] A peer-to-peer wireless connection or direct wireless connection, such as with Wi-Fi Direct®, provides for wireless coupling of devices without a wireless access point (AP) router. Further, wireless display technology, such as Miracast™, may employ Wi-Fi Direct® to stream video and audio content wirelessly from a computing device such as a laptop, smartphone, or tablet, to a second device such as a monitor, television, or other computing device. In some cases, adapters may be employed on the receiver. For instance, adapters are available that plug into high definition multimedia interface (HDMI) ports or universal serial bus (USB) ports that enable non-Miracast devices to connect via Miracast™.

[0004] Miracast™ is a certification program of the Wi-Fi Alliance. Devices that are Miracast™ certified have a software implementation based on the Wi-Fi Display technical specification. The Wi-Fi Alliance maintains a current list of Miracast-certified devices. The sender and the receiver devices generally may be Miracast™ certified for the technology to function. However, as mentioned, to stream music and movies to a non-certified device, Miracast™ adapters are available that plug into HDMI or USB ports. Moreover, the technology may generally work across devices, regardless of brand. Miracast™ devices negotiate settings for each connection, which may simplify the process for the users. In the competitive business of

consumer electronics and services, there exists an ongoing need for continuous improvement in implementation, reliability, affordability, and so forth.

BRIEF DESCRIPTION OF DRAWINGS

[0005] FIGS. 1A and 1B are a block diagram of a system for wireless display.

[0006] FIGS. 2A and 2B are a block diagram of a system for wireless display in accordance with embodiments of the present techniques.

[0007] FIG. 3 is a block diagram of a system for wireless display in accordance with embodiments of the present techniques.

[0008] FIG. 4 is a block flow diagram of method for wireless display in accordance with embodiments of the present techniques.

[0009] FIG. 4A is a block flow diagram of method for wireless display in accordance with embodiments of the present techniques.

[0010] FIG. 5 is a block diagram depicting an example of a tangible non-transitory, computer-readable medium that directs wireless display in accordance with embodiments of the present techniques.

[0011] The same numbers are used throughout the disclosure and the figures to reference like components and features. Numbers in the 100 series refer to features originally found in Fig. 1; numbers in the 200 series refer to features originally found in Fig. 2; and so on.

DETAILED DESCRIPTION

[0012] The present techniques relate generally to wireless display (e.g., Miracast™, Apple AirPlay®, Google Chromecast™, etc.), and more particularly, to streaming protected content via the wireless display connection. In accordance with present examples, a wireless display standard, such as Miracast™, may provide for direct streaming by a transmitter to send video content to a receiver without the transmitter decoding and encoding the video. A specific example provides for direct streaming and content protection via wireless display services such as with Miracast™ revision two (R2) and later revisions.

[0013] Embodiments accommodate wirelessly streaming audio/video from a transmitter (e.g., a computing device) to a receiver over a wireless connection (e.g.,

wireless direct, peer-to-peer, Wi-Fi Direct®, etc.) and a wireless display connection (e.g., a Miracast™ connection, Apple AirPlay® connection, Google Chromecast™ connection, etc.). Some examples are applicable to various standards, such as the Miracast™ standard including revision two (R2) expected in 2017 and later revisions. However, other examples are not limited to a particular standard. Further, while the discussion herein may focus on Miracast™, the present techniques are applicable to other standards and wireless display services. For instance, some embodiments are applicable to Apple AirPlay®, Google Chromecast™, and other wireless display standards and connections. Indeed, the techniques may be applicable to wireless display service connections generally in which video, audio, data, etc. are transmitted wirelessly from a transmitter to a receiver. Moreover, while Wi-Fi Direct® generally does not require an access point (AP) router, some examples of the techniques may accommodate Wi-Fi via an AP router.

[0014] Embodiments herein further direct protected content. Indeed, in certain embodiments, the protected content may be streamed from the transmitter to the receiver via the wireless display without transmitter actions of decoding, composing, and/or encoding the video stream. Such may be useful, for example, with low-processing devices (e.g., smartphone or tablet) as the transmitter that have limited processing capability to handle decoding, composing, and encoding. A particular example handles protected content license acquisition and transcryption, e.g., from a Digital Rights Management (DRM) key to a High Definition Copy Protocol (HDCP2) key, on the transmitter side and, therefore, may avoid Miracast™ revision one (R1) style flow and enable R2 direct streaming.

[0015] In a typical protected content license acquisition and transcryption using Miracast™ R1 flow, the following may be implemented: license acquisition and DRM key extraction, HDCP2 authentication, decrypt using DRM key, decode, compose with User Interface (UI), encode, and encrypt with HDCP2 key. In contrast, embodiments (including with R2) may avoid the decode, compose, and/or encode actions on the transmitter side, and implement the protected playback content with the transmitter as follows: license acquisition and DRM key extraction, HDCP2 authentication, decrypt using DRM key, and encrypt with HDCP2 key. Thus, with certain embodiments of this latter implementation, the processing of up to three work

items (decode, compose, and encode) or more may be avoided by the transmitter. These work items may be relatively heavy duty. The avoidance of these work items by the transmitter may reduce processor (e.g., graphic processing unit or GPU) workload on the transmitter side, reduce latency, reduce power consumption, and/or improve performance, and so forth.

[0016] FIGS. 1A and 1B are a wireless display system 100 for streaming of content from a transmitter 102 to a receiver 104. The transmitter 102 and the receiver 104 may each be a computing device such as a smartphone, tablet, laptop, desktop, monitor, television, etc. In some examples, the transmitter 102 is a smaller device such as a smartphone or tablet, and the receiver 104 is a larger device such as a monitor or television. As discussed with respect to FIG. 3 below, each device may have memory and a processor. The processors of the transmitter 102 and the receiver 104 may each be one or more processors, and include more than one core. The processors may be a microprocessor, central processing unit (CPU), graphics processing unit (GPU), and so on. The memory of the transmitter 102 and the receiver 104 may each include nonvolatile and volatile memory.

[0017] An example of a wireless display services standard is the Miracast™ standard. Some variations of FIGS. 1A and 1B may be for Miracast™ R1 or other standards. The depicted actions may represent code (logic, instructions) stored in memory and executed by a processor. Of course, the actions depicted may be implemented via the indicated hardware (wires, cables, buffers, mediums, conductors, demux, mux, etc.) of the transmitter 102 and the receiver 104.

[0018] In the illustrated embodiment, a content server 106 provides content, and a license server 107 provides a license. The content may be video and/or audio. The transmitter 102 may receive the content. Again, FIGS. 1A and 1B may accommodate the Miracast™ R1 design for protected content playback. A DRM license acquisition via the license server 107 may establish the authentication between the content server 106 and the client (transmitter 102), so that with the license acquisition, the client may be capable to decrypt content by having the DRM content key (for audio and video).

[0019] A demultiplex (demux) 108 of the transmitter 102 may split the content into audio 110 and video 112. Moreover, as indicated, a key 113 (e.g., a DRM key)

obtained via the license acquisition may be used by the transmitter 102 to decrypt the audio and video streams to give decrypted audio 114 and decrypted video 116. Thus, the transmitter 102 decrypts the incoming DRM bitstream.

[0020] Continuing in the transmitter 102 environment, these decrypted streams may be decoded to an audio decoded buffer 118 and video decoded buffer 120, respectively. Such consumes decoder duty cycle. Further, in the illustrated example, the audio may be encoded 122 to give an encoded bitstream 124. As for the video, the video may be composed 126 with any UI 128 and/or subtitle 130 to a composed buffer 132, and then encoded to give an encoded bitstream 134. In other words, if there is a UI content and/or subtitle, the transmitter 102 may compose the UI and/or subtitle along with the video content. This may require significant GPU time, especially for 4k content, for instance. As for the encoding after composition, the uncompressed buffer is encoded and output as a bitstream, which again this action may be heavy duty with the GPU/encoder.

[0021] The transmitter 102 may encrypt the encoded bitstreams 124 and 134 to give HDCP2 encrypted audio content 136 and HDCP2 encrypted video content 138, respectively. This encryption may be performed via an HDCP2 key 140 obtained in the HDCP2 negotiation and authorization between the transmitter 102 and the receiver 104. The HDCP authentication may involve a key exchange between receiver 104 and transmitter 102 and, thus, at the end of the flow, the transmitter 102 having a HDCP2 key to encrypt content.

[0022] The encrypted streams may be sent to a multiplexer (mux) 142 and with the content ready for wireless display transfer to the receiver 104, as indicated by reference numeral 144. In the illustrated embodiment, the mux 142 includes a Moving Picture Experts Group (MPEG)-2 transport stream(MPEG2-TS) as a standard container format for transmission and storage of audio, video, and Program and System Information Protocol (PSIP) data. Thus, the mux 142 may include a container for broadcast systems for audio, video, and data.

[0023] The receiver 104 receives the content, and divides the content via a demux 146 into an audio 148 stream and a video 150 stream, both of which may be decrypted (using the key 140) to give decrypted audio 152 and decrypted video 154. The receiver 104 may decode this decrypted content to an audio decoded buffer 156

and a video decoded buffer 158 for play and display at the receiver 104, as indicated by reference numeral 160.

[0024] FIGS. 2A and 2B are a wireless display system 200 for streaming of content from a transmitter 202 to a receiver 204. Embodiments may provide for a direct streaming mode. In order to send the media content in native encoding formats without the need of decoding and re-encoding, the audio, video, and image content provided from the media application in the source device may be sent as separate elementary streams. Features such as UI, subtitle, scaling, alpha blending, and the like, may be accommodated. Moreover, the system 200 may handle protected content.

