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(54) **ENABLING/DISABLING DISPLAY DATA CHANNEL ACCESS TO ENABLE/DISABLE HIGH-BANDWIDTH DIGITAL CONTENT PROTECTION**

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(*) Notice: This patent is subject to a terminal disclaimer.

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H04L 9/32 (2006.01)
H04L 29/06 (2006.01)

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CPC ***H04L 9/32*** (2013.01); ***H04L 29/06*** (2013.01); ***H04L 63/083*** (2013.01);
(Continued)

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CPC H04L 63/0832; H04L 63/105; H04L 63/0853; H04L 63/0435; H04L 9/32; H04L 29/06
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,398,547 B2 * 7/2008 deCarmo 726/3
7,589,734 B2 * 9/2009 Mawatari et al. 345/501
(Continued)

OTHER PUBLICATIONS

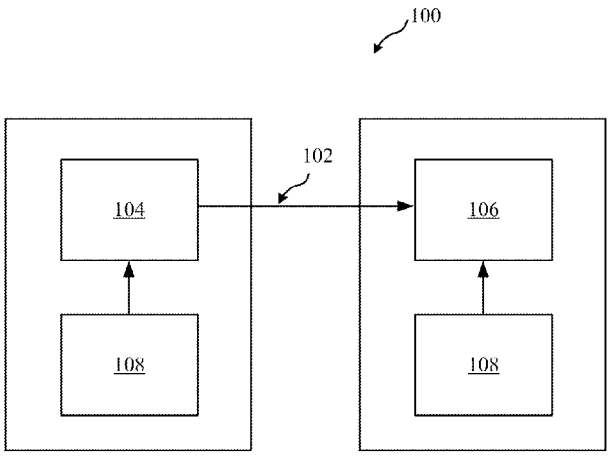
Robert Carter, The nuts and bolts of HDCP, Digital TV Design Line, Feb. 20, 2008.
(Continued)

Primary Examiner — Jalatee Worjloh
(74) *Attorney, Agent, or Firm* — Crestron Electronics, Inc

(57) **ABSTRACT**

A switcher device comprises a multiplexer coupled in-between at least one input and output cards. The multiplexer detects the presence of an event signal from an activated sink. In response to the detection of the event signal, the switch dynamically switches to a closed position in order to enable the at least one source to authenticate with the input card and the output card to authenticate with the at least one sink for security protocol encryption. In response to the non-detection of the event signal, the switch switches dynamically to an open position in order to disable the at least one source from authenticating with the input card, therefore the output card also does not attempt to authenticate with the at least one sink for security protocol encryption.

21 Claims, 8 Drawing Sheets



Related U.S. Application Data

application for the reissue of Pat. No. 8,898,467, which is a continuation of application No. 13/363,310, filed on Jan. 31, 2012, now Pat. No. 8,713,316.

(60) Provisional application No. 61/577,380, filed on Dec. 19, 2011, provisional application No. 61/569,886, filed on Dec. 31, 2011.

(52) **U.S. Cl.**
CPC ***H04L 63/0853*** (2013.01); ***H04L 63/105*** (2013.01); *H04L 63/0435* (2013.01)

(58) **Field of Classification Search**
USPC 713/168; 348/544, 690, 705; 710/16; 726/11; 705/50–59
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,702,925	B2	4/2010	Northcutt et al.	
7,796,194	B2	9/2010	Hall	
7,893,941	B2	2/2011	Day et al.	
8,199,258	B2	6/2012	Tokoro	
8,253,860	B2	8/2012	Hsiao	
8,269,892	B2	9/2012	Asada et al.	
8,374,346	B2	2/2013	Choi et al.	
8,387,095	B2	2/2013	Ohki et al.	
8,447,158	B2	5/2013	Yamamoto	
2005/0228995	A1	10/2005	Kwak et al.	
2006/0209884	A1	9/2006	MacMullan et al.	
2006/0209892	A1	9/2006	MacMullan et al.	
2007/0143801	A1	6/2007	Madonna et al.	
2007/0186015	A1	8/2007	Taft et al.	
2007/0242062	A1*	10/2007	Guo et al.	345/204
2008/0170839	A1	7/2008	Choi	
2009/0058868	A1	3/2009	Kang et al.	
2009/0138935	A1*	5/2009	Ohkita	G09G 5/006 725/134
2009/0193266	A1	7/2009	Gable et al.	
2009/0222905	A1	9/2009	Choi et al.	
2009/0251605	A1	10/2009	Hsiao	
2009/0251606	A1	10/2009	Tokoro	
2009/0268100	A1	10/2009	Suga	
2009/0278984	A1	11/2009	Suzuki et al.	
2010/0073560	A1	3/2010	Kitano et al.	
2010/0177892	A1	7/2010	Choi et al.	
2010/0271548	A1	10/2010	Kabuto	
2011/0022739	A1*	1/2011	Guillerm	G09G 5/006 710/18
2011/0113442	A1*	5/2011	Kikkawa	G09G 5/006 725/25
2011/0134330	A1*	6/2011	Yu	H04N 5/268 348/705
2011/0150215	A1	6/2011	Domingo et al.	
2011/0150216	A1	6/2011	Barry et al.	
2011/0187929	A1	8/2011	Suzuki et al.	
2011/0197073	A1	8/2011	Taraci	
2011/0317830	A1	12/2011	Richardson	
2012/0023331	A1*	1/2012	Altmann	H04N 21/43635 713/168
2012/0036284	A1	2/2012	Tao et al.	
2012/0139973	A1	6/2012	Tsai	
2012/0320275	A1	12/2012	Sasaki et al.	
2013/0100247	A1	4/2013	Tsukagoshi	
2013/0148943	A1	6/2013	Velasco et al.	
2013/0151851	A1*	6/2013	Velasco et al.	713/168

OTHER PUBLICATIONS

Digital Content Protection, LLC, High-Bandwidth Digital Content Protection System, Interface Independent Adaptation, Revision 2.1, Jul. 18, 2011, available at www.digital-cp.com/sites/default/files/HDCP%20Interface%20Independent%20Adaptation%20Specification%20Rev2_0_0.pdf.

Digital Content Protection, LLC, High-bandwidth Digital Content Protection, revision 2.0, Content Protection for Next Generation Scenarios, document dated Dec. 1, 2008, available at www.digital-cp.com/sites/default/files/HDCP%20rev%202.pdf.

Kramer Electronics, Product Name: VP-730, VP-731, Firmware Revisions, document dated Mar. 8, 2015, available at k.kramerav.com/downloads/releaseNotes/vp-730_vp-731_release_notes1.pdf.

Kramer Electronics, VP 729 Command Sets, FAE-SP008 RS232 command set—Model 2010-0330, document dated Apr. 22, 2015, available at k.kramerav.com/downloads/protocols/vp-728_729_rs-232_command_set_2014-0521.pdf.

* cited by examiner

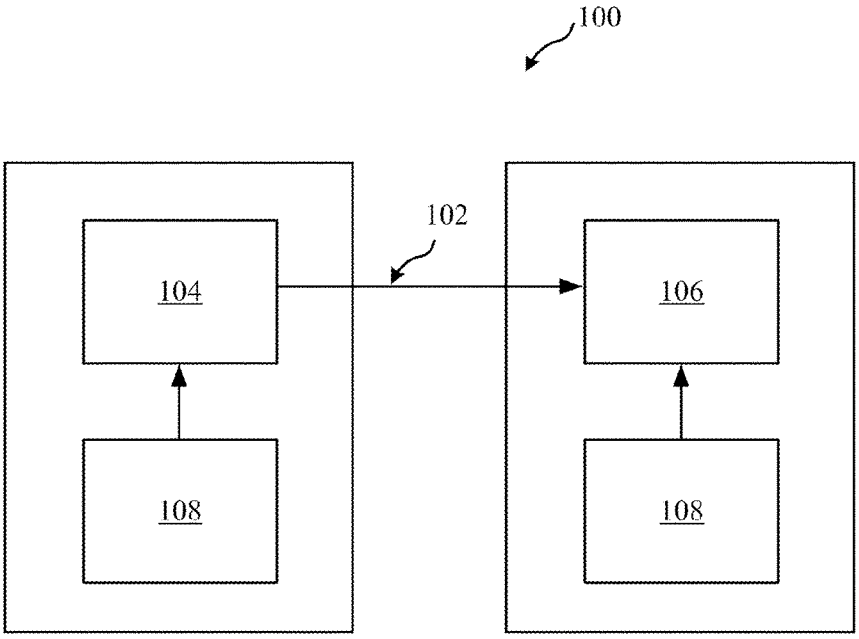
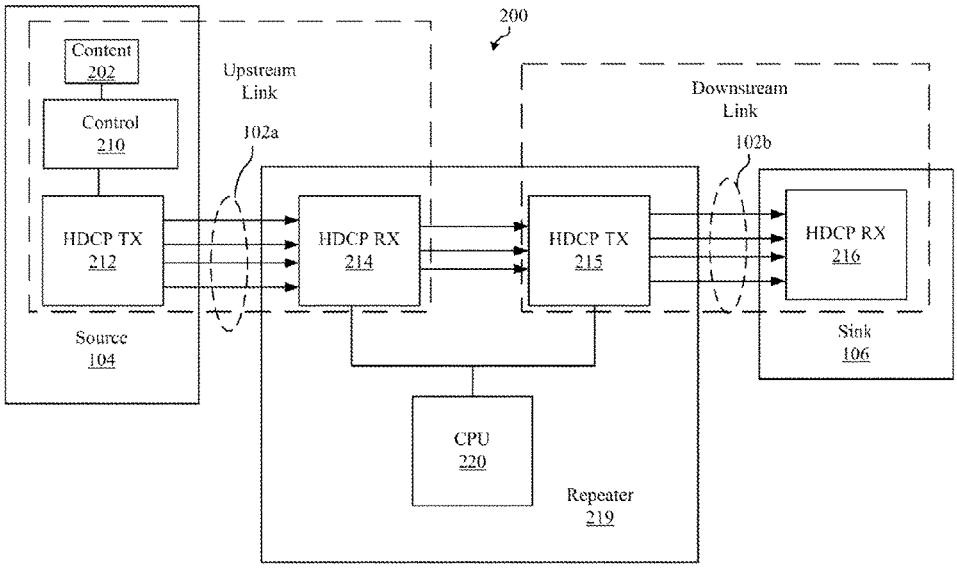


FIG. 1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Content
202
Control
210
HDCP TX
212
Source
104
Upstream
Link
102a
HDCP RX
214
HDCP TX
215
Downstream
Link
102b
HDCP RX
216
Sink
106
CPU
220
Repeater
219

