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Watkins

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(54) **VIDEO ON DEMAND DVD SYSTEM**

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Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** **725/100**; 709/219; 709/217

(58) **Field of Search** 709/217-219, 709/209, 224, 247; 348/7-9, 12, 13; 725/87, 91, 92, 93, 78

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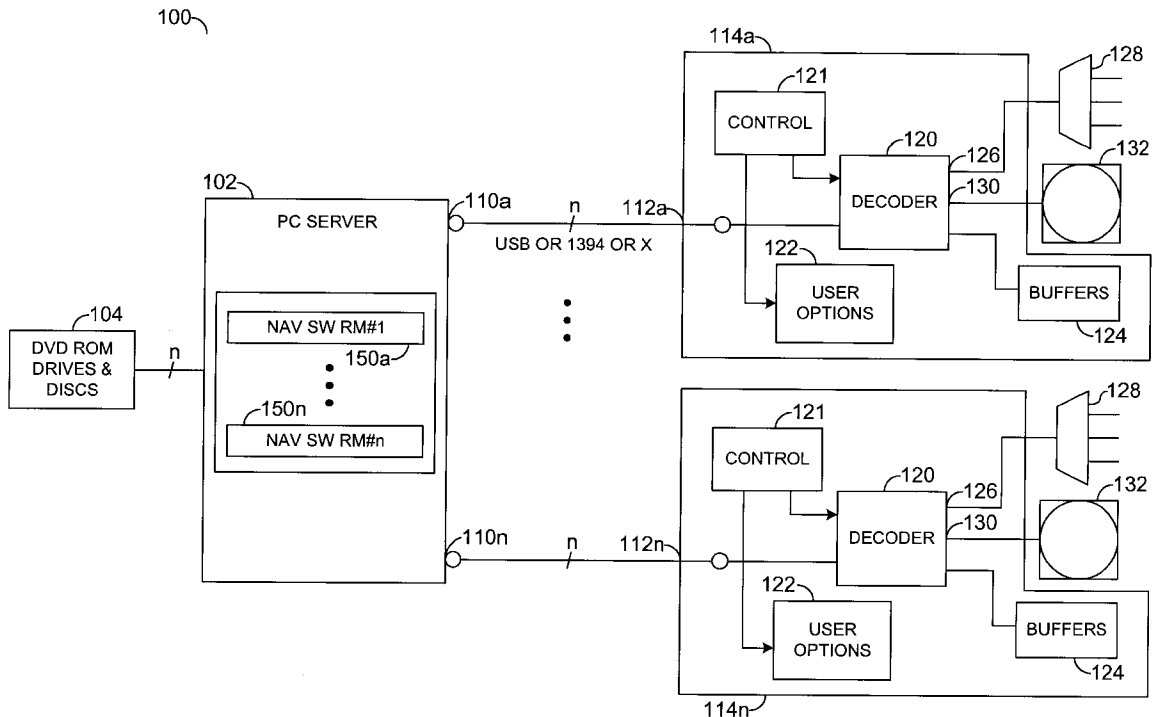
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(57) **ABSTRACT**

An apparatus comprising a drive server, a control server and one or more decoder devices. The drive server may be configured to present one or more compressed data streams in response to one or more first control signals. The control server may be configured to present one or more of the compressed data streams in response to (i) one or more request signals and (ii) the one or more compressed data streams. The decoder devices may be configured to present a decoded video signal and a decoded audio signal in response to (i) one or more second control signals and (ii) the one or more compressed data streams. The navigation software, which traditionally is processed local to the decoder, may be processed on the control server. The control server may be enabled