[0025] As with the devices of FIGS. 1A and 1B, the transmitter 202 and the receiver 204 in FIGS. 2A and 2B may each be a computing device such as a smartphone, tablet, laptop, desktop, monitor, television, etc. In some examples, the transmitter 202 is a smaller device such as a smartphone or tablet, and the receiver 204 is a larger device such as a monitor or television. As discussed with respect to FIGS 1A, 1B, and 3, the transmitter and receiver may each have memory and a processor. The transmitter 202 processor and the receiver 204 processor may each be one or more processors, and include more than one core. The processor may be a microprocessor, central processing unit (CPU), graphics processing unit (GPU), and so on. The transmitter 202 memory and the receiver 204 memory may each include nonvolatile and volatile memory.

[0026] As mentioned, an example of a wireless display services standard is the Miracast™ standard. Some variations of FIGS. 2A and 2B may be for Miracast™ R2 or other standards. The depicted actions may represent code (logic, instructions) stored in memory and executed by a processor. Of course, the actions depicted may be implemented via the indicated hardware (wires, cables, buffers, mediums, conductors, demux, mux, etc.) of the transmitter 202 and the receiver 204.

[0027] In the illustrated embodiment, a content server 106 provides content, and a license server 107 provides a license to use the content. The content may be video and/or audio. The transmitter 202 may receive the content. Again, in certain examples, FIGS. 2A and 2B may accommodate the Miracast™ R2 design for protected content playback. In the illustrated example, the transmitter 202, via a

demux 208, splits the content into audio 210 and video 212. The transmitter 202 employs the key 214 (e.g., a DRM key) obtained in the license acquisition to decrypt the audio and video to give a decrypted audio stream 216 and a decrypted video stream 218.

[0028] In instances with a subtitle 210, the subtitle may be compressed to give a compressed subtitle 222 which may be subjected to a packetized elementary stream (PES) packetizer to give a subtitle PES 224. As for a UI 226 stream, the UI 226 may be compressed by the transmitter 202 to give a compressed UI 228 which may also be subjected to a PES packetizer to give a UI PES 230. Further, in certain embodiments, the audio stream 216 and the video stream 218 may each be sent through a PES packetizer to give a video PES packet and audio PES packet, respectively, and then encrypted (along with the subtitle PES 224) to give HDCP2 encrypted content 232, 234, and 236. No decoding is performed. Lastly, these streams 232, 234, 236 along with the UI PES 230 may be sent to a MPEG2-TS mux 238, and with the content ready for transfer, as indicated by reference numeral 240. Moreover, the aforementioned encryption may be performed with a key 242 (e.g., a HDCP key such as a HDCP2 key) obtained with an HDCP authorization negotiation between the transmitter 202 and the receiver 204.

[0029] The receiver 204 receives the content and divides, via a demux 244, the content into audio 246, video 248, and the subtitle 250 (if there is a subtitle). The streams may be decrypted via the key 242 to give decrypted audio 252, decrypted video 254, and the decrypted subtitle 256, all of which may be decoded into an audio decoded buffer 258, a video decoded buffer 260, and subtitle decoded buffer 262, respectively. Further, the receiver 204 via the demux 244, may split the UI 264 from the received content. The UI 264 along with the decoded video and decoded subtitle may be composed into a composed buffer 266 which may, along with the decoded audio, feed the display 268.

[0030] FIG. 3 is a system 300 providing for wireless display. The system 300 may be similar or identical to the system 200 of FIGS. 2A and 2B. A wireless display (e.g., Miracast™) connection may be established between a transmitter 302 (e.g., computing device) and a receiver 304. Indeed, embodiments accommodate wirelessly streaming audio/video from the transmitter 302 to the receiver 304 over a

wireless connection (e.g., Wi-Fi Direct®) and a wireless display connection (e.g., a Miracast™ connection). The transmitter 302 and the receiver 304 may each be a computing device such as a smartphone, tablet, laptop, desktop, monitor, television, dongle, etc. The transmitter 302 has a processor 306 and memory 308 storing code 309 (instructions, logic) executable by the processor 306. The code 309 may be executable by the processor 306 to provide or the actions of the transmitter as discussed with respect to FIGS. 2A and 2B. Indeed, embodiments may provide for a direct streaming mode. In order to send the media content from the transmitter 302 in native encoding formats without decoding and re-encoding, the audio, video, and image content provided from the transmitter 302 may be sent as separate elementary streams. Certain examples may provide for the Miracast™ R2 design for protected content playback. Again, the actions of decoding, coding, and/or composing may be shifted from the transmitter to 302 to the receiver 304. The code 308 when executed by the processor 306 may provide for the transmitter to perform the transcryption without decoding (or composing).

[0031] In the illustrated embodiment, the transmitter 302 includes a network interface 310 (e.g., network adapter) for a wireless connection. Similarly, the receiver 304 includes a network interface 312 (e.g., network adapter) for a wireless connection. Further, the receiver 304 has a processor 314 and memory 316 storing code 318 executable by the processor 314. The code 318 may provide for the aforementioned actions by the receiver discussed with respect to FIGS. 2A and 2B. Moreover, as indicated, the processors 306 and 314 may each be a microprocessor, hardware processor, CPU, GPU, and so on. The transmitter memory 308 and the receiver memory 316 may each include nonvolatile and volatile memory.

[0032] FIG. 4 is a method 400 for wireless display between a transmitter and a receiver, and with the transmitter receiving encrypted content (e.g., video) such as from a content server. The method includes the transmitter performing (block 402) license acquisition and DRM key extraction, and the transmitter performing (block 404) HDCP2 authentication. Indeed, the transmitter decrypts (block 406) the content using a DRM key, and encrypts (block 408) the content using an HDCP2 key such as a HDCP2 key. In certain embodiments, the transmitter performs this

transcryption without decoding, encoding, or composing, and sends the HDCP-encrypted content to the receiver over the wireless display connection.

[0033] FIG. 4A is a method 400A of wireless display between a transmitter and a receiver. At block 410, the method includes negotiating a wireless connection (e.g., Wi-Fi Direct®) between a transmitter and a receiver to wirelessly couple the transmitter and the receiver. At block 412, the method establishes a wireless display connection (e.g., Miracast™) between the transmitter and the receiver. At block 414, the transmitter receives a first encrypted content or a first-key encrypted content. The content may include video, audio, and/or a subtitle. At block 416, the transmitter processes the first encrypted content (e.g., DRM encrypted) into a second encrypted content (e.g., HDCP2 encrypted) or second-key encrypted content (e.g., with the second key as a HDCP2 key). This processing may be performed without decoding, encoding, or composing. Instead, the receiver may perform these actions. At block 418, the transmitter transfers the second encrypted content or second-key encrypted content over the wireless display connection to the receiver.

[0034] The method 400A may include the transmitter performing a license acquisition to obtain a first key (e.g., a DRM key), with the processing at block 416 includes decrypting the first encrypted content with the first key, and then encrypting the content with a second key (e.g., HDCP2 key) different from the first key to give the second encrypted content. The processing by the transmitter at block 416 may include dividing the first encrypted content into a first encrypted video and a first encrypted audio, decrypting the first encrypted video to decrypted video, and decrypting the first encrypted audio to decrypted audio. Decrypting the first encrypted video may include decrypting the first encrypted video with the first key, and decrypting the first encrypted audio may include decrypting the first encrypted audio with the first key. Moreover, the transmitter may packetize (e.g., via a PES packetizer) the decrypted video and the decrypted audio. In examples, the transmitter does not decode the decrypted video, and wherein the transmitter does not decode the decrypted audio.

[0035] Further, the transmitter processing at block 416 may include encrypting (e.g., via a second key such as a HDCP2 key) the decrypted video to a second encrypted video, encrypting (e.g., via the second key) the decrypted audio to a

second encrypted audio, and combining the second encrypted video and the second encrypted audio to give the second encrypted content. Moreover, the processing may include compressing a UI stream and combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing. Further, a subtitle may also be included, as discussed above with respect to FIGS. 2A and 2B. In addition, the method 400A may include the actions of the receiver, as also discussed above with respect to FIGS. 2A and 2B. The operation may include wirelessly streaming video or audio, or both, from the transmitter to the receiver over the wireless connection and the wireless display connection.

[0036] As should be apparent for certain embodiments, the DRM encrypted content is not sent to receiver. Thus, the receiver is not required to support that particular DRM scheme, which could be difficult. Receivers may already generally support HDCP decryption. Therefore, in some embodiments, the system and operation may be beneficial with the transmitter to decrypt (DRM) and encrypt (HDCP).

[0037] FIG. 5 is a block diagram depicting an example of a tangible non-transitory, computer-readable medium 500 that can facilitate application registration and enablement in a wireless display environment, as discussed above. The computer-readable medium 400 may be accessed by a processor 402 over a computer interconnect 404. The processor 402 may be a processor (e.g., 306) of the computing device. The tangible, non-transitory, computer-readable medium 400 may include executable instructions or code to direct the processor 402 to perform the operations of the techniques described herein.

[0038] The various software components discussed herein may be stored on the tangible, non-transitory, computer-readable medium 400, as indicated in FIG. 4. For example, the code may direct the processor to negotiate a wireless connection between a transmitter and a receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter may be the computing device, and establish a wireless display service connection between the transmitter and the receiver. The code may direct the processor to: receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio;

decrypt the first encrypted video to give decrypted video, and decrypt the first encrypted audio to give decrypted audio; encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio; combine the second encrypted video and the second encrypted audio into a second encrypted content; and transfer, via the wireless display service connection, the second encrypted content to the receiver.