FIG. 2

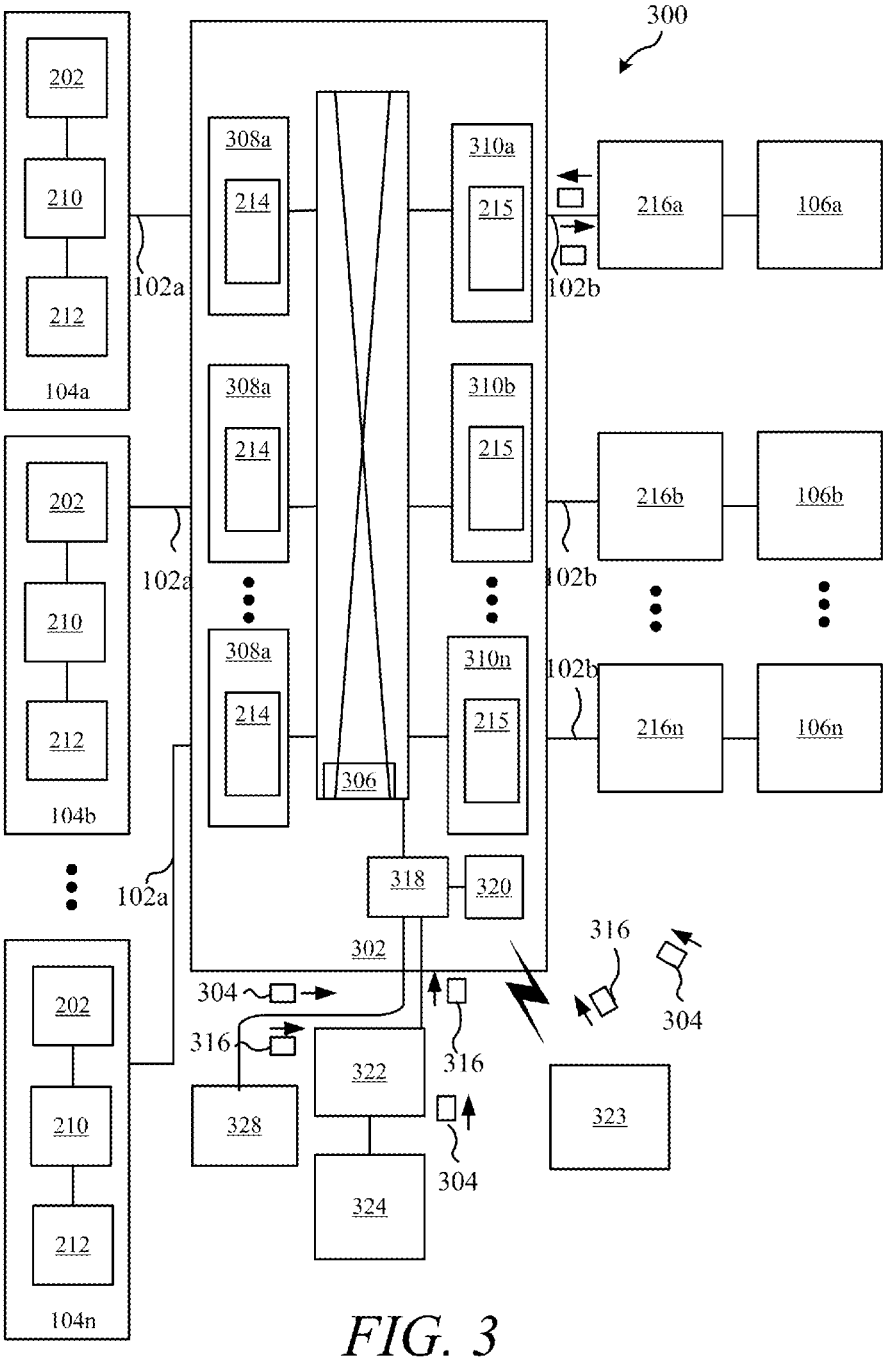
300
202
210
212
104a
102a
308a
214
310a
215
216a
106a
102b
104b
308a
214
310b
215
216b
106b
102b
308a
214
310n
215
216n
106n
306
318
320
302
102a
104n
304
316
322
328
324
323
316
304

FIG. 3

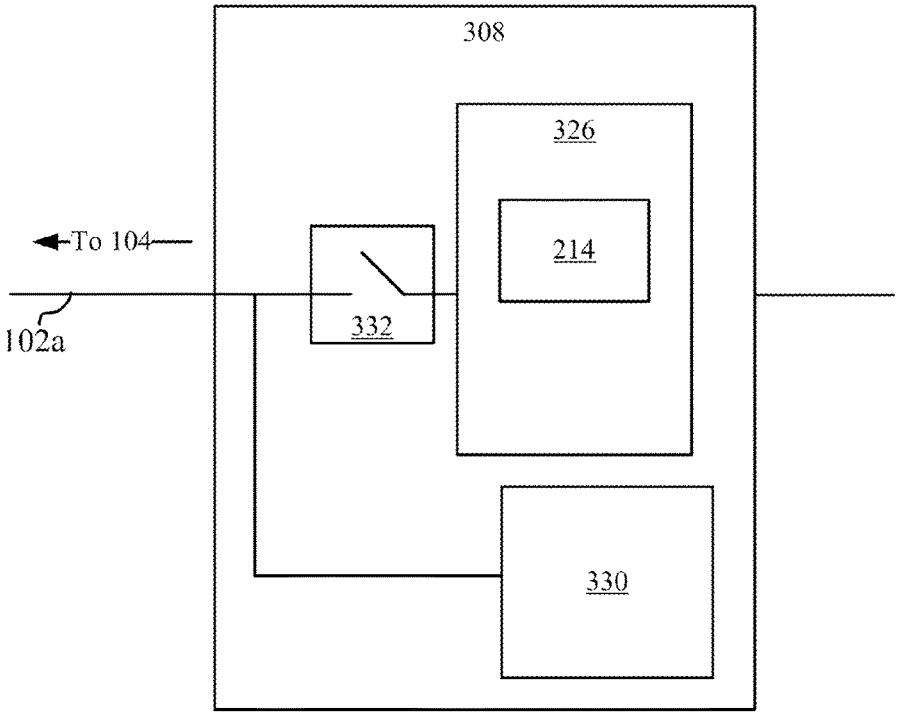

FIG. 4

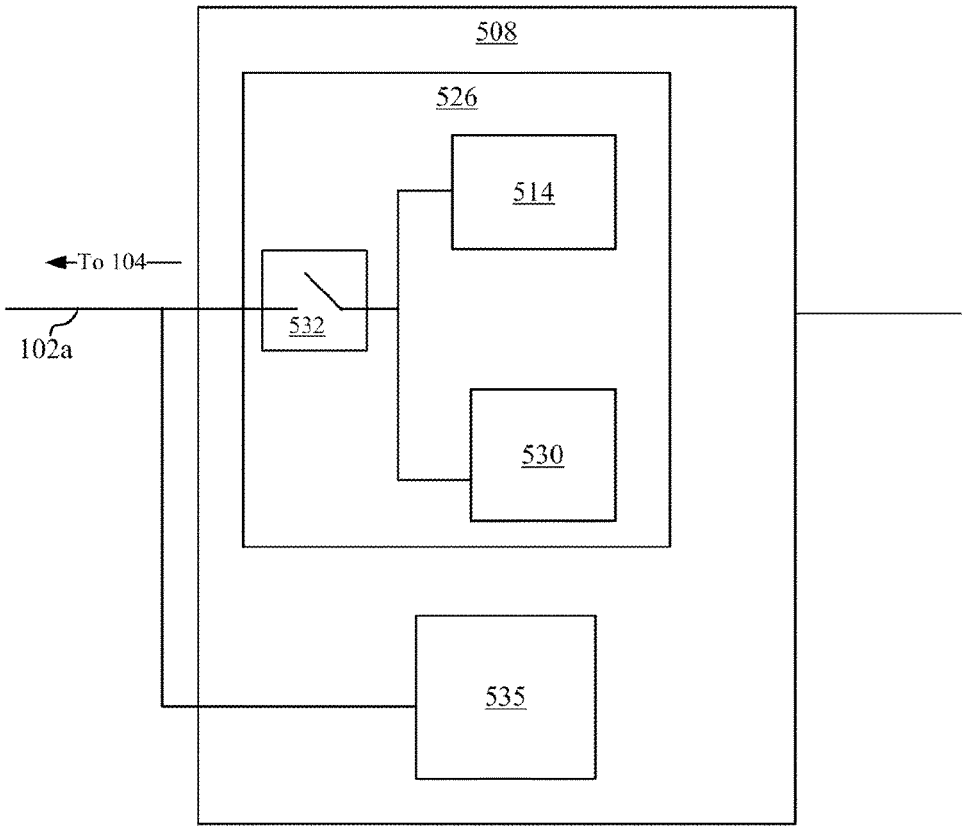

FIG. 5

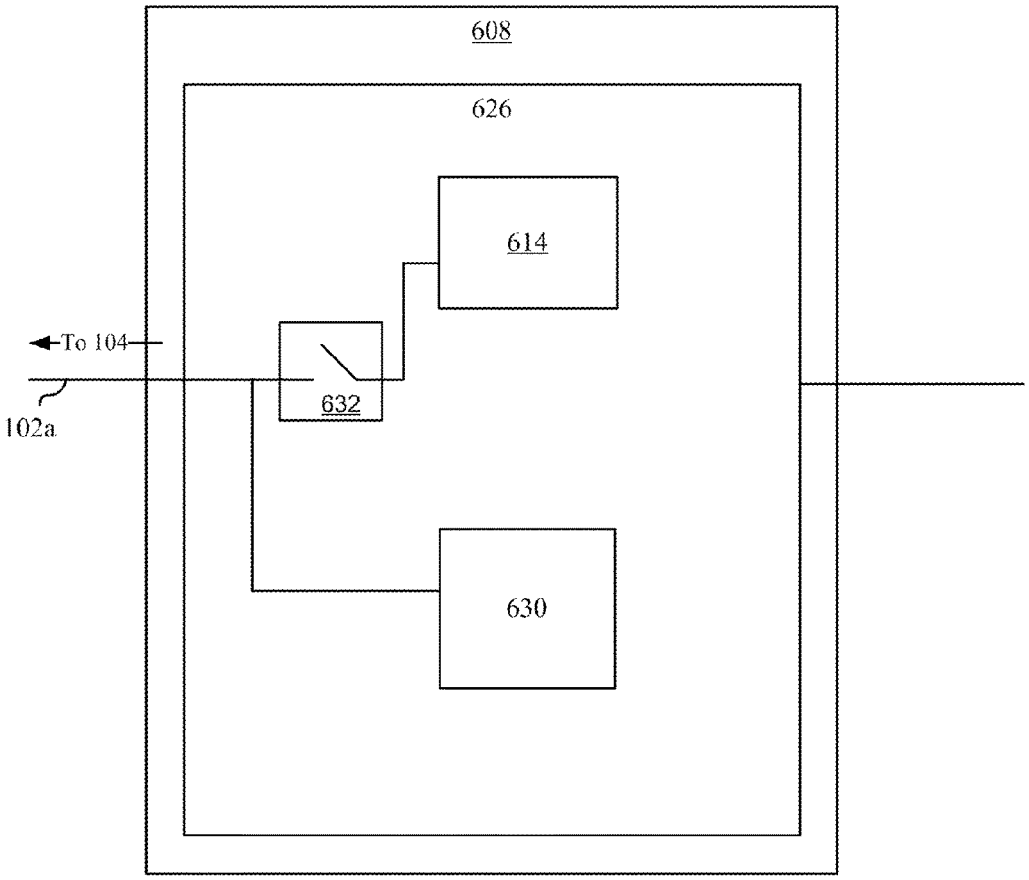

FIG. 6

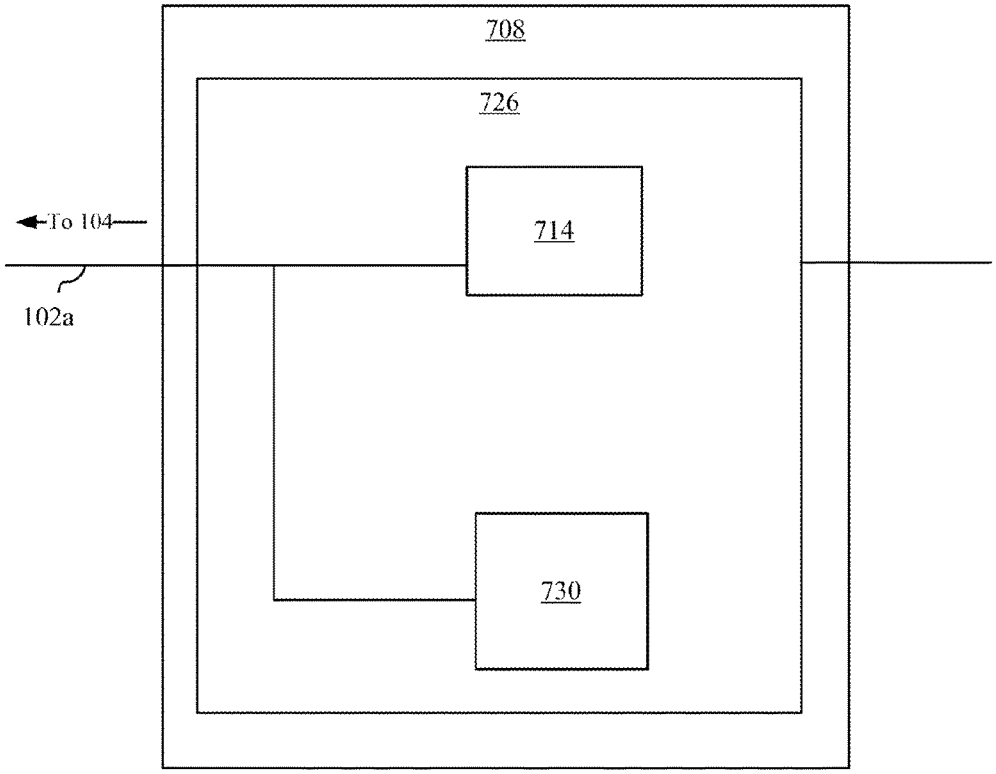

FIG. 7

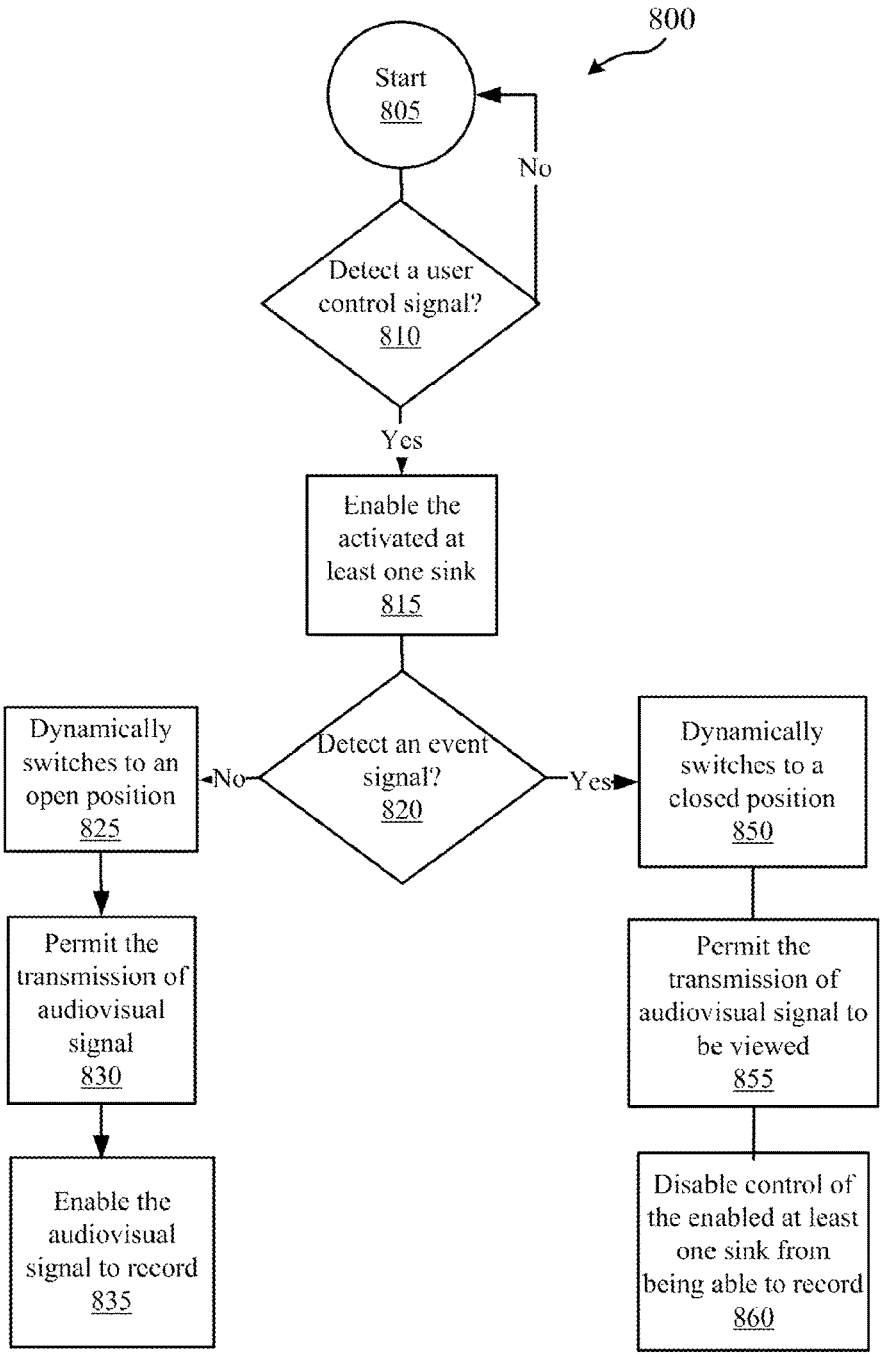
800
Start
805
No
Detect a user control signal?
810
Yes
Enable the activated at least one sink
815
Detect an event signal?
820
No
Yes
Dynamically switches to an open position
825
Dynamically switches to a closed position
850
Permit the transmission of audiovisual signal
830
Permit the transmission of audiovisual signal to be viewed
855
Enable the audiovisual signal to record
835
Disable control of the enabled at least one sink from being able to record
860

FIG. 8

ENABLING/DISABLING DISPLAY DATA CHANNEL ACCESS TO ENABLE/DISABLE HIGH-BANDWIDTH DIGITAL CONTENT PROTECTION

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application currently being filed is a reissue continuation application, meaning it is a continuation of U.S. Reissue application Ser. No. 15/346,131, and is also a reissue of U.S. Pat. No. 8,898,467. U.S. Reissue application Ser. No. 15/346,131 was filed on Nov. 8, 2016 and is an application for reissue of U.S. Pat. No. 8,898,467. U.S. Pat. No. 8,898,467 was filed as U.S. application Ser. No. 14/166,028 on Jan. 28, 2014, and issued on Nov. 25, 2014, which is a continuation of U.S. application Ser. No. 13/363,310, filed on Jan. 31, 2012, and issued as U.S. Pat. No. 8,713,316 on Apr. 29, 2014, which claims priority to U.S. Provisional Application Ser. No. 61/577,380, filed on Dec. 19, 2011 and U.S. Provisional Application Ser. No. 61/569,886, filed on Dec. 13, 2011. The entire contents of the foregoing chain of applications are expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates generally to High-Bandwidth Digital Content Protection. More particularly, the invention relates a method, apparatus, and system for enabling and/or disabling Display Data Channel (DDC) access to enable and/or disable High-Bandwidth Digital Content Protection.

2. Background Art

As the digital distribution of television, movies, and music expands, content providers are growing increasingly concerned about the simplicity with which content pirates can copy and share copy protected material. Various digital rights management (DRM) schemes have been developed to ensure that television shows, movies, and music can only be viewed by authorized parties (i.e., paying consumers). The Content Scrambling System (CSS) used to encrypt DVDs and Apple's Fairplay technology are two widely-known examples of DRM schemes. One DRM scheme to protect digital content as it is transmitted over cables between devices is known as High-Bandwidth Digital Content Protection (HDCP). HDCP is a specified method developed by Digital Content Protection, L.L.C., for protecting copyrighted digital content as it travels across connection interfaces and protocols such as DisplayPort (DP), Digital Video Interface (DVI), High-Definition Multimedia Interface (HDMI), Giga-bit Video Interface (GVIF), Digital Light Interface (DLI), Unified Display Interface (UDI), Internet Protocol (IP), Wireless Home Digital Interface (WHDI), Transmission Control Protocol/Internet Protocol (TCP/IP), and Universal Serial Bus (USB). The HDMI specification defines an interface for carrying digital audiovisual content from a source such as a DVD player, to a sink or display device such as a television (TV). As designed by the Digital

Content Protection, L.L.C., when the source and sink/display are HDCP compliant, HDCP protected content is displayed but the HDCP protected content cannot be copied and shared. When the source is HDCP compliant and the sink/display is not HDCP compliant, the copy protected material cannot be displayed, copied and/or shared. When the source is HDCP compliant and the sink/display is not HDCP compliant, a non-copy protected material can be displayed, copied and/or shared.

HDCP is designed to prevent copying and sharing of copy protected material. There are issues with interoperability when the material itself is non-copy protected. For example, when an HDCP compliant source such as a laptop is connected to an HDCP compliant sink/display device, non-HDCP protected content cannot, for example, be copied, shared, and replayed at a later time even though the non-HDCP protected content can be displayed on the sink/display device. Many HDCP compliant sources, such as laptops, choose to enable/disable content encryption based on the downstream display's HDCP capabilities. These devices do not "care" if the real-time video content is actually copy protected or non-copy protected and will leave content encryption enabled as soon as the device sees an HDCP compliant sink/display. In the academic field, for example, a university instructor may want students to copy and share content material that is not copy protected (e.g., the professor's PowerPoint presentation). Even though the content is non-copy protected, the students will not be able to copy, replay or share the content because the source and sink/display devices are HDCP compliant.

Accordingly, it is the object of the present invention to correct interoperability issues related to HDCP. The present invention provides a system, apparatus, and method for enabling/disabling Display Data Channel access to enable/disable HDCP.

SUMMARY OF THE INVENTION

It is to be understood that both the general and detailed descriptions that follow are exemplary and explanatory only and are not restrictive of the invention.

DISCLOSURE OF INVENTION

Principles of the invention provide a system, apparatus, and method for enabling/disabling Display Data Channel access to enable/disable a security protocol, such as HDCP. For example, in a first aspect of the invention, a system for enabling/disabling Display Data Channel (DDC) access to enable/disable a security protocol comprises at least one source, at least one sink, and a switcher device communicatively coupled in-between the at least one source and the at least one sink. The switcher device comprises a multiplexer coupled in-between at least one input and output cards and configured to transmit an audiovisual signal from the at least one input card to a first and at least a second output card via a physical connection. The multiplexer is configured to dynamically switch between the first and at least second output card based on a user control signal that activates one of the at least one sinks. Each of the output cards is coupled to the at least one sink. The input card comprises an integrated circuit that includes a security protocol enabled receiver and a switch coupled in-between the security protocol enabled receiver and an Extended Display Identification Data (EDID) memory. The input card is configured to detect the presence of an event signal from at least one user interfaced device. In response to the

detection of the event signal, the switch dynamically switches to a closed position in order to enable the at least one source to authenticate with the input card and the output card to authenticate with the at least one sink for security protocol encryption. In response to the non-detection of the event signal, the switch switches dynamically to an open position in order to disable the at least one source from authenticating with the input card, therefore the output card also does not attempt to authenticate with the at least one sink for security protocol encryption.

In a second aspect of the invention, a switcher device comprises a multiplexer coupled in-between at least one input and output cards and configured to transmit an audio-visual data signal from the at least one input card to a first and at least a second output card. The multiplexer is configured to dynamically switch between the first and at least second output card based on a user control signal that activates one of at least one sinks. Each of the output cards is coupled to the at least one sink. The input card comprises an integrated circuit that includes a High-Bandwidth Digital Content Protection (HDCP) enabled receiver and a switch coupled in-between the HDCP enabled receiver and an Extended Display Identification Data (EDID) memory. The at least one input card is configured to detect the presence of an event signal from the at least one user interface device. In response to the detection of the event signal, the switch is configured to dynamically switch to a closed position in order to enable the at least one source configured to authenticate with the input card and the output card configured to authenticate with the at least one sink for security protocol encryption. In response to the non-detection of the event signal, the switch is configured to dynamically switch to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption.

In a third aspect of the invention, a method for enabling/disabling Display Data Channel (DDC) access to enable/disable High-Bandwidth Digital Content Protection comprises detecting a user control signal to activate one of at least one sinks. The method further comprises in response to the detection of the user control signal, enabling the selected at least one sink for receiving audiovisual signal and detecting an event signal. In response to the detection of the event signal, switching the switch dynamically to a closed position for enabling the at least one source to authenticate with the input card and enabling the output card to authenticate with the at least one sink for security protocol encryption. The method further comprises permitting the transmission of audiovisual signal from the at least one source to the enabled at least one sink upon successful authentication and disabling control of the enabled at least one sink from being able to record since the audiovisual signal contains copy protected content. In response to the non-detection of the event signal, switching the switch dynamically to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption. The method further comprises permitting the transmission of the audiovisual signal to be displayed from the at least one source to the enabled at least one sink, and enabling control of the enabled at least one sink from being able to be recorded since the audiovisual signal contains non-copy protected content.