[0039] It should be understood that any number of additional software components not shown in FIG. 4 may be included within the tangible, non-transitory, computer-readable medium 400, depending on the application or other considerations. Moreover, while one module 406 is depicted, additional modules directed to other code and actions may be stored on medium 400.

[0040] Some embodiments may be implemented in one or a combination of hardware, firmware, and software. Some embodiments may also be implemented as instructions stored on a machine-readable medium, which may be read and executed by a computing platform to perform the operations described herein. A machine-readable medium may include any mechanism for storing or transmitting information in a form readable by a machine, e.g., a computer. For example, a machine-readable medium may include read only memory (ROM); random access memory (RAM); magnetic disk storage media; optical storage media; flash memory devices; or electrical, optical, acoustical or other form of propagated signals, e.g., carrier waves, infrared signals, digital signals, or the interfaces that transmit and/or receive signals, among others.

[0041] An embodiment is an implementation or example. Reference in the specification to “an embodiment”, “one embodiment”, “some embodiments”,“various embodiments,” or “other embodiments” means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least some embodiments, but not necessarily all embodiments, of the present techniques. The various appearances of “an embodiment,” “one embodiment,” or “some embodiments” are not necessarily all referring to the same embodiments. Elements or aspects from an embodiment can be combined with elements or aspects of another embodiment.

[0042] Not all components, features, structures, characteristics, etc. described and illustrated herein need be included in a particular embodiment or embodiments. If the specification states a component, feature, structure, or characteristic "may", "might", "can" or "could" be included, for example, that particular component, feature, structure, or characteristic is not required to be included. If the specification or claim refers to "a" or "an" element, that does not mean there is only one of the element. If the specification or claims refer to "an additional" element, that does not preclude there being more than one of the additional element.

[0043] It is to be noted that, although some embodiments have been described in reference to particular implementations, other implementations are possible according to some embodiments. Additionally, the arrangement and/or order of circuit elements or other features illustrated in the drawings and/or described herein need not be arranged in the particular way illustrated and described. Many other arrangements are possible according to some embodiments.

[0044] In each system shown in a figure, the elements in some cases may each have a same reference number or a different reference number to suggest that the elements represented could be different and/or similar. However, an element may be flexible enough to have different implementations and work with some or all of the systems shown or described herein. The various elements shown in the figures may be the same or different. Which one is referred to as a first element and which is called a second element is arbitrary.

[0045] Examples are given. Example 1 is a method of wireless display. The method includes negotiating a wireless connection between a transmitter and a receiver to wirelessly couple the transmitter and the receiver; establishing a wireless display connection between the transmitter and the receiver; receiving at the transmitter a first encrypted content; processing, via the transmitter, the first encrypted content into a second encrypted content without decoding; and transferring, via the wireless display connection, the second encrypted content from the transmitter to the receiver.

[0046] Example 2 includes the method of example 1, including or excluding optional features. In this example, the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display connection comprises Miracast™.

[0047] Example 3 includes the method of any one of examples 1 to 2, including or excluding optional features. In this example, the method includes the transmitter performing a license acquisition to obtain a first key, wherein the processing comprises: decrypting the first encrypted content with the first key; and performing encryption with a second key different than the first key to give the second encrypted content. Optionally, the first key comprises a Digital Rights Management (DRM) key, and wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

[0048] Example 4 includes the method of any one of examples 1 to 3, including or excluding optional features. In this example, the processing comprises: dividing the first encrypted content into a first encrypted video and a first encrypted audio; decrypting the first encrypted video to decrypted video, and decrypting the first encrypted audio to decrypted audio; encrypting the decrypted video to a second encrypted video, and encrypting the decrypted audio to a second encrypted audio; and combining the second encrypted video and the second encrypted audio to give the second encrypted content. Optionally, the processing comprises: packetizing the decrypted video; packetizing the decrypted audio; compressing a user interface (UI) stream; and combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content Optionally, packetizing comprises subjecting the decrypted audio or decrypted video to a packetized elementary stream (PES) packetizer.

[0049] Example 5 is a method of wireless display. The method includes establishing a wireless display connection between a transmitter and a receiver; and performing by the transmitter: dividing a first encrypted content into a first encrypted video and a first encrypted audio; decrypting the first encrypted video to give decrypted video, and decrypting the first encrypted audio to give decrypted audio; encrypting the decrypted video to give a second encrypted video, and encrypting the decrypted audio to give a second encrypted audio; combining the second encrypted video and the second encrypted audio into a second encrypted content; and transferring, via the wireless display connection, the second encrypted content to the receiver.

[0050] Example 6 includes the method of example 5, including or excluding optional features. In this example, the method includes negotiating a wireless connection between the transmitter and the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter does not decode the decrypted video, and wherein the transmitter does not decode the decrypted audio. Optionally, the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display connection comprises Miracast™.

[0051] Example 7 includes the method of any one of examples 5 to 6, including or excluding optional features. In this example, the method includes the transmitter receiving the first encrypted content and performing a license acquisition to obtain a first key, wherein decrypting the first encrypted video comprises decrypting the first encrypted video with the first key, and wherein decrypting the first encrypted audio comprises decrypting the first encrypted audio with the first key. Optionally, encrypting the decrypted video comprises encrypting the decrypted video with a second key different than the first key, and wherein encrypting the decrypted audio comprises encrypting the decrypted audio with the second key.

[0052] Example 8 includes the method of any one of examples 5 to 7, including or excluding optional features. In this example, the method includes the transmitter packetizing the decrypted video, and the transmitter packetizing the decrypted audio, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

[0053] Example 9 includes the method of any one of examples 5 to 8, including or excluding optional features. In this example, the method includes the transmitter compressing a user interface (UI) stream, and wherein combining into a second encrypted content comprises the transmitter combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing.

[0054] Example 10 is a transmitter configured for wireless display. The transmitter configured for wireless display includes a processor; and memory storing instructions that when executed by the processor cause the transmitter to: receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio; decrypt the first encrypted video to give decrypted

video, and decrypt the first encrypted audio to give decrypted audio; encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio; combine the second encrypted video and the second encrypted audio into a second encrypted content; and transfer the second encrypted content over a wireless display service connection to a receiver.

[0055] Example 11 includes the transmitter configured for wireless display of example 10, including or excluding optional features. In this example, the transmitter is a computing device and is to negotiate a wireless connection with the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter is to establish over the wireless connection the wireless display service connection between the transmitter and the receiver. Optionally, the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display service connection comprises Miracast™.

[0056] Example 12 includes the transmitter configured for wireless display of any one of examples 10 to 11, including or excluding optional features. In this example, to decrypt the first encrypted video comprises decrypting the first encrypted video with the first key, wherein to decrypt the first encrypted audio comprises decrypting the first encrypted audio with the first key, wherein to encrypt the decrypted video comprises encrypting the decrypted video with a second key different from the first key, and wherein to encrypt the decrypted audio comprises encrypting the decrypted audio with the second key. Optionally, the first key comprises a Digital Rights Management (DRM) key, and wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

[0057] Example 13 includes the transmitter configured for wireless display of any one of examples 10 to 12, including or excluding optional features. In this example, to combine into a second encrypted content comprises combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

[0058] Example 14 is a tangible, non-transitory, computer-readable medium. The tangible, non-transitory, computer-readable medium includes instructions that direct the processor to receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio; decrypt the first encrypted video to give decrypted video, and decrypt the first encrypted audio to give decrypted audio; encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio; combine the second encrypted video and the second encrypted audio into a second encrypted content; and transfer, via a wireless display service connection, the second encrypted content to a receiver.

[0059] Example 15 includes the tangible, non-transitory, computer-readable medium of example 14, including or excluding optional features. In this example, the first encrypted content comprises content encrypted by a first key; the first encrypted video comprises video encrypted by the first key; the first encrypted audio comprises audio encrypted by the first key; the second encrypted content comprises content encrypted by a second key different than the first key; the second encrypted video comprises video encrypted by the second key; and the second encrypted audio comprises audio encrypted by the second key.

[0060] Example 16 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 15, including or excluding optional features. In this example, the instructions when executed by the processor cause the computing device to: negotiate a wireless connection between a transmitter and the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter comprises the computing device; establish the wireless display service connection between the transmitter and the receiver; and acquire a license to obtain a first key, wherein to decrypt the first encrypted video comprises decrypting the first encrypted video with the first key, and wherein to decrypt the first encrypted audio comprises decrypting the first encrypted audio with the first key. Optionally, the instructions when executed by the processor cause the computing device to packetize the decrypted video and packetize the decrypted audio, wherein to encrypt the decrypted video comprises encrypting the decrypted video with a second key different from the first

key, and wherein to encrypt the decrypted audio comprises encrypting the decrypted audio with the second key.

[0061] Example 17 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 16, including or excluding optional features. In this example, the instructions when executed by the processor cause the computing device to compress a user interface (UI) stream, and wherein to combine into the second encrypted content comprises combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing. Optionally, the first key comprises a Digital Rights Management (DRM) key. Optionally, the second key comprises a High Definition Copy Protocol (HDCP) key. Optionally, the wireless connection comprises Wi-Fi Direct®.

[0062] Example 18 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 17, including or excluding optional features. In this example, the wireless display service connection comprises Miracast™.

[0063] Example 19 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 18, including or excluding optional features. In this example, the wireless display service connection comprises Google Chromecast™.

[0064] Example 20 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 19, including or excluding optional features. In this example, the wireless display service connection comprises Apple AirPlay®.