In a fourth aspect of the invention, an integrated circuit comprises an enabled High-Bandwidth Digital Content Protection (HDCP) receiver, an Extended Display Identification Data (EDID) memory, and a switch coupled in-between the security protocol enabled receiver and the EDID memory. The integrated circuit is configured to detect the presence of an event signal from at least one user interface device. In response to the detection of the event signal, the switch is configured to dynamically switch to a closed position in order to enable the at least one source configured to authenticate with the input card and the output card configured to authenticate with the at least one sink for security protocol encryption. In response to the non-detection of the event signal, the switch is configured to dynamically switch to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption.

In a fifth aspect of the invention, a computer program product for enabling and disabling a security protocol, the computer program product comprises a computer readable storage medium having computer readable program code embodied therewith. The computer readable program code comprises computer readable program code configured to: detect a user control signal to activate one of at least one sinks; in response to the detection of the user control signal, enabling the selected at least one sink for receiving audio-visual signal; detect an event signal; wherein in response to the detection of the event signal, switching the switcher dynamically to a closed position for enabling the at least one source to authenticate with the input card and enabling the output card to authenticate with the at least one sink for security protocol encryption; permit the transmission of audiovisual signal from the at least one source to the enabled at least one sink upon successful authentication; and disable control of the enabled at least one sink from being able to be recorded since the audiovisual signal contains copy protected content; wherein in response to the non-detection of the event signal, switch the switch dynamically to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption; permit the transmission of the audiovisual signal to be displayed from the at least one source to the enabled at least one sink; and enable control of the enabled at least one sink from being able to record since the audiovisual signal contains non-copy protected content.

The present invention seeks to overcome or at least ameliorate one or more of several problems, including but not limited to: the ability to view, copy, and share non-copy protected content on source and sink/display devices that are HDCP compliant.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic of a system in accordance with an illustrative embodiment of the present invention.

FIG. **2** is a schematic of a system in accordance with an illustrative embodiment of the present invention.

FIG. **3** is a schematic of system in accordance with an illustrative embodiment of the present invention.

FIG. **4** is a schematic of an input card **308** in accordance with an illustrative embodiment of the present invention.

FIG. **5** is a schematic of an input card **508** in accordance with another illustrative embodiment of the present invention.

FIG. **6** is a schematic of an input card **608** in accordance with yet another illustrative embodiment of the present invention.

FIG. **7** is a schematic of an input card **708** in accordance with yet another illustrative embodiment of the present invention.

FIG. **8** illustrates a flowchart for enabling/disabling HDCP content protection in accordance with an illustrative embodiment of the present invention.

The foregoing will be apparent from the following more particular description of example embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating embodiments of the present invention.

LIST OF REFERENCE NUMBERS FOR THE MAJOR ELEMENTS IN THE DRAWING

The following is a list of the major elements in the drawings in numerical order.

100 High-Bandwidth Digital Content Protection system
102 Collectively interface cable, link or physical connection of **102**a, **102**b
104 Collectively the source of **104**a, **104**b, . . . , **104**n
106 Collectively the sink/display of **106**a, **106**b, . . . , **106**n
108 Secret device keys
200 High-Bandwidth Digital Content Protection system
202 HDCP content or audiovisual data
210 Control function
212, **215** HDCP transmitter
214, **216**, **514**, **614**, **714** HDCP receiver
219 Repeater
220 Central Processing Unit
300 System for enabling and disabling DDC
302 Switcher
304 Event signal
306 Multiplexer
308 Collectively the input card of **308**a, **308**b, . . . , **308**n
310 Collectively the output card of **310**a, **310**b, **310**n
316 User control signal
318 Processing unit
320 Transceiver
322 Control system
323 User interface device, specifically wireless/mobile device
324 User interface device
326, **526**, **626**, **726** Integrated circuit
328 Software Tools
330 Extended Display Identification Data
332, **532**, **632** Switch
508, **608**, **708** Input card
530 Internal EDID
535 External EDID
630, **730** EDID
800 Method for enabling/disabling DDC
805 Step—starts
810 Step of detecting a user control signal
815 Step of enabling the activated at least one sink
820 Step of detecting an event signal
825 Step of dynamically switching to an open position
830 Step of permitting the transmission of AV signal
835 Step of enabling the AV signal from being able to be recorded and shared
850 Step of dynamically switching to a closed position
855 Step of permitting the transmission of audiovisual signal to be viewed
860 Step of disabling the audiovisual signal from being able to be recorded and shared

DETAILED DESCRIPTION OF THE INVENTION

Mode(s) for Carrying Out the Invention

Disclosure of Invention

Definitions

Authorized device—An HDCP device that is permitted access to HDCP content. An HDCP transmitter may test if an attached HDCP receiver is an authorized device by successfully completing the first and, when applicable, second part of the authentication protocol. If the authentication protocol successfully results in establishing authentication, then the other device is considered by the HDCP transmitter to be an authorized device.

Downstream—Used as an adjective to refer to being towards the sink/display of the HDCP content stream.

DVI—Digital Video (or Visual) Interface, a digital interface standard created by the Digital Display Working Group (DDWG) to accommodate both analog and digital monitors.

Event Signal—A signal that includes, but not limited to, activating a particular mode of a source.

HDCP—High-Bandwidth Digital Content Protection.

HDCP content—Audiovisual content that is protected by the HDCP system. HDCP content includes the audiovisual content in encrypted form as it is transferred from an HDCP transmitter to an HDCP receiver over an HDCP-protected Interface.

HDCP device—Any device that contains one or more HDCP-protected interface ports and is designed in adherence to HDCP.

HDCP Encryption—The encryption technology of HDCP when applied to the protection of HDCP content in an HDCP system.

HDCP-protected Interface—An interface for which HDCP applies.

HDCP-protected Interface Port—A connection point on an HDCP Device that supports an HDCP-protected Interface.

HDCP receiver—An HDCP device that can receive and decrypt HDCP content through one or more of its HDCP-protected interface ports.

HDCP repeater—An HDCP device that can receive and decrypt HDCP content through one or more of its HDCP-protected interface ports, and can also re-encrypt and emit the HDCP content through one or more of its HDCP-protected interface ports. An HDCP repeater may also be referred to as either an HDCP receiver or an HDCP transmitter when referring to either the upstream side or the downstream side, respectively.

HDCP transmitter—An HDCP device that can encrypt and emit HDCP content through one or more of its HDCP-protected interface ports.

HDMI—Short for High-Definition Multimedia Interface, an industry-supported, uncompressed, all-digital audio/video interface.

Mode—The mode of the source includes, but not limited to, playing a blu-ray DVD, displaying a PowerPoint presentation, displaying a website, collaborating on a white board application, using a document camera, and streaming content from a media player.

Upstream—Term used as an adjective to refer to being towards the source of the HDCP content stream. The antonym of "downstream," defined above.

FIGS. **1** and **2** illustrate examples of High-Bandwidth Digital Content Protection (HDCP) systems **100**, **200**. Referring to FIG. **1**, the HDCP system **100** encrypts the digital content transmission between a video source **104** (set-top box, computer, DVD, etc.) and a sink or display **106** (Liquid Crystal Display, television, etc.) via an interface **102** such as Digital Video Interface (DVI), High-Definition Multimedia Interface (HDMI), and DisplayPort.

FIG. **2** illustrates an HDCP system **200** wherein two or more HDCP devices **104**, **106** are interconnected through at least one interface **102**a, **102**b (collectively **102**) such as HDCP-protected interface. A single point-to-point HDCP link can involve one HDCP transmitter **212**, and one HDCP receiver **214**. As such, a repeater **219** must decrypt the HDCP content **202** at the HDCP receiver **214** on each of its inputs. The repeater **219** must then re-encrypt the data with an HDCP transmitter **215** of each of its outputs. The repeater **219** must inform the upstream device of its downstream connection, but it is the repeater's **219** responsibility to maintain those connections. The audiovisual content protected by HDCP, HDCP content **202**, flows from an upstream content control function **210** into the HDCP system **200** at the most upstream transmitter **212**. From there, the HDCP content **202**, encrypted by the HDCP system **200**, flows through a tree-shaped topology of HDCP receivers **214** over HDCP-protected interfaces **102**a. HDCP receivers **214** may be HDCP repeaters **219** that serve as downstream HDCP transmitters **215** emitting the HDCP content **202** further downstream to one or more additional HDCP receivers **216**. The system **200** is meant to stop HDCP-encrypted content from being played on devices that do not support HDCP or which have been modified to copy HDCP content **202**. Before sending data, the each transmitter **212**, **215** checks that the HDCP receivers **214**, **216** are authorized to receive the HDCP content **202**. If so, the transmitter **212** encrypts the HDCP content **202** to prevent eavesdropping as it flows to the receiver **216**. A central processing unit **220** includes firmware to process the data **202** and other information and control. The HDCP receiver **216** may incorporate a lecture system that permits non-copy protected content to be recorded. For example, such a lecture system may be a CAPTURELIVEHD system available from Crestron Electronics, Inc. of Rockleigh, N.J. The system enables a simple and efficient end-to-end solution for recording, scheduling, processing, online distribution, and remote viewing of lecture and presentation content. The recorded lecture system may include content and microphone audio, plus full screen, picture-in-picture (PIP) and picture-by-picture video, including from the instructor camera and any other presentation source such as a PowerPoint®, DVD or website. In another embodiment, the lecture system may be a separate system that connects to the receiver **216** and the sink **106**.

There are three facets of the content protection system. First, there is the authentication protocol, through which the HDCP transmitter **212** verifies that a given HDCP receiver **216** is licensed to receive HDCP content **202**. Second, the legitimacy of the HDCP receiver **216** determined, encrypted HDCP content **202** is transmitted between the two devices **104**, **106** based on shared secrets established during the authentication protocol. The use of such shared secrets prevents eavesdropping devices from utilizing the content. Finally, in the event that legitimate devices are compromised to permit unauthorized use of HDCP content **202**, renewability allows an HDCP transmitter **212** to identify such compromised devices and prevent the transmission of HDCP content **202**.

The HDCP authentication protocol is an exchange between an HDCP transmitter **212** and an HDCP receiver **216** that affirms to the HDCP transmitter **212** that the HDCP receiver **214** is authorized to receive HDCP content **202**. That affirmation is in the form of the HDCP receiver **216** demonstrating knowledge of a set of secret device keys **108** (FIG. **1**). Each HDCP device is provided with a unique set of secret device keys, referred to as the Device Private Keys, from Digital Content Protection, LLC. (DCP). The communication exchange, which allows for the receiver **216** to demonstrate knowledge of such secret device keys **108**, also provides for both HDCP devices **104**, **106** to generate a shared secret value that cannot be determined by eavesdropping on that exchange. By having that shared secret information embedded into the demonstration of authorization, the shared secret can then be used as a symmetric key to encrypt HDCP content **202** intended only for the authorized device. Thus, a communication path is established between the HDCP transmitter **212** and HDCP receiver **216** that only authorized devices can access.

Device manufacturers typically purchase HDCP chips from a DCP-licensed silicon vendor. These chips usually also provide Transition Minimized Differential Signaling (TMDS) encoders or decoders and other HDMI-specific features. Every transmitter **212** will have at least one HDCP transmitter chip and every receiver **216** will have at least one HDCP receiver chip. The HDCP transmitters **212**, and receivers **216** frequently require a microprocessor to implement the authentication state machines. Transmitters **212**, **215** are HDMI transmitters.