[0065] Example 21 includes the tangible, non-transitory, computer-readable medium of any one of examples 14 to 20, including or excluding optional features. In this example, the instructions when executed by the processor cause the computing device to packetize the decrypted video and packetize the decrypted audio. Optionally, to packetize the decrypted video comprises subjecting the decrypted video to a packetized elementary stream (PES) packetizer. Optionally, to packetize the decrypted audio comprises subjecting the decrypted audio to a packetized elementary stream (PES) packetizer.

[0066] Example 22 is a computing device. The computing device includes means for dividing a first encrypted content into a first encrypted video and a first encrypted

audio; means for decrypting the first encrypted video to give decrypted video, and for decrypting the first encrypted audio to give decrypted audio; means for encrypting the decrypted video to give a second encrypted video without decoding the decrypted video, and for encrypting the decrypted audio to give a second encrypted audio without decoding the decrypted audio; means for combining the second encrypted video and the second encrypted audio into a second encrypted content; and means for transferring, via a wireless display service connection, the second encrypted content to a receiver.

[0067] Example 23 includes the computing device of example 22, including or excluding optional features. In this example, the first encrypted content comprises content encrypted by a first key; the first encrypted video comprises video encrypted by the first key; the first encrypted audio comprises audio encrypted by the first key; the second encrypted content comprises content encrypted by a second key different than the first key; the second encrypted video comprises video encrypted by the second key; and the second encrypted audio comprises audio encrypted by the second key.

[0068] Example 24 includes the computing device of any one of examples 22 to 23, including or excluding optional features. In this example, the computing device includes means for negotiating a wireless connection between a transmitter and the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter is the computing device; means for establishing the wireless display service connection between the transmitter and the receiver; and means for acquiring a license to obtain a first key, wherein decrypting the first encrypted video comprises decrypting the first encrypted video with the first key, and wherein decrypting the first encrypted audio comprises decrypting the first encrypted audio with the first key. Optionally, the computing device includes means to packetize the decrypted video and packetize the decrypted audio, wherein encrypting the decrypted video comprises encrypting the decrypted video with a second key different from the first key, and wherein encrypting the decrypted audio comprises encrypting the decrypted audio with the second key.

[0069] Example 25 includes the computing device of any one of examples 22 to 24, including or excluding optional features. In this example, the computing device

includes means for compressing a user interface (UI) stream, and wherein the means for combining comprises means for combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing. Optionally, the first key comprises a Digital Rights Management (DRM) key. Optionally, the second key comprises a High Definition Copy Protocol (HDCP) key. Optionally, the wireless connection comprises Wi-Fi Direct®.

[0070] Example 26 includes the computing device of any one of examples 22 to 25, including or excluding optional features. In this example, the wireless display service connection comprises Miracast™.

[0071] Example 27 includes the computing device of any one of examples 22 to 26, including or excluding optional features. In this example, the wireless display service connection comprises Google Chromecast™.

[0072] Example 28 includes the computing device of any one of examples 22 to 27, including or excluding optional features. In this example, the wireless display service connection comprises Apple AirPlay®.

[0073] Example 29 includes the computing device of any one of examples 22 to 28, including or excluding optional features. In this example, the comprises means to packetize the decrypted video and packetize the decrypted audio. Optionally, to packetize the decrypted video comprises subjecting the decrypted video to a packetized elementary stream (PES) packetizer. Optionally, to packetize the decrypted audio comprises subjecting the decrypted audio to a packetized elementary stream (PES) packetizer.

[0074] Example 30 is a method of wireless display. The method includes instructions that direct the processor to negotiating a wireless connection between a transmitter and a receiver to wirelessly couple the transmitter and the receiver; establishing a wireless display connection between the transmitter and the receiver; receiving at the transmitter a first encrypted content; processing, via the transmitter, the first encrypted content into a second encrypted content without decoding; and transferring, via the wireless display connection, the second encrypted content from the transmitter to the receiver, wherein the wireless display connection comprises Miracast™, Google Chromecast™, or Apple AirPlay®.

[0075] Example 31 includes the method of example 30, including or excluding optional features. In this example, the wireless connection comprises Wi-Fi Direct®.

[0076] Example 32 includes the method of any one of examples 30 to 31, including or excluding optional features. In this example, the method includes the transmitter performing a license acquisition to obtain a first key, wherein the processing comprises: decrypting the first encrypted content with the first key; and performing encryption with a second key different than the first key to give the second encrypted content. Optionally, the first key comprises a Digital Rights Management (DRM) key, and wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

[0077] Example 33 includes the method of any one of examples 30 to 32, including or excluding optional features. In this example, the processing comprises: dividing the first encrypted content into a first encrypted video and a first encrypted audio; decrypting the first encrypted video to decrypted video, and decrypting the first encrypted audio to decrypted audio; encrypting the decrypted video to a second encrypted video, and encrypting the decrypted audio to a second encrypted audio; and combining the second encrypted video and the second encrypted audio to give the second encrypted content. Optionally, the processing comprises: packetizing the decrypted video; packetizing the decrypted audio; compressing a user interface (UI) stream; and combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content Optionally, packetizing the decrypted video comprises subjecting the decrypted video to a packetized elementary stream (PES) packetizer. Optionally, packetizing the decrypted audio comprises subjecting the decrypted audio to a packetized elementary stream (PES) packetizer.

[0078] Example 34 is a method of wireless display. The method includes instructions that direct the processor to negotiating a wireless direct connection between a transmitter and a receiver to wirelessly couple the transmitter and the receiver; establishing a wireless display connection between the transmitter and the receiver; receiving at the transmitter a first encrypted content; processing, via the

transmitter, the first encrypted content into a second encrypted content without decoding; and transferring, via the wireless display connection, the second encrypted content from the transmitter to the receiver.

[0079] Example 35 includes the method of example 34, including or excluding optional features. In this example, the wireless direct connection comprises Wi-Fi Direct®.

[0080] Example 36 includes the method of any one of examples 34 to 35, including or excluding optional features. In this example, the wireless direct connection comprises a wireless peer-to-peer connection.

[0081] Example 37 includes the method of any one of examples 34 to 36, including or excluding optional features. In this example, the method includes the transmitter performing a license acquisition to obtain a first key. Optionally, the processing comprises decrypting the first encrypted content with the first key. Optionally, the first key comprises a Digital Rights Management (DRM) key. Optionally, the method includes performing encryption with a second key different than the first key to give the second encrypted content. Optionally, the second key comprises a High Definition Copy Protocol (HDCP) key.

[0082] Example 38 includes the method of any one of examples 34 to 37, including or excluding optional features. In this example, the processing comprises: dividing the first encrypted content into a first encrypted video and a first encrypted audio; decrypting the first encrypted video to decrypted video, and decrypting the first encrypted audio to decrypted audio; encrypting the decrypted video to a second encrypted video, and encrypting the decrypted audio to a second encrypted audio; and combining the second encrypted video and the second encrypted audio to give the second encrypted content. Optionally, the processing comprises: packetizing the decrypted video; and packetizing the decrypted audio. Optionally, the processing comprises: compressing a user interface (UI) stream; and combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing.

[0083] Example 39 includes the method of any one of examples 34 to 38, including or excluding optional features. In this example, the first encrypted content

comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

[0084] Example 40 is a transmitter configured for wireless display and comprising a processor and memory storing instructions, wherein the transmitter is a computing device and is to negotiate a wireless direct connection with a receiver. The instructions when executed by the processor cause the transmitter to: receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio; decrypt the first encrypted video to give decrypted video, and decrypt the first encrypted audio to give decrypted audio; encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio; combine the second encrypted video and the second encrypted audio into a second encrypted content; and transfer the second encrypted content over a wireless display service connection to the receiver.

[0085] Example 41 includes the transmitter configured for wireless display of example 40, including or excluding optional features. In this example, the transmitter is to establish over the wireless direct connection the wireless display service connection between the transmitter and the receiver.

[0086] Example 42 includes the transmitter configured for wireless display of any one of examples 40 to 41, including or excluding optional features. In this example, the wireless direct connection comprises Wi-Fi Direct®.

[0087] Example 43 includes the transmitter configured for wireless display of any one of examples 40 to 42, including or excluding optional features. In this example, the wireless display service connection comprises Miracast™, Google Chromecast™, or Apple AirPlay®.

[0088] Example 44 includes the transmitter configured for wireless display of any one of examples 40 to 43, including or excluding optional features. In this example, the instructions when executed by the processor cause the transmitter to acquire a license to obtain a first key, wherein to decrypt the first encrypted video comprises decrypting the first encrypted video with the first key, wherein to decrypt the first encrypted audio comprises decrypting the first encrypted audio with the first key, wherein to encrypt the decrypted video comprises encrypting the decrypted video

with a second key different from the first key, and wherein to encrypt the decrypted audio comprises encrypting the decrypted audio with the second key. Optionally, the first key comprises a Digital Rights Management (DRM) key, wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

[0089] Example 45 includes the transmitter configured for wireless display of any one of examples 40 to 44, including or excluding optional features. In this example, the instructions when executed by the processor cause the transmitter to packetize the decrypted video, packetize the decrypted audio, and compress a user interface (UI) stream, wherein to combine into a second encrypted content comprises combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing

[0090] Example 46 includes the transmitter configured for wireless display of any one of examples 40 to 45, including or excluding optional features. In this example, the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

[0091] It is to be understood that specifics in the aforementioned examples may be used anywhere in one or more embodiments. For instance, all optional features of the computing device described above may also be implemented with respect to either of the methods described herein or a computer-readable medium. Furthermore, although flow diagrams and/or state diagrams may have been used herein to describe embodiments, the present techniques are not limited to those diagrams or to corresponding descriptions herein. For example, flow need not move through each illustrated box or state or in exactly the same order as illustrated and described herein.