To support HDCP, each transmitter **212** and receiver **216** must possess the following elements:

Keys: Each HDCP transmitter **212**, **215** and receiver **214**, **216** has forty unique 56-bit private keys. These keys are provided by DCP to licensed HDCP chip vendors, who preload the keys onto the chips before selling them to device manufacturers. These keys must never leave the chip and may not be read by any other device.

KSVs: Each HDCP chip also has a public 40-bit value known as the Key Selection Vector (KSV). Each KSV consists of twenty binary 1s and twenty binary 0s. The KSVs and keys of all licensed HDCP devices are mathematically related according to a cryptographic key exchange protocol similar to Blom's scheme. In this scheme, any two licensed devices can swap KSVs and use them, along with their private keys, to come up with a shared secret key. This shared key can be used to encrypt and decrypt the TMDS stream. The KSV can also be used to uniquely identify a transmitter or receiver.

HDCP cipher: Each chip must implement the HDCP cipher. The cipher accepts a seed value and uses it to generate a deterministic pseudo-random stream of data. All HDCP cipher implementations should generate the same output stream given the same seed value. This publicly defined cipher is used during both authentication and encryption.

Registers: Each HDCP receiver **214**, **216** provides a series of pre-defined Digital Display Channel (DDC) accessible registers. All of the HDCP communications between the source **104** and sink/display **106** occurs by the source **104** reading from and writing to these registers.

The Authentication and Encryption Protocols

HDCP authentication consists of three parts:

Part 1: The source **104** authenticates with the sink/display **106** connected to its output. If successful, encryption is enabled and audiovisual (A/V) content transmission begins.

Part 2: This part is used if the downstream device is a repeater **219**. The repeater **219** authenticates with the devices connected to its output(s) and passes the HDCP tree topology information up to the source **104**. The source **104** is the root and sinks/displays **106** are the leaves, while repeaters **219** make up the branches of the tree.

Part 3: The source **104** performs periodic checks with the sink/display **106** to ensure that encryption is in sync. HDCP also supports a key revocation mechanism that is designed to prevent content from being transmitted to known hacked devices. If any part of authentication fails or any revoked devices are found in the HDCP tree, the transmitter **212** must stop sending protected content and authentication starts over at Part 1. Authentication, encryption, and revocation are described in detail in the following sections.

Authentication Part 1

Part 1 of authentication is a key exchange protocol. The transmitter **212** and receiver **216** calculate a common secret session key **108** to be used for encryption. If they cannot come up with the same key value, authentication fails and the receiver **216** will not be able to decrypt the content **202**. The session key **108** is derived from each device's private key according to the following protocol:

First the transmitter **212** generates a random number "An" and sends it to the receiver **216**. This value will be used later in the protocol. The devices **104**, **106** then exchange KSVs. The receiver **216** also sends its REPEATER bit, a flag that indicates whether or not it is part of a repeater. Now each device **104**, **106** has the other device's Key Selection Vector (KSV). Each device **104**, **106** uses the other device's Key Selection Vector to select twenty of its own keys. The forty bits in the KSV correspond to the indexes of each of the forty private keys. For every set bit in the received KSV, the local private key at that index is selected. All KSVs have twenty set bits, so twenty keys are selected. The devices **104**, **106** then each add up their selected keys to come up with the sums Km and Km', for the transmitter and receiver, respectively **212**, **216**. For authentication to succeed, Km and Km' must match. Each device **104**, **106** tells the other which of its own unique, secret keys to select, and they both come up with the same sum. That may seem counter-intuitive, but it is the aforementioned mathematical relationship between the keys and the KSVs that accounts for this behavior. The source **104** must determine whether Km and Km' match. However, they are secret values, so they cannot be transmitted over the interface cable or physical connection **102** for the DDC. Each device **104**, **106** feeds Km (or Km'), the random number "An", and the REPEATER bit into their respective HDCP cipher engines in order for the transmitter **212** to verify that the values match without sending them across the cable **102** for everyone to see. The resulting data stream is split into three values:

R0/R0': This return value may be shared between the devices **104**, **106** and is used to verify that authentication was successful.

Ks/Ks': This value is kept private and is used as the encryption session key for the HDCP cipher.

M0/M: This value is also kept private and is used in Part 2 of authentication (if the downstream device is a repeater **219**).

The receiver sends R0' to the transmitter **212**, which compares it against its' own R0 value. If they match, that proves that the sums Km and Km' matched, and authentication is successful. Furthermore, the session keys Ks and K match, so the receiver **214** will be able to decrypt the content encrypted by the transmitter. If Part 1 of authentication was successful, the transmitter **212** may begin sending encrypted content **202**. If the downstream device is a repeater **219**, the repeater **219** must authenticate with its own downstream device according to the same protocol. The transmitter **212** then starts a 5-second timer to allow for the repeater **219** to perform Part 2 of authentication. If Part 2 fails or times out, authentication fails and the transmitter **212** must stop transmitting the protected content **202**.

Authentication Part 2

Part 2 of authentication only occurs if the downstream device is a repeater **219**. The purpose of Part 2 is to inform the source **104** of all downstream devices and the HDCP tree depth. The source **104** uses this information to ensure that the tree topology maximums have not been exceeded and to ensure that none of the downstream devices have been revoked by DCP. The repeater **219** first assembles a list of the KSVs of all downstream devices, as well as the device count and the tree depth. The repeater **219** then passes this information up to the source **104**. To ensure that this information hasn't been tampered with during transmission, each device takes this list, appends its secret value M0/M0' from Part 1, and calculates a SHA-1 hash of the whole thing. The transmitter **212** reads the hash result from the receiver **214** and compares it against its own. If they match, Part 2 of authentication is successful.

Authentication Part 3

All HDCP devices are considered authenticated after successful completion of Authentication Parts 1 and 2. Part 3 is simply a link integrity check to ensure that encryption is in sync between all transmitter/receiver pairs **212**, **214**, **215**, **216** in the tree. To support link integrity checks, the return values Ri and Ri' roll over to a new value every 128 frames. Recall that the initial Ri values R0 and R0' were generated during Part 1 of authentication. Every two seconds, the transmitter **212** compares the receiver's **216** Ri' value against its own Ri value to see if they match. If they do not, encryption is out of sync and the receiver **216** cannot correctly decrypt the content **202**. The user will see a scrambled or "snowy" image on the screen. In this case the transmitter **212** must restart authentication from the beginning.

Encryption

The transmitter **212** uses the HDCP cipher engine to encrypt the content **202**. The session key Ks from Authentication Part 1 is used as the seed value, and the cipher output stream is simply XORed with the audiovisual content. The transmitter **212** then sends the XOR output to the receiver **216** as the encrypted data stream. To decrypt the data, the HDCP receiver **214** seeds its own cipher engine with its matching value Ks'. Since Ks equals Ks', the cipher output matches that of the transmitter **212**. The receiver **216** then XORs its cipher output stream with the encrypted data, and the output is the decrypted audiovisual content **202**.

Revocation

The HDCP designers recognized that despite their best efforts, private device keys could possibly be compromised. If such a compromise were discovered, the designers wanted a method by which they could prevent content from being sent to the compromised units. To this end, HDCP sources **104** are required to manage System Renewability Messages (SRMs). SRMs carry a list of revoked KSVs that may be provided with the audiovisual content. For instance, a SRM could be stored on an HD-DVD or may be transmitted with

a cable television signal. If presented with an SRM, the HDCP source must check all the downstream KSVs obtained during Parts 1 and 2 against the KSVs listed in the SRM. If there are any matches, the HDCP source must stop transmitting the protected content. SRMs are only supported by the HDCP source **104**; neither repeaters **219** nor sink/displays **106** handle SRMs.

HDCP eliminates the possibility of intercepting digital data midstream between the source **104** to the sink/display **106** because of the authentication process as described above. However, in some situation when the source **104** and the sink/display **106** are HDCP compliant, non-HDCP content cannot be recorded and shared. This is an issue, for example, in a university setting where instructors want students to have the ability to copy and share non-HDCP content. More specifically, the use of laptops during a university lecture by instructors and students has become common, particularly when wireless networks allow free campus internet access. The instructors may show a PowerPoint presentation of the lecture and want students to view, record, and/or copy the presentation. Additionally, some university professors are aware of the needs of disabled students who require laptops to take notes and/or copy the presentation.

With HDCP compliant source **104** and sink/display **106** devices, students will not be able to copy and/or record presentation. As will be explained below, the present invention discloses system, apparatus and method for allowing the non-copy protected content to be recorded and/or shared when the source **104** (that is HDCP compliant) and a sink/display **106** (that is HDCP compliant or not). The present invention discloses that the source **104** does not recognize the sink/display **106** to be HDCP compliant when the sink/display **106** itself is HDCP compliant. As a result, the authentication process never occurs and hence failure of authentication is not possible. The HDCP compliant source **104** proceeds to transmit the non-HDCP content to the HDCP compliant sink/display **106** even though the sink/display **166** is HDCP compliant.

FIG. **3** is a system **300** for enabling and disabling a DDC access to enable/disable a security protocol such as HDCP between a source **104** (that is HDCP compliant) and sink/display **106** (that is HDCP compliant). The owner of the non-copy protected content may use the system **300** to enable or disable the DDC at the source **104** (that is HDCP compliant) and transmit the non-copy protected content to the sink/display **106** (that is HDCP compliant or not). Thereby, enabling the viewers such as university students to be able to record and/or copy the lecture. The system **300** includes at least one source **104**a, **104**b, . . . , **104**n (collectively **104**) and at least one sink or display **106**a, **106**b, . . . , **106**n (collectively **106**). Each source **104** includes an HDCP supported HDMI transmitter **212** configured to transmit audiovisual data to the at least one sink **106**. Each source **104** further includes a graphic generator (not shown) to generate the graphic or image. The HDCP transmitter **212** receives the HDCP content **202** from an upstream content control function **210**.

Some sinks/displays **106**a may include an HDCP compliant receiver. Other sinks/displays **106**b may not include an HDCP compliant receiver. The source **104** determines via the authentication process what content can be viewed, recorded, and shared based on sinks/displays **106** that support HDCP and sinks/displays **106** that do not support HDCP. The output of the source **104** is connected to an input of a switcher device **302** through its HDCP-protected interfaces. It should be understood that the switcher device **302** could be any device or apparatus that is capable of enabling, connecting, disabling, disconnecting an I2C signal used in DDC communication such as a relay, FET switch, I2C buffer, mux, and digital logic.

The output of the switcher device **302** is connected to the input of the sink/display **106** via another interface **102**b. The interface **102**a, **102**b for the input and the output of the switcher device **302** may be an HDMI cable that carries a variety of signals such as Transition Minimized Differential Signaling (TMDS), Digital Display Channel (DDC), Hot Plug Detect (HPD), and 5-volt.

When an HDCP source **104** (more specifically source **104**a) detects an HPD signal from an HDCP compliant sink/display **106** (more specifically sink/display **106**a), the source **104**a will transmit the HDCP content **202** to the sink/display **106**a after the authentication process is successful.

The audiovisual data **202** is encoded into three data channels. These channels and a TMDS clock are carried over four differential pairs from the source **104** to the sink/display **106**. The DDC is a communications interface similar to I2C. This interface provides two-way communication in a master-slave relationship. The upstream device **104** is the DDC master and the downstream device **106** is the DDC slave. The sink/display **106** indicates its presence to the source **104** with the HPD signal. The sink/display **106** can toggle the HPD signal to reset the HDMI connection (and thus, the HDCP session). Though not specifically defined by HDMI, many devices support a feature known as RxSense. There is no RxSense wire, but rather, sources **104** can detect that a sink/display **106** has terminated the TMDS differential pairs. Similarly to HPD, this signal can be used to detect the presence of a sink/display **106**. The HDCP transmitter **212** is the HDCP Device most upstream, and receives the HDCP content **202** from an upstream content control function **210**.

The switcher device **302** is a fully modular and expandable matrix switcher offering low-latency digital video and audio switching, and HD lossless multi-room signal distribution, for all types of A/V sources. The switcher device **302** may be a CRESTRON DIGITAL MEDIA SWITCHER available from Crestron Electronics, Inc. of Rockleigh, N.J. The CRESTRON DIGITAL MEDIA SWITCHER is a field-configurable to handle, but not limited to, 8, 16, or 32 audiovisual sources of virtually any type. The outputs are also field-configurable to provide, but not limited to, 8, 16, or 32 room outputs and/or HDMI outputs in a single chassis. The switcher device **302** includes a multiplexer **306** coupled in-between the at least one input card **308**a, **308**b, **308**n (collectively **308**) and at least one output card **310**a, **310**b, **310**n (collectively **310**).

The multiplexer **306** transmits an audiovisual data signal **202** from the at least one input card **308** to a first and at least a second output card **310**. The multiplexer **306** dynamically switches between the first and at least second output cards **310**a, **310**b based on a user control signal **316** that activates one of the at least one sinks/displays **106**. Each of the output cards **310** is coupled to the at least one sink/display **106** via interface cable/physical connection **102**b. The switcher **302** further includes a processing unit **318** coupled to the multiplexer **306**. The processing unit **318** includes at least one transceiver **320** for bidirectional communications with user interface devices (e.g., **323**, **324**), in part, to receive the user control signal **316** and event signal **314**. The user interface device **323**, **324** transmits the user control signal **316** from a touch panel display **324** via a control system **322**. An end user may also transmit the user control signal **316** from a wireless device **323**. Software tools **328** may be loaded onto

the wireless device and/or touch panel **324** to assist the end user in selecting a desired sink/display **106**. In response to the user activating the desired sink or display **106**, the end user device transmits the user control signal **316** to the switcher **302**. A user interface device **324** may be a display device such as, but not limited to, a graphical user interface (GUI) touch panel, mobile device **323**, tablet, projector, desktop computer, and laptop.

FIG. **4** is a schematic of an input card **308** in accordance with an illustrative embodiment of the present invention. The input card **308** includes a switch **332** connected in series with an integrated circuit **326**. The switch **332** may be, but is not limited to, a mechanical switch, electrically operated switch, solid state relay, latching relay, reed relay, Single Pole Single Throw (SPST) relay, Single Pole Double Throw (SPDT) relay, Double Pole Single Throw (DPST) relay or Double Pole Double Throw (DPDT) relay. The interface cable **102**a is connected to the input card **308**. Various signals are carried in the interface cable **102**a including TMDS, DDC, HPD, and five (5) volts signals. The switch **332** and integrated circuit **326** are in series, which in turn, is in parallel with an Extended Display Identification Data (EDID) memory **330**. The input card **308** includes an integrated circuit **326** that includes a security protocol enabled receiver **214**. The security protocol may be HDCP. In operation, the input card **308** detects the presence of an event signal **304** from the user interface devices (e.g., **323**, **324**). In response to the detection of the event signal **304**, the switch **332**, **532**, **632** switches dynamically to a closed position for enabling the at least one source **104** to authenticate with the input card **308**, **508**, **608**, **708** and enabling the output card **310** to authenticate with the at least one sink **106** for security protocol encryption.

In response to the non-detection of the event signal **304**, the switch **332**, **532**, **632** switches dynamically to an open position in order to disable the at least one source **104** from initiating an authentication with the input card **308**, **508**, **608**, **708**. Therefore, the output card **310** also does not attempt to initiate an authentication with the at least one sink **106** for security protocol encryption. Since the source **104** does not detect the HDCP capability of the input card **308**, **508**, **608**, **708**, authentication never occurs or more specifically an attempt to authenticate never happened, therefore a failed authentication never occurred.

More specifically, when the source **104** fails authentication or changes the resolution of the multimedia data or changes the resolution of the sink **106**, the reestablishment and encoding/decoding of the HDCP become unstable, such that the sink **106** cannot display the multimedia data normally. The source **104** uses a hot-plug detect signal of the HDMI interface to identify the coupling state between the sink **106** and the source **104**. When the hot-plug detect signal is a logic high level pulse signal, the source **104** and the sink **106** are in a coupled state. In the conventional art, in order to solve the problem that the sink does not function normally, it may be required to disconnect and connect the HDMI connector again or restart the source **104** to enable the source **104** to read the EDID again and reestablish the HDCP.

Continuing on to the operation, typically, the source **104** initially authenticates with the input card **308**, **508**, **608**, **708**. Once that authentication is successful, the output card **310** then authenticates with the sink **106**. In one embodiment, when the input card **308** does not detect the event signal **304**, the switch **332**, **532**, **632** switches dynamically to an open position in order to disable the source **104** from initiating authentication with the input card **308**, **508**, **608**, **708**. As a result, the output card **310** also does not attempt to initiate an authentication with sink **106** for security protocol encryption. The non-copy protected content is still transmitted to the sink/display **106** even though the source **104** and the sink/display **106** are HDCP compliant. Moreover, the end user can copy and/or share the non-copy protected content. Without, in part, the switch **332** and its placement thereof, the non-copy protected content will not be able to be shared and/or recorded when the source **104** and the sink/display **106** are HDCP compliant.

Typically, if an end user wants to switch between watching copy protected content (HDCP required) or watching/recording non-copy protected content such as a PowerPoint in a lecture scenario, the end user installs two different AV distribution switcher infrastructure. One AV switcher supports HDCP and another AV switcher does not support HDCP. When the customer wants to watch copy protected content, the end user physically plugs into the HDCP supported AV switcher and when the end user wants to watch/record lectures, the end user plugs into a different system. The present disclosure allows a single [AN] *AV* switcher system to be used so that the end user does not need to physically change the cable positioning. Moreover, the present disclosure saves resources and complexities because separate systems do not need to be setup.

It should be understood that there may be more than one source **104** and sink/display **106** connected to the system **300**. It should also be understood that there may be more than one input card **308**a, **308**b, **308**n (collectively **308**) with similar electrical connections and physical layouts.

FIG. **5** is a schematic of an input card **508** in accordance with another illustrative embodiment of the present invention. The input card **508** has the DDC signal in the interface cable **102**a into the input card **508**. The input card **508** includes an integrated circuit **526**. The integrated circuit **526** includes a switch **532**, a security protocol enabled receiver **514**, and an EDID **530**. The EDID **530** and receiver **514** are in parallel with each other. The EDID **530** and receiver **514**, in turn, are in series with the switch **532**. The switch **532**, security protocol enabled receiver **514**, and EDID **530** have full integration on the integrated circuit **526**. When the input card **508** does not detect the event signal **304** from the user interface device **323**, **324**, the switch **532** dynamically switches to an open or disconnect position. The non-copy protected content is displayed on the sink/display **106**. And the non-copy protected content can be recorded and/or shared even when the sink/display **106** is HDCP compliant. The EDID **535** is connected to the interface cable **102**a prior to the cable **102**a inputting into the switch **532**. In one embodiment, the EDID **535** is connected externally to the integrated circuit **526**. The internal EDID **530** is then disabled via software. When the input card **508** detects the event signal **304** from at least one user interface device (**323**, **324**), the switch **532** dynamically switches to a closed or connect position and the non-copy protected content or HDCP content **202** is transmitted to the sink/display **106**. Both the non-copy protected content and the HDCP content **202** cannot be recorded and/or shared when the sink/display **106** is HDCP compliant.

FIG. **6** is a schematic of an input card **608** in accordance with yet another illustrative embodiment of the present invention. The input card **608** is similar to the input card **508** with the exception that there is no external EDID **535** and the connection to the switch **632**. Input card **608** has the DDC signal on the interface cable **102**a, which connects to the input card **608**. The input card **608** includes an integrated circuit **626**. The integrated circuit **626** includes a switch **632**,

a security protocol enabled receiver **614**, and an EDID **630**. The switch **632** is in series with the receiver **614**, which in turn, is in parallel with the EDID **630**. The switch **632**, security protocol enabled receiver **614**, and EDID **630** have full integration on the integrated circuit **626**. The EDID **630** is connected to line **102**a before it is connected into the input of the switch **632**. That way, when the switch **632** is disconnected, non-copy protected content can still be passed to the sink/display **106**. Hence, non-copy protected content can be recorded and/or stored even when sink/display **106** is HDCP compliant. As described above, when the input card **608** does not detect the event signal **304**, the switch dynamically switches to an open or disconnect position in order to disable the at least one source **104** from being able to detect the HDCP capability of the input card **608**. As a result, the output card **310** also does not attempt to authenticate with the sink **106**.

FIG. **7** is a schematic of an input card **708** in accordance with yet another illustrative embodiment of the present invention. This embodiment changes the register of the security protocol enabled receiver **714**. According to the HDCP specification, the register or memory location of the receiver **714** is typically 0x70. By using a software program, the register memory location is changed to, for example, 0x60. As a result, the source **104** will not recognize the receiver **714**. Since the receiver **714** is not recognized, the authentication process never gets initiated and hence no failure in authentication is possible. Non-copy protected content can still be passed to the sink/display **106** even though the sink/display **106** is HDCP compliant. The non-copy protected content can be recorded and/or shared.

The following is a pseudo-code representation of the operation in accordance with an illustrative embodiment of the present invention.

User sets HDCP enable or disable for a desired sink/display

Drop hot plug to change HDCP switch

Wait until hot plug signal goes away based on measurements such as sync measurements and sync detect.

Perform switch method

Set hardware disconnect switch

Raise hot plug

FIG. **8** illustrates a method **800** for enabling/disabling DDC access to enable/disable HDCP according to an embodiment of the invention. Procedure **800** begins at step **805**. In step **810** a system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) detects a user control signal **316** to activate one of the at least one sinks **106**. If the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) does not detect the user control signal **316**, the procedure goes back to step **805**. However, if there is a detection of the user control signal **316**, the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) activates or enables the at least one sink **106** for receiving and displaying audiovisual signal, which is the HDCP content **202** in step **815**.

In step **820**, the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) detects an event signal **304** from at least one user interface device (**323**, **324**). In response to the detection of the event signal **304**, the switch **332** switches dynamically to a closed position for enabling the at least one source **104** to authenticate with the input card **308**, **508**, **608**, **708** and enabling the output card **310** to authenticate with the at least one sink **106** for security protocol encryption in step **850**. The system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) permits the transmission of audiovisual signal or HDCP content **202** from the at least one source **104** to the enabled at least one sink **106** upon successful authentication between the at least one source **104** and the activated at least one sink **106** in step **855**. In step **860**, the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) disables control of the enabled at least one sink **106** from being able to record the audiovisual signal that contains copy protected content (e.g., HDCP content **202**) from being able to be recorded and shared.

In response to the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) not detecting the event signal **304**, the switch **332** switches dynamically to an open position in order to disable the at least one source **104** from initiating an authentication with the input card **308**, **508**, **608**, **708** in step **825**. To this end, the output card **310** also does not attempt to initiate an authentication with the at least one sink **106** for security protocol encryption. In step **830**, the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) permits transmission of the audiovisual signal (e.g., HDCP content **204**) to be displayed from the at least one source **104** onto the activated at least one sink **106**. In step **835**, the system (e.g., **300**) or apparatus (e.g., **308**, **408**, **508**, **608**, **708**) enables control of the enabled at least one sink **106** from being able to record since the audiovisual signal **202** contains non-copy protected content.

Any process descriptions or blocks in flow charts should be understood as representing modules, segments, or portions of code that include one or more executable instructions for implementing specific logical functions or steps in the process. Alternate implementations are included within the scope of the preferred embodiment of the present invention in which functions may be executed out of order from that shown or discussed, including substantial concurrence or reverse order, depending on the functionality involved, as would be understood by those reasonably skilled in the art of the present invention. Also, steps disclosed as separate may be performed concurrently or combined, and a step shown as discrete may be performed as two or more steps. Furthermore, numerical values and disclosures of specific hardware are illustrative rather than limiting. Moreover, while the preferred embodiment has been disclosed in the context of DVI, the invention can be implemented for use with another suitable interface that uses HDCP, such as HDMI or any substantially DVI-like interference. Therefore, the present invention should be construed as limited only by the appended claims.