[0092] The present techniques are not restricted to the particular details listed herein. Indeed, those skilled in the art having the benefit of this disclosure will appreciate that many other variations from the foregoing description and drawings may be made within the scope of the present techniques. Accordingly, it is the following claims including any amendments thereto that define the scope of the present techniques.

CLAIMS

What is claimed is:

1. A method of wireless display, comprising:

negotiating a wireless connection between a transmitter and a receiver to wirelessly couple the transmitter and the receiver;

establishing a wireless display connection between the transmitter and the receiver;

receiving at the transmitter a first encrypted content;

processing, via the transmitter, the first encrypted content into a second encrypted content without decoding; and

transferring, via the wireless display connection, the second encrypted content from the transmitter to the receiver.

2. The method of claim 1, wherein the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display connection comprises Miracast™.

3. The method of claim 1, comprising the transmitter performing a license acquisition to obtain a first key, wherein the processing comprises:

decrypting the first encrypted content with the first key; and

performing encryption with a second key different than the first key to give the second encrypted content.

4. The method of claim 3, wherein the first key comprises a Digital Rights Management (DRM) key, and wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

5. The method of claim 1, wherein the processing comprises:

dividing the first encrypted content into a first encrypted video and a first encrypted audio;

decrypting the first encrypted video to decrypted video, and decrypting the first encrypted audio to decrypted audio;

encrypting the decrypted video to a second encrypted video, and encrypting the decrypted audio to a second encrypted audio; and

combining the second encrypted video and the second encrypted audio to give the second encrypted content.

6. The method of claim 5, wherein the processing comprises:
packetizing the decrypted video;
packetizing the decrypted audio;
compressing a user interface (UI) stream; and
combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content

7. The method of claim 6, wherein packetizing comprises subjecting the decrypted audio or decrypted video to a packetized elementary stream (PES) packetizer.

8. A method of wireless display, comprising:
establishing a wireless display connection between a transmitter and a receiver; and
performing by the transmitter:
dividing a first encrypted content into a first encrypted video and a first encrypted audio;
decrypting the first encrypted video to give decrypted video, and decrypting the first encrypted audio to give decrypted audio;
encrypting the decrypted video to give a second encrypted video, and encrypting the decrypted audio to give a second encrypted audio;
combining the second encrypted video and the second encrypted audio into a second encrypted content; and
transferring, via the wireless display connection, the second encrypted content to the receiver.

9. The method of claim 8, comprising negotiating a wireless connection between the transmitter and the receiver to wirelessly couple the transmitter and the receiver,

wherein the transmitter does not decode the decrypted video, and wherein the transmitter does not decode the decrypted audio.

10. The method of claim 9, wherein the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display connection comprises Miracast™.

11. The method of claim 8, comprising the transmitter receiving the first encrypted content and performing a license acquisition to obtain a first key, wherein decrypting the first encrypted video comprises decrypting the first encrypted video with the first key, and wherein decrypting the first encrypted audio comprises decrypting the first encrypted audio with the first key.

12. The method of claim 11, wherein encrypting the decrypted video comprises encrypting the decrypted video with a second key different than the first key, and wherein encrypting the decrypted audio comprises encrypting the decrypted audio with the second key.

13. The method of claims 8 or 9, comprising the transmitter packetizing the decrypted video, and the transmitter packetizing the decrypted audio, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

14. The method of claims 8 or 9, comprising the transmitter compressing a user interface (UI) stream, and wherein combining into a second encrypted content comprises the transmitter combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing.

15. A transmitter configured for wireless display, comprising:
a processor; and
memory storing instructions that when executed by the processor cause the transmitter to:

receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio;

decrypt the first encrypted video to give decrypted video, and decrypt the first encrypted audio to give decrypted audio;

encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio;

combine the second encrypted video and the second encrypted audio into a second encrypted content; and

transfer the second encrypted content over a wireless display service connection to a receiver.

16. The transmitter of claim 15, wherein the transmitter is a computing device and is to negotiate a wireless connection with the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter is to establish over the wireless connection the wireless display service connection between the transmitter and the receiver.

17. The transmitter of claim 16, wherein the wireless connection comprises Wi-Fi Direct®, and wherein the wireless display service connection comprises Miracast™.

18. The transmitter of claim 15, wherein the instructions executable by the processor to acquire a license to obtain a first key, wherein to decrypt the first encrypted video comprises decrypting the first encrypted video with the first key, wherein to decrypt the first encrypted audio comprises decrypting the first encrypted audio with the first key, wherein to encrypt the decrypted video comprises encrypting the decrypted video with a second key different from the first key, and wherein to encrypt the decrypted audio comprises encrypting the decrypted audio with the second key.

19. The transmitter of claim 18, wherein the first key comprises a Digital Rights Management (DRM) key, and wherein the second key comprises a High Definition Copy Protocol (HDCP) key.

20. The transmitter of claims 15 or 16, wherein the instructions executable by the processor to packetize the decrypted video, packetize the decrypted audio, and compress a user interface (UI) stream, wherein to combine into a second encrypted content comprises combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing, wherein the first encrypted content comprises a first-key encrypted content, and wherein the second encrypted content comprises a second-key encrypted content.

21. A tangible, non-transitory, computer-readable medium comprising instructions that, when executed by a processor of a computing device, cause the computing device to:

receive a first encrypted content and divide the first encrypted content into a first encrypted video and a first encrypted audio;

decrypt the first encrypted video to give decrypted video, and decrypt the first encrypted audio to give decrypted audio;

encrypt the decrypted video to give a second encrypted video without decoding the decrypted video, and encrypt the decrypted audio to give a second encrypted audio without decoding the decrypted audio;

combine the second encrypted video and the second encrypted audio into a second encrypted content; and

transfer, via a wireless display service connection, the second encrypted content to a receiver.

22. The non-transitory, computer-readable medium of claim 21, wherein:

the first encrypted content comprises content encrypted by a first key;

the first encrypted video comprises video encrypted by the first key;

the first encrypted audio comprises audio encrypted by the first key;

the second encrypted content comprises content encrypted by a second key different than the first key;

the second encrypted video comprises video encrypted by the second key; and

the second encrypted audio comprises audio encrypted by the second key.

23. The non-transitory, computer-readable medium of claim 21, wherein the instructions when executed by the processor cause the computing device to:

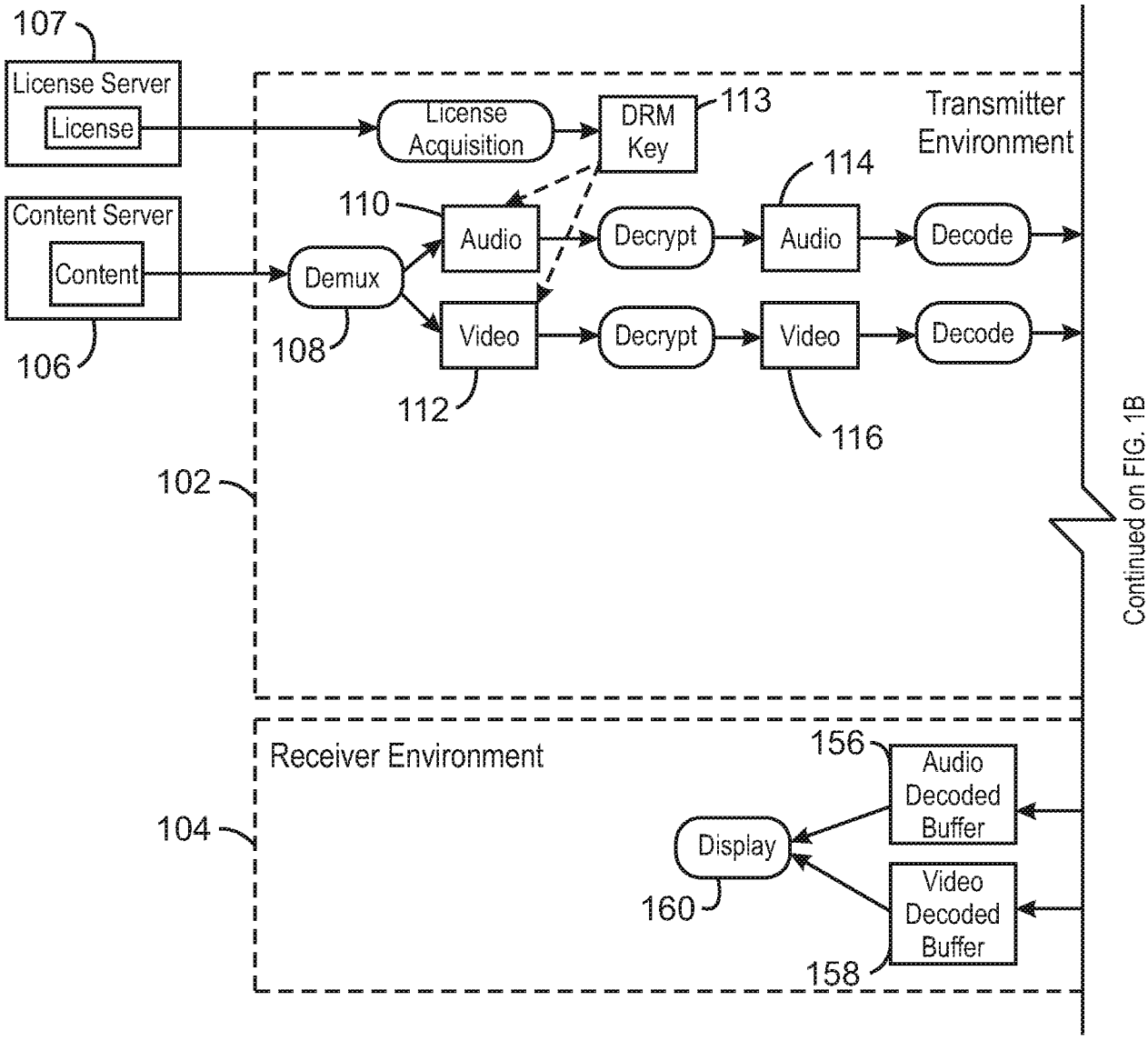
negotiate a wireless connection between a transmitter and the receiver to wirelessly couple the transmitter and the receiver, wherein the transmitter comprises the computing device;

establish the wireless display service connection between the transmitter and the receiver; and

acquire a license to obtain a first key, wherein to decrypt the first encrypted video comprises decrypting the first encrypted video with the first key, and wherein to decrypt the first encrypted audio comprises decrypting the first encrypted audio with the first key.