INDUSTRIAL APPLICABILITY

To solve the aforementioned problems, the present invention is a unique method, apparatus, and system for enabling and/or disabling dynamic Display Identification Data to enable and/or disable High-Bandwidth Digital Content Protection without an authentication process.

LIST OF ACRONYMS USED IN THE DETAILED DESCRIPTION OF THE INVENTION

The following is a list of the acronyms used in the specification in alphabetical order.

API Application Programming Interface

AV Audiovisual

CD ROM Compact Disk Read-Only Memory

CPU Central Processing Unit

CSS Content Scrambling System

DCP Digital Content Protection, LLC.

DDC Digital Display Channel

DDWG Digital Display Working Group

DLI Digital Light Interface
DP DisplayPort
DPDT Double Pole Double Throw relay
DPST Double Pole Single Throw relay
DRM Digital rights management
DVD Digital Versatile Disk
DVI Digital Video Interface
EDID Extended Display Identification Data
GVIF Giga-bit Video Interface
GUI Graphical User Interface
HDCP High-Bandwidth Digital Content Protection
HD-DVD High-Definition Digital Versatile/Video Disc
HDMI High-Definition Multimedia Interface
HP Hot Plug Detect
IP Internet Protocol
KSV Key Selection Vector
RAM Random Access Memory
ROM Read Only Memory
SDK Software Development Kit
SPDT Single Pole Double Throw relay
SPST Single Pole Single Throw relay
SRM System Renewability Message
TCP/IP Transmission Control Protocol/Internet Protocol
TMDS Transition Minimized Differential Signaling
TV Television
UDI Unified Display Interface
USB Universal Serial Bus
WHDI Wireless Home Digital Interface

Alternate Embodiments

It is to be understood that both the general and detailed descriptions above are exemplary and explanatory only and are not restrictive of the invention. It should be understood that the invention can be implemented in a DVI or HDMI capable set-top box. While the invention has been disclosed for use with HDCP, it can be used with any other security protocol that satisfies the following two attributes. The first attribute is that the security protocol is tied to the video content being transmitted; that is, if the video attributes change, the security protocol must be renegotiated. The second attribute is that the security protocol offers a way to determine or detect whether the remote device is capable of supporting the security protocol.

At least a portion of the input card (e.g., **308**, **408**, **508**, **608**, **708**) of the present invention may be implemented in an integrated circuit. In forming integrated circuits, a plurality of identical die is typically fabricated in a repeated pattern on a surface of a semiconductor wafer. Each die includes a device described herein, and may include other structures and/or circuits. The individual die are cut or diced from the wafer, then packaged as an integrated circuit. One skilled in the art would know how to dice wafers and package die to produce integrated circuits. Integrated circuits so manufactured are considered part of this invention.

In this description, various functions and operations may be described as being performed by or caused by software code to simplify description. However, those skilled in the art will recognize what is meant by such expressions is that the functions result from execution of the code by a processor, such as a microprocessor. Alternatively, or in combination, the functions and operations can be implemented using special purpose circuitry, with or without software instructions, such as using Application-Specific Integrated Circuit (ASIC) or Field-Programmable Gate Array (FPGA). Embodiments can be implemented using hardwired circuitry without software instructions, or in combination with software instructions. Thus, the techniques are limited neither to any specific combination of hardware circuitry and software, nor to any particular source for the instructions executed by the data processing system.

While some embodiments can be implemented in fully functioning computers and computer systems, various embodiments are capable of being distributed as a computing product in a variety of forms and are capable of being applied regardless of the particular type of machine or computer-readable media used to actually effect the distribution.

At least some aspects disclosed can be embodied, at least in part, in software. That is, the techniques may be carried out in a computer system or other data processing system in response to its processor, such as a microprocessor, executing sequences of instructions contained in a memory, such as ROM, volatile RAM, non-volatile memory, cache or a remote storage device.

Routines executed to implement the embodiments may be implemented as part of an operating system, middleware, service delivery platform, SDK (Software Development Kit) component, web services, or other specific application, component, program, object, module or sequence of instructions referred to as "computer programs." Invocation interfaces to these routines can be exposed to a software development community as an API (Application Programming Interface). The computer programs typically comprise one or more instructions set at various times in various memory and storage devices in a computer, and that, when read and executed by one or more processors in a computer, cause the computer to perform operations necessary to execute elements involving the various aspects.

A machine readable medium can be used to store software and data which when executed by a data processing system causes the system to perform various methods. The executable software and data may be stored in various places including for example ROM, volatile RAM, non-volatile memory and/or cache. Portions of this software and/or data may be stored in any one of these storage devices. Further, the data and instructions can be obtained from centralized servers or peer to peer networks. Different portions of the data and instructions can be obtained from different centralized servers and/or peer to peer networks at different times and in different communication sessions or in a same communication session. The data and instructions can be obtained in their entirety prior to the execution of the applications. Alternatively, portions of the data and instructions can be obtained dynamically, just in time, when needed for execution. Thus, it is not required that the data and instructions be on a machine readable medium in entirety at a particular instance of time.

Examples of computer-readable media include but are not limited to recordable and non-recordable type media such as volatile and non-volatile memory devices, read only memory (ROM), random access memory (RAM), flash memory devices, floppy and other removable disks, magnetic disk storage media, optical storage media (e.g., Compact Disk Read-Only Memory (CD ROMS), Digital Versatile Disks (DVDs), etc.), among others. The instructions may be embodied in digital and analog communication links for electrical, optical, acoustical or other forms of propagated signals, such as carrier waves, infrared signals, digital signals, etc.

In general, a machine readable medium includes any mechanism that provides (i.e., stores and/or transmits) information in a form accessible by a machine (e.g., a computer,

network device, personal digital assistant, manufacturing tool, any device with a set of one or more processors, etc.).

In various embodiments, hardwired circuitry may be used in combination with software instructions to implement the techniques. Thus, the techniques are neither limited to any specific combination of hardware circuitry and software nor to any particular source for the instructions executed by the data processing system.

Although some of the drawings illustrate a number of operations in a particular order, operations which are not order dependent may be reordered and other operations may be combined or broken out. While some reordering or other groupings are specifically mentioned, others will be apparent to those of ordinary skill in the art and so do not present an exhaustive list of alternatives. Moreover, it should be recognized that the stages could be implemented in hardware, firmware, software or any combination thereof.

Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various other changes and modifications may be made therein by one skilled in the art without departing from the scope of the appended claims.

What is claimed is:

[1. A system for enabling/disabling Display Data Channel (DDC) access to enable/disable a security protocol, the system comprising:

at least one source;

at least one sink; and

a switcher device communicatively coupled in-between the at least one source and the at least one sink, the switcher device comprises:

a multiplexer coupled in-between at least one input and output cards and configured to transmit an audiovisual signal from the at least one input card to a first and at least a second output card via a physical connection; wherein the multiplexer is configured to dynamically switch between the first and at least second output card based on a user control signal that activates one of the at least one sinks, wherein each of the output cards is coupled to the at least one sink;

wherein the input card comprises:

an integrated circuit that includes High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

a switch coupled in-between the HDCP enabled receiver and an Extended Display Identification Data (EDID) memory, wherein the input card is configured to detect the presence of an event signal from at least one user interfaced device,

wherein in response to the detection of the event signal, the switch is configured to dynamically switch to a closed position in order to enable the at least one source configured to perform a first authentication with the input card and the output card configured to perform a second authentication with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink, and

wherein in response to the non-detection of the event signal, the switch is configured to dynamically switch to an open position in order to disable the at least one source from initiating a first authentication with the input card, therefore the output card also does not attempt to initiate a second authentication with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink;

wherein the input card is configured to enable the at least one sink from being able to record since the audiovisual signal includes a non-copy protected content.]

[2. The system of claim 1, wherein the at least one source and sink are High-Bandwidth Digital Content Protection compliant.]

[3. The system of claim 1, wherein the at least one physical connection interconnects to the at least one source, the switcher device, and the at least one sink device.]

[4. The system of claim 1, wherein the physical connection comprises an HDMI cable that carries Transition Minimized Differential Signal (TMDS), Digital Display Channel (DDC), and Hot Plug Detect (HPD) signals.]

[5. The system of claim 1, wherein the integrated circuit comprises the switch device, HDCP enabled receiver, and EDID memory, wherein the HDCP enabled receiver and EDID memory are in parallel with respect to each other, and wherein the combination of the HDCP enabled receiver and EDID memory are in series with the switch device.]

[6. The system of claim 5, wherein the integrated circuit is in parallel with another EDID memory.]

[7. The system of claim 1, wherein the switch device comprises a mechanical switch, electrically operated switch, solid state relay, latching relay, reed relay, Single Pole Single Throw (SPST) relay, Single Pole Double Throw (SPDT) relay, Double Pole Single Throw (DPST) relay, and Double Pole Double Throw (DPDT) relay.]

[8. The system of claim 1, wherein the switcher device further comprises a processor coupled to a transceiver for bidirectional communication with the at least one user interface device, wherein the processor and transceiver are configured to process and receive the user control signal in response to a user activating the at least one user interface device.]

[9. The system of claim 8, wherein the at least one user interface device comprises a graphical user interface (GUI) touch panel, mobile device, tablet, and computer.]

[10. The system of claim 8, wherein the at least one user interface device is configured to transmit the user control signal wired or wirelessly.]

[11. The system of claim 8, wherein the at least one user interface device further comprises software tools to assist the user in selecting the at least one source.]

[12. The system of claim 1, wherein the at least one source comprises a game console, digital versatile disc (DVD) player, cable box, desktop computer, laptop, and blu-ray player.]

[13. The system of claim 1, wherein the least one sink comprises a display device, wherein the display device is a television.]

[14. The system of claim 1, wherein the input card is configured to disable the at least one sink from being able to record since the audiovisual signal includes copy protected content.]

[15. The system of claim 1, wherein the input card is configured to permit the transmission of audiovisual signal from the at least one source to the at least one sink.]

[16. The system of claim 1, wherein the second authentication is attempted if the first authentication is successful between the at least one source and the input card.]

[17. The system of claim 1, wherein the first and second authentications includes an encryption.]

[18. A switcher device, comprising:

a multiplexer coupled in-between at least one input and output cards and configured to transmit an audiovisual data signal from the at least one input card to a first and at least a second output card;

wherein the multiplexer is configured to dynamically switch between the first and at least second output card based on a user control signal that activates one of at least one sinks;

wherein each of the output cards is coupled to the at least one sink;

wherein the input card comprises:

an integrated circuit that includes a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

a switch coupled in-between the HDCP enabled receiver and an Extended Display identification Data (EDID) memory, wherein the at least one input card is configured to detect the presence of an event signal from the at least one user interface device;

wherein in response to the detection of the event signal, the switch is configured to dynamically switch to a closed position in order to enable the at least one source configured to authenticate with the input card and the output card configured to authenticate with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink, and

wherein in response to the non-detection of the event signal, the switch is configured to dynamically switch to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink;

wherein the input card is configured to enable the at least one sink from being able to record since the audiovisual signal includes non-copy protected content.]

[19. The switcher device of claim 18, wherein the integrated circuit comprises the switch device, HDCP enabled receiver, and EDID memory, wherein the HDCP enabled receiver and EDID memory are in parallel with respect to each other, and wherein the combination of the HDCP enabled receiver and EDID memory are in series with the switch device.]

[20. The switcher device of claim 19, wherein the integrated circuit is in parallel with another EDID memory.]

[21. The switcher device of claim 18, wherein the switch device comprises a mechanical switch, electrically operated switch, solid state relay, latching relay, reed relay, Single Pole Single Throw (SPST) relay, Single Pole Double Throw (SPDT) relay, Double Pole Single Throw (DPST) relay, and Double Pole Double Throw (DPDT) relay.]

[22. The switcher device of claim 18, further comprises a processor coupled to a transceiver for bidirectional communication with the at least one user interface device, wherein the processor and transceiver are configured to process and receive the user control signal in response to a user activating the user activating the at least one user interface device.]

[23. The switcher device of claim 18, wherein the at least one user interface device comprises at least one graphical user interface (GUI) touch panel, mobile device, tablet, and computer.]

[24. The switcher device of claim 18, wherein the at least one user interface device is configured to transmit the user control signal wired or wirelessly.]

[25. The switcher device of claim 18, wherein the at least one user interface device further comprises software tools to assist the user in selecting the at least one source.]

[26. The switcher device of claim 18, wherein the least one source comprises a game console, digital versatile disc (DVD) player, cable box, desktop computer, laptop, and blu-ray player.]

[27. The switcher device of claim 18, wherein the least one sink comprises a display device, wherein the display device is a television.]

[28. A method for enabling/disabling Display Data Channel (DDC) access to enable/disable High-Bandwidth Digital Content Protection source, the method comprising:

providing at least one source;

providing at least one sink;

coupling a switcher device communicatively in-between the at least one source and the at least one sink;

coupling a multiplexer in-between at least one input and output cards for transmitting an audiovisual signal from the at least one input card to a first and at least a second output card via physical connection; wherein the input card includes High-Bandwidth Content Protection (HDCP) enabled receiver;

detecting, using an input card, a user control signal to activate one of at least one sinks;

in response to the detection of the user control signal, enabling the selected at least one sink for receiving audiovisual signal;

detecting an event signal;

wherein in response to the detection of the event signal, switching the switcher device dynamically to a closed position for enabling the at least one source to authenticate with the input card and enabling the output card to authenticate with the at least one sink for security protocol encryption;

permitting the transmission of audiovisual signal from the at least one source to the enabled at least one sink upon successful authentication; and

disabling control of the enabled at least one sink from being able to record since the audiovisual signal contains copy protected content;

wherein in response to the non-detection of the event signal, switching the switcher device dynamically to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption;

permitting the transmission of the audiovisual signal to be displayed from the at least one source to the enabled at least one sink; and

enabling control of the enabled at least one sink from being able to record since the audiovisual signal contains non-copy protected content.]

[29. The method of claim 28, wherein the event signal is a signal that includes activating a particular mode of the at least one source, wherein the mode includes playing a blu-ray DVD, displaying a PowerPoint presentation, dis-

playing a website, collaborating on a white board application, using a document camera, and streaming content from a media player.]

[30. The method of claim 29, wherein the mode is associated with the audiovisual signal containing either copy protected content or non-copy protected content.]

[31. The method of claim 28, wherein detecting the user control signal wired or wirelessly.]

[32. The method of claim 28, wherein in response to detecting the event signal, changing an address of the HDCP enabled receiver to another address so that the at least one source does not detect the HDCP compatibility of the input card.]

[33. An integrated circuit, comprising:

an enabled High-Bandwidth Digital Content Protection (HDCP) receiver;

an Extended Display Identification Data (EDID) memory; and

a switch coupled in-between the security protocol enabled receiver and the EDID memory, wherein the integrated circuit is configured to detect the presence of an event signal from at least one user interface device,

wherein in response to the detection of the event signal, the switch is configured to dynamically switch to a closed position in order to enable the at least one source configured to authenticate with an input card and an output card configured to authenticate with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink, and

wherein in response to the non-detection of the event signal, the switch is configured to dynamically switch to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption and the input card is configured to permit the transmission of the audiovisual signal from the at least one source to the at least one sink;

wherein the input card is configured to enable the at least one sink from being able to record since the audiovisual signal includes non-copy protected content.]

[34. A computer program product for enabling and disabling a security protocol, the computer program product comprising: a non-transitory computer readable storage medium having computer readable program code embodied therewith, the computer readable program code comprising: computer readable program code configured to:

provide at least one source;

provide at least one sink;

couple a switcher device communicatively in-between the at least one source and the at least one sink;

couple a multiplexer in-between at least one input and output cards for transmitting an audiovisual signal from the at least one input card to a first and at least a second output card via physical connection;

detect, using an input card, a user control signal to activate one of at least one sinks; wherein the input card includes High-Bandwidth Content Protection (HDCP) enabled receiver;

in response to the detection of the user control signal, enabling the selected at least one sink for receiving audiovisual signal;

detect an event signal;

wherein in response to the detection of the event signal, switching the switcher device dynamically to a closed position for enabling the at least one source to authenticate with the input card and enabling the output card to authenticate with the at least one sink for security protocol encryption;

permit the transmission of audiovisual signal from the at least one source to the enabled at least one sink upon successful authentication; and

disable control of the enabled at least one sink from being able to be recorded since the audiovisual signal contains copy protected content;

wherein in response to the non-detection of the event signal, switch the switcher device dynamically to an open position in order to disable the at least one source from initiating an authentication with the input card, therefore the output card also does not attempt to initiate an authentication with the at least one sink for security protocol encryption;

permit the transmission of the audiovisual signal to be displayed from the at least one source to the enabled at least one sink; and

enable control of the enabled at least one sink from being able to record since the audiovisual signal contains non-copy protected content.]

[35. The computer program product of claim 34, wherein detecting the user control signal wired or wirelessly.]

[36. The computer program product of claim 34, further comprising in response to detecting the event signal, changing an address of the HDCP enabled receiver to another address so that the at least one source does not detect the HDCP compatibility of the input card.]

37. A system for transmitting audiovisual signals containing copy-protected content or non-copy protected content, the system comprising:

a source comprising an output, said output outputting audiovisual signals containing at least one of copy-protected content and non-copy protected content;

a sink comprising an input;

a signal indicating whether to enable or disable HDCP;

a switcher device coupled in-between the at least one source and the at least one sink, said switcher device comprising:

an input circuitry coupled to the output of the source, wherein the input circuitry comprises a High-Bandwidth Digital Content Protection (HDCP) enabled receiver and an Extended Display Identification Data (EDID) memory, wherein the input circuitry is configured to detect the signal;

an output circuitry coupled to the input of the sink;

wherein in response to detecting a signal indicating to enable HDCP, the input circuitry is configured to:

enable access to the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to detecting a signal to disable HDCP, the input circuitry is configured to:

disable access to the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the

output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

38. A switcher device comprising at least one input circuitry configured for coupling with at least one source and at least one output circuitry configured for coupling with at least one sink, wherein the input circuitry comprises:

a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

wherein the input circuitry is configured to detect a signal indicating whether to enable or disable HDCP:

wherein in response to detecting a signal indicating to enable HDCP, the input circuitry is configured to:

enable access to the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to detecting a signal indicating to disable HDCP, the input circuitry is configured to:

disable access to the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

39. The switcher device of claim 38 further comprising a switch configured for enabling or disabling access to the HDCP receiver.

40. The switcher device of claim 39, wherein the HDCP enabled receiver is parallel with an Extended Display Identification Data (EDID) memory, and wherein the combination of the HDCP enabled receiver and the EDID memory are in series with the switch.

41. The switcher device of claim 40, wherein the combination of the HDCP enabled receiver and the EDID memory are parallel with another EDID memory.

42. The switcher device of claim 39, wherein the switch is coupled in-between the HDCP enabled receiver and an Extended Display Identification Data (EDID) memory.

43. The switcher device of claim 39, wherein the HDCP enabled receiver is in series with the switch, and wherein the combination of the HDCP enabled receiver and the switch are in parallel with an Extended Display Identification Data (EDID) memory.

44. The switcher device of claim 39, wherein the switch comprises at least one of a relay, a FET switch, an I2C buffer, a mux, digital logic, a mechanical switch, an electrically operated switch, a solid state relay, a latching relay, a reed relay, a Single Pole Single Throw (SPST) relay, a Single Pole Double Throw (SPDT) relay, a Double Pole Single Throw (DPST) relay, and a Double Pole Double Throw (DPDT) relay.

45. The switcher device of claim 38, wherein the input circuitry is configured to receive the signal indicating whether to enable or disable HDCP from at least one user interface.

46. The switcher device of claim 45, wherein the at least one user interface comprises at least one of a graphical user interface (GUI) touch panel, a mobile device, a wireless device, a tablet, and a computer.

47. The switcher device of claim 38, wherein the input circuitry is configured to enable access to the HDCP receiver when the audiovisual signal includes copy-protected content.

48. The switcher device of claim 38, wherein the signal is a signal that includes activating a particular mode of the at least one source.

49. The switcher device of claim 48, wherein the mode includes at least one of playing a blu-ray DVD, displaying a PowerPoint presentation, displaying a website, collaborating on a white board application, using a document camera, and streaming content from a media player.

50. The switcher device of claim 48, wherein the mode is associated with the audiovisual signal containing either copy protected content or non-copy protected content.

51. The switcher device of claim 38, wherein in response to detecting the signal indicating to enable HDCP, the input circuitry is further configured to drop hot plug detection before enabling access to the HDCP receiver and raise hot plug detection after enabling access to the HDCP receiver.

52. The switcher device of claim 38, wherein in response to detecting the signal indicating to disable HDCP, the input circuitry is further configured to drop hot plug detection before disabling access to the HDCP receiver and raise hot plug detection after disabling access to the HDCP receiver.

53. An switcher device comprising at least one input circuitry configured for coupling with at least one source and at least one output circuitry configured for coupling with at least one sink, wherein the input circuitry comprises:

a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

an Extended Display Identification Data (EDID) memory;

wherein the input circuitry is configured to receive a signal:

wherein in response to receiving a signal indicating to enable HDCP, the input circuitry is configured to:

enable HDCP encryption thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to receiving a signal to disable HDCP, the input circuitry is configured to:

disable HDCP encryption such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

54. A switcher device comprising at least one input circuitry configured for coupling with at least one source and at least one output circuitry configured for coupling with at least one sink, wherein the input circuitry comprises:

a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

an Extended Display Identification Data (EDID) memory;

wherein the input circuitry is configured to receive a signal:

wherein in response to receiving a signal indicating to enable HDCP, the input circuitry is configured to:

enable HDCP capability of the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to receiving a signal to disable HDCP, the input circuitry is configured to:

disable HDCP capability of the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

55. A method by a switcher device for transmitting audiovisual signals containing copy-protected content or non-copy protected content, wherein the switcher device is coupled in-between at least one source via at least one input circuitry and at least one sink via at least one output circuitry, wherein the input circuitry comprises a High-Bandwidth Digital Content Protection (HDCP) enabled receiver, the method comprising:

receiving a signal indicating whether to enable or disable HDCP;

wherein in response to receiving a signal to enable HDCP:

enabling access to the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permitting a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to receiving a signal to disable HDCP:

disabling access to the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permitting a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

56. A switcher device comprising at least one input circuitry configured for coupling with at least one source and at least one output circuitry configured for coupling with at least one sink, wherein the input circuitry comprises a hardwired circuity without software instructions comprising:

a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

wherein the input circuitry is configured to receive a signal:

wherein in response to receiving a signal indicating to enable HDCP, the input circuitry is configured to:

enable access to the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to receiving a signal indicating to disable HDCP, the input circuitry is configured to:

disable access to the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

57. A switcher device comprising at least one input circuitry configured for coupling with at least one source and at least one output circuitry configured for coupling with at least one sink, wherein the input circuitry comprises a hardwired circuity in combination with software instruction comprising:

a High-Bandwidth Digital Content Protection (HDCP) enabled receiver; and

wherein the input circuitry is configured to receive a signal:

wherein in response to receiving a signal indicating to enable HDCP, the input circuitry is configured to:

enable access to the HDCP receiver thereby causing the at least one source to authenticate with the input circuitry and the output circuitry to authenticate with the at least one sink; and

permit a transmission of an audiovisual signal containing copy-protected content from the at least one source to the at least one sink upon successful authentication; and

wherein in response to receiving a signal indicating to disable HDCP, the input circuitry is configured to:

disable access to the HDCP receiver such that the at least one source does not detect HDCP capability of the input circuitry and does not initiate authentication with the input circuitry and thereby the output circuitry also does not initiate authentication with the at least one sink; and

permit a transmission of an audiovisual signal containing non-copy protected content from the at least one source to the at least one sink, thereby enabling the at least one sink to be able to record.

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