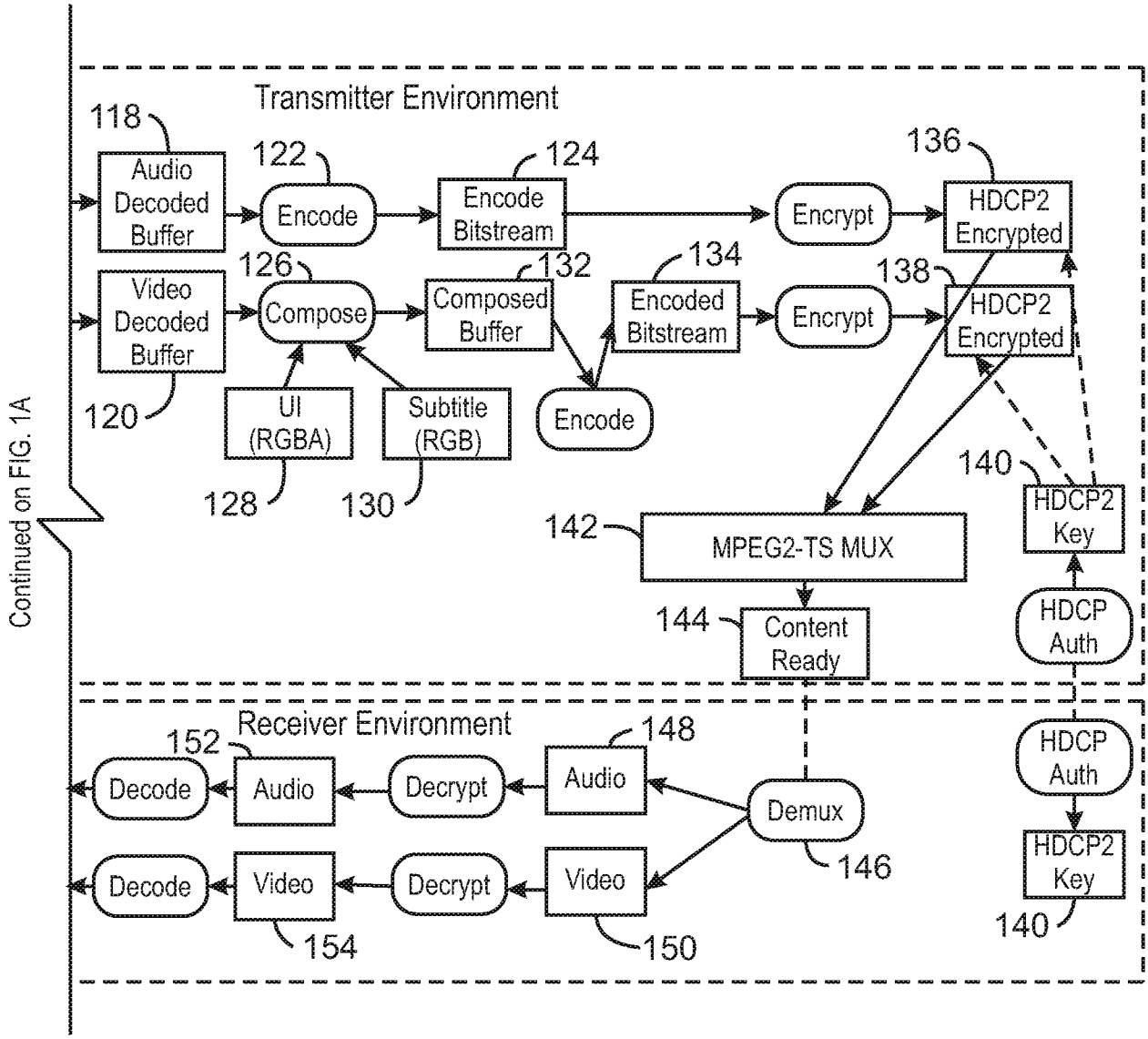
24. The non-transitory, computer-readable medium of claim 23, wherein the instructions when executed by the processor cause the computing device to packetize the decrypted video and packetize the decrypted audio, wherein to encrypt the decrypted video comprises encrypting the decrypted video with a second key different from the first key, and wherein to encrypt the decrypted audio comprises encrypting the decrypted audio with the second key.

25. The non-transitory, computer-readable medium of claims 21 to 23, wherein the instructions when executed by the processor cause the computing device to compress a user interface (UI) stream, and wherein to combine into the second encrypted content comprises combining the compressed UI stream with the second encrypted video and the second encrypted audio to give the second encrypted content without composing.


107
License Server
License
License Acquisition
DRM Key
113
Transmitter Environment
Content Server
Content
106
Demux
108
110
Audio
Video
112
Decrypt
Decrypt
114
Audio
Video
116
Decode
Decode
102
Continued on FIG. 1B
Receiver Environment
104
156
Audio Decoded Buffer
Display
160
Video Decoded Buffer
158

100

FIG. 1A


Transmitter Environment
118
Audio Decoded Buffer
122
Encode
124
Encode Bitstream
Encrypt
136
HDCP2 Encrypted
126
Video Decoded Buffer
Compose
132
Composed Buffer
134
Encoded Bitstream
Encrypt
138
HDCP2 Encrypted
120
UI (RGBA)
128
Subtitle (RGB)
130
Encode
140
HDCP2 Key
142
MPEG2-TS MUX
144
Content Ready
HDCP Auth
Continued on FIG. 1A
Receiver Environment
152
Decode
Audio
Decrypt
148
Audio
Demux
HDCP Auth
Decode
Video
Decrypt
Video
146
HDCP2 Key
154
150
140

100

FIG. 1B

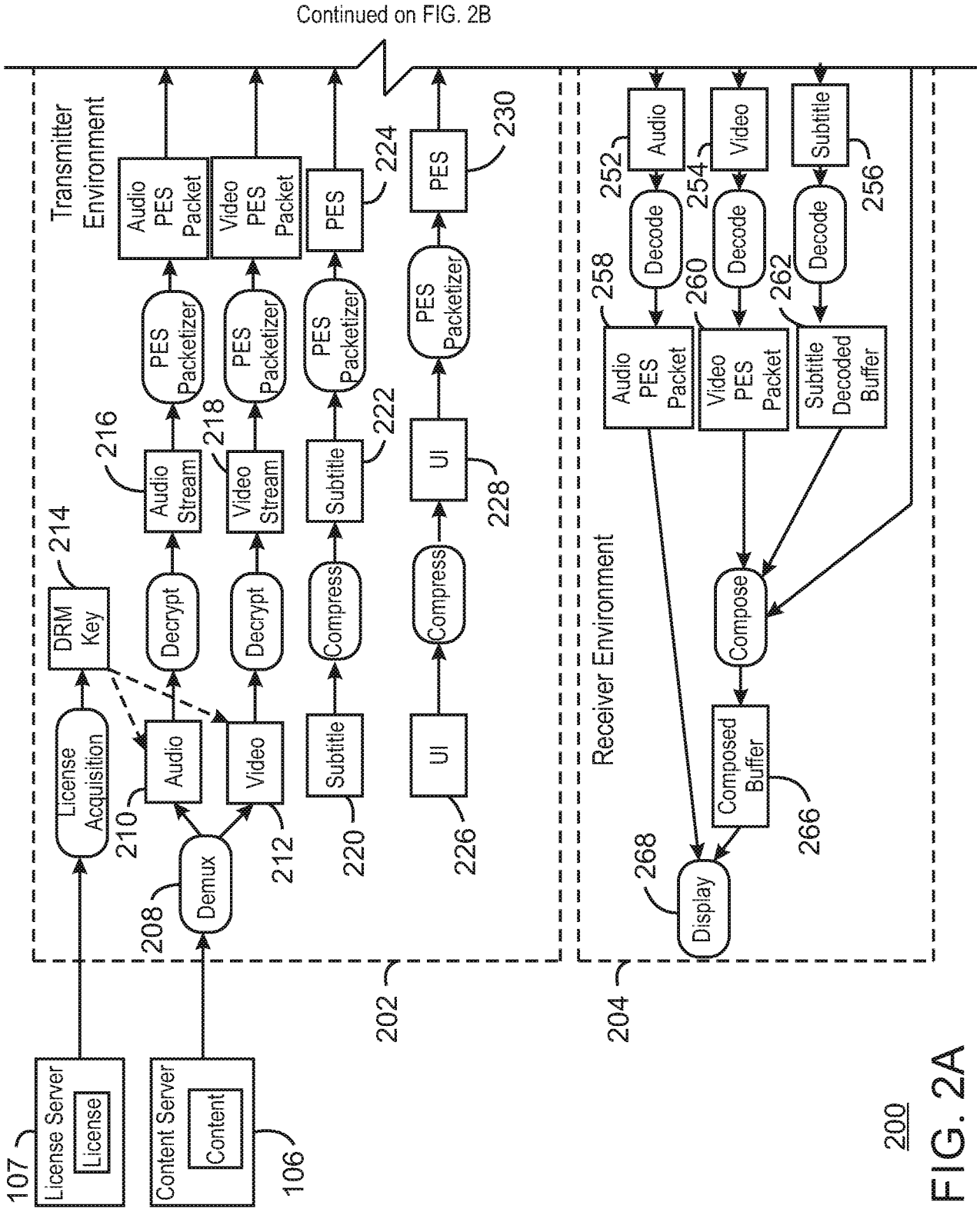
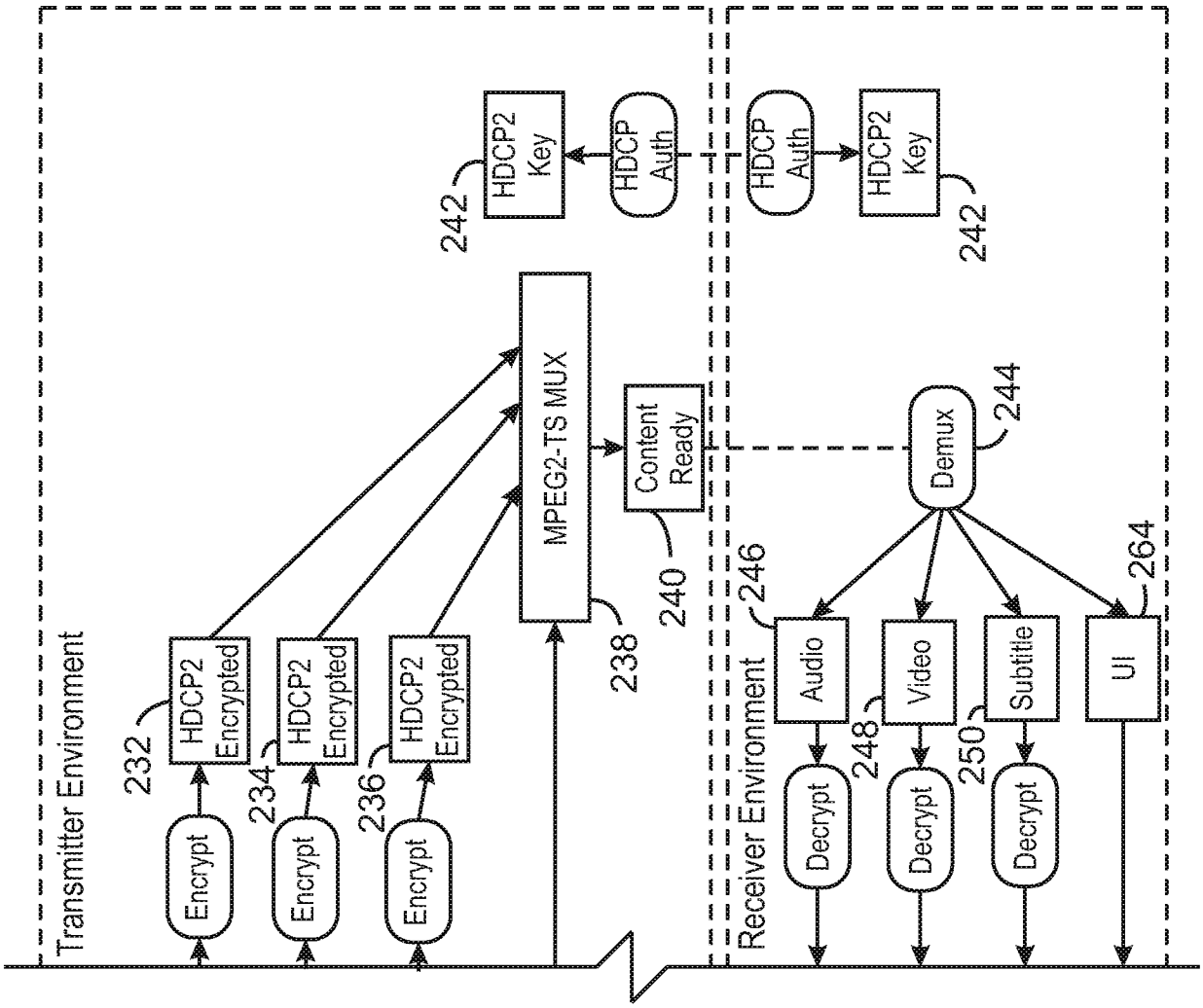

Continued on FIG. 2B
Transmitter Environment
Receiver Environment
License Server
License
Content Server
Content
License Acquisition
DRM Key
Demux
Audio
Video
Subtitle
UI
Decrypt
Compress
Audio Stream
Video Stream
PES Packetizer
Audio PES Packet
Video PES Packet
PES
Decode
Compose
Composed Buffer
Display
Subtitle Decoded Buffer
106
107
202
204
208
210
212
214
216
218
220
222
224
226
228
230
252
254
256
258
260
262
266
268
200

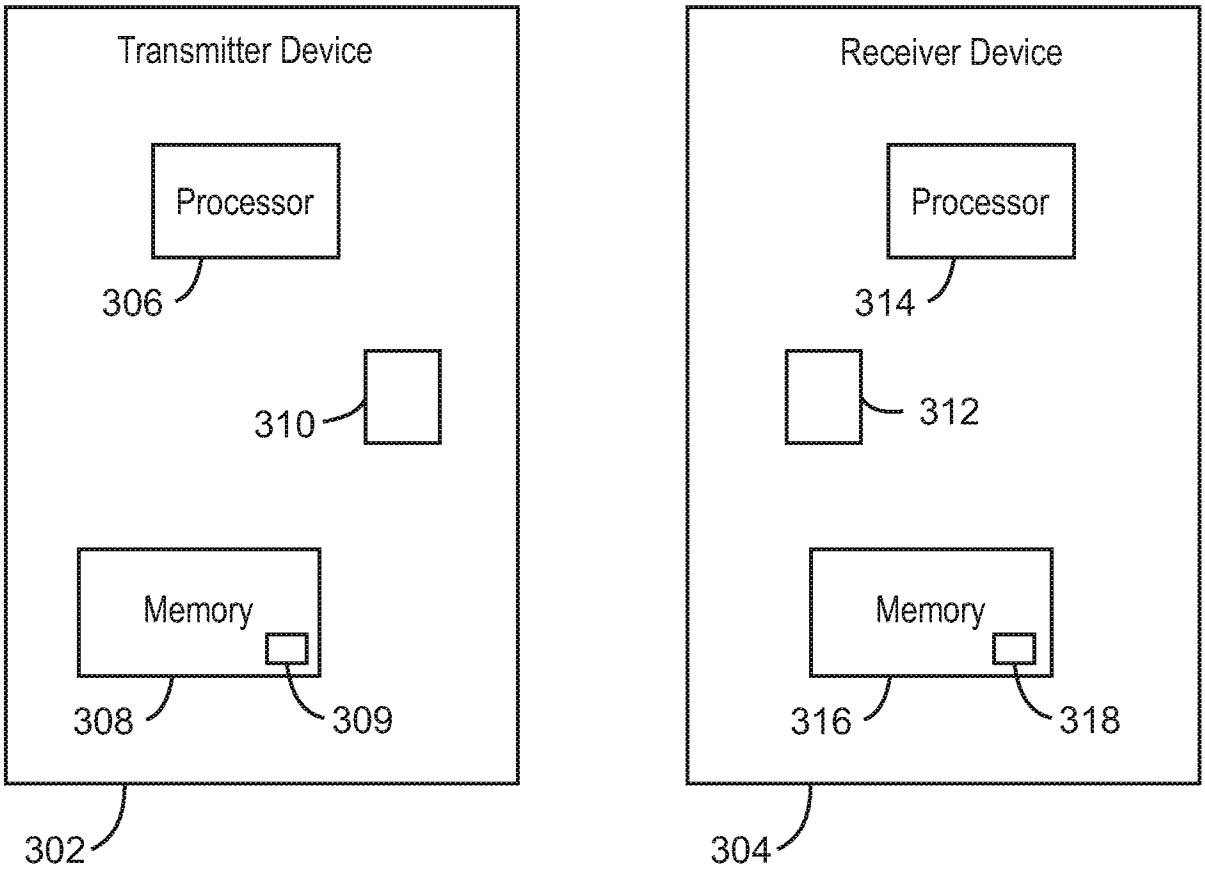
FIG. 2A



Continued on FIG. 2A

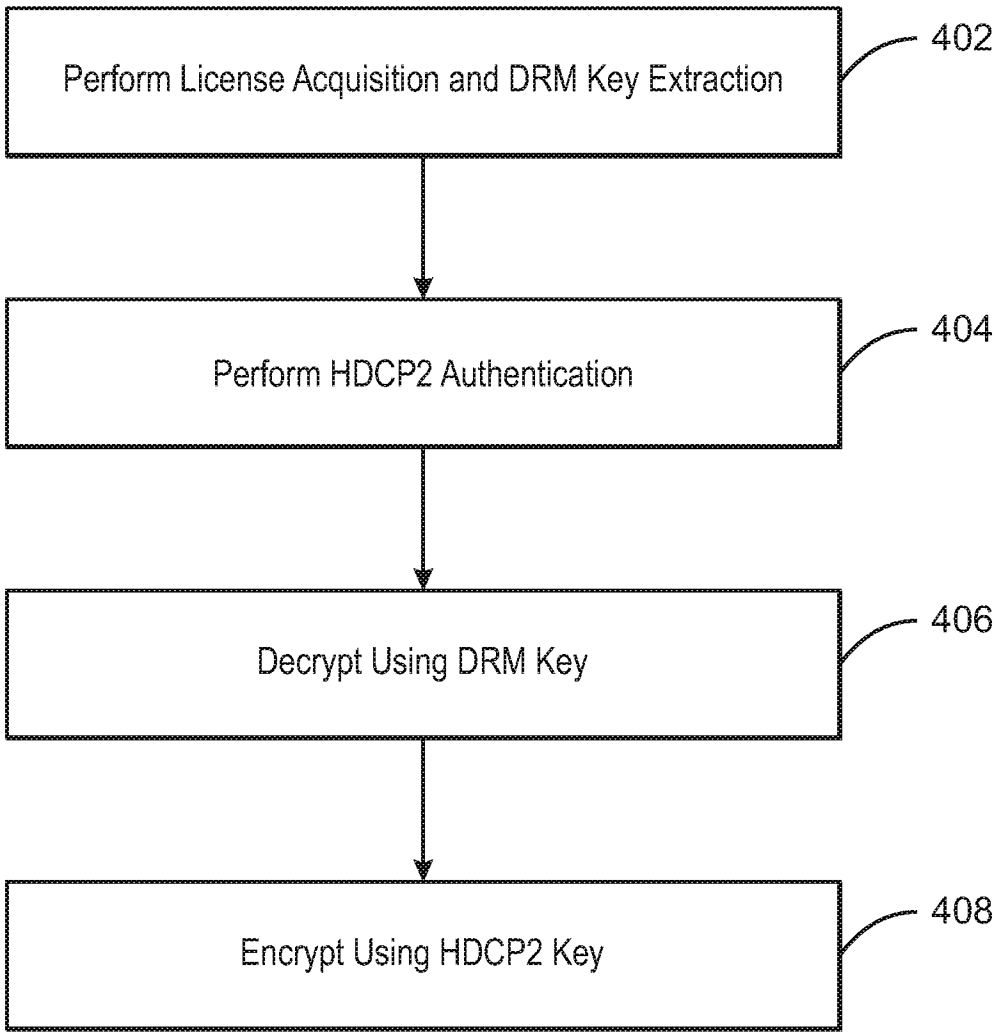
200

FIG. 2B


Transmitter Device
Processor
306
310
Memory
308
309
302
Receiver Device
Processor
314
312
Memory
316
318
304

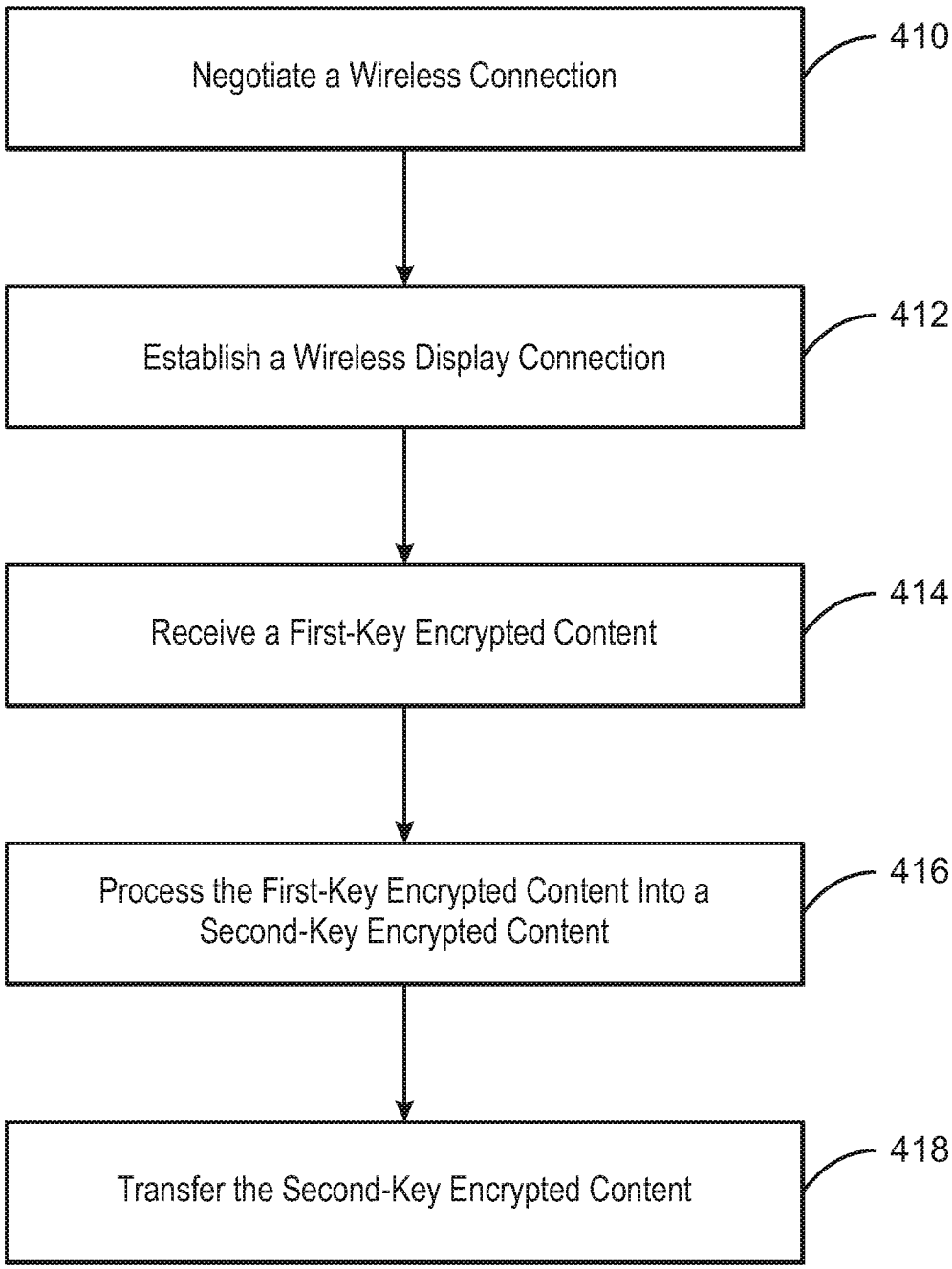
300

FIG. 3


Perform License Acquisition and DRM Key Extraction
402
Perform HDCP2 Authentication
404
Decrypt Using DRM Key
406
Encrypt Using HDCP2 Key
408

400

FIG. 4


Negotiate a Wireless Connection
410
Establish a Wireless Display Connection
412
Receive a First-Key Encrypted Content
414
Process the First-Key Encrypted Content Into a Second-Key Encrypted Content
416
Transfer the Second-Key Encrypted Content
418

400A

FIG. 4A

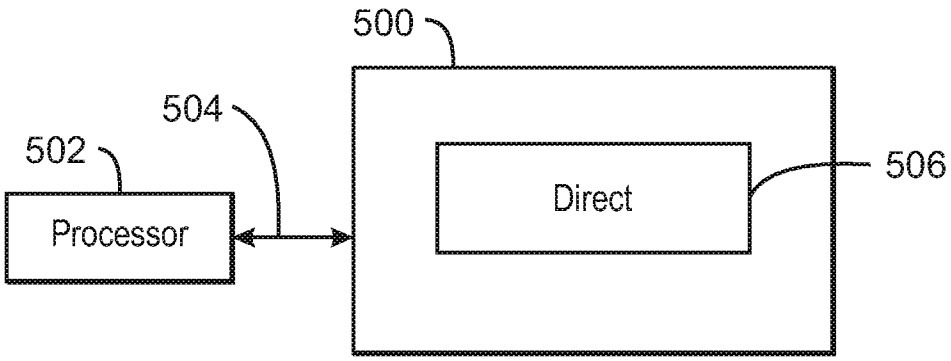


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/034258

A. CLASSIFICATION OF SUBJECT MATTER

H04L 9/08(2006.01)i, H04L 9/14(2006.01)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)
H04L 9/08; H04N 7/167; H04N 21/854; G06F 21/10; H04L 9/00; H04N 21/431; H04L 9/14

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: without decoding, encrypted content, different key, divide, audio, video, combine, wireless display, Wi-Fi direct, Miracast, DRM, HDCP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2013-0283393 A1 (INSIDE SECURE) 24 October 2013 See paragraphs [0105]-[0160], [0203]-[0219]; claims 1, 2; and figures 11, 12.	1-5,8-13,18,19,22-24
A		6,7,14-17,20,21,25
Y	US 2014-0010367 A1 (CHANGLIANG WANG) 09 January 2014 See paragraphs [0018]-[0075]; and figures 1, 2, 4, 7.	1-5,9,10,15-19,21-24
Y	US 2012-0257750 A1 (CHRISTIAN WILLIBALD BOHM et al.) 11 October 2012 See paragraphs [0007]-[0047]; and figures 2-5B.	5,8-13,15-19,21-24
A	US 2016-0073155 A1 (QUALCOMM INCORPORATED) 10 March 2016 See paragraphs [0031]-[0045]; and figures 1, 4.	1-25
A	US 2010-0272257 A1 (WILLIAM MICHAEL BEALS) 28 October 2010 See paragraphs [0046]-[0055]; and figures 5, 6.	1-25

☐ 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
23 August 2017 (23.08.2017)	**28 August 2017 (28.08.2017)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2017/034258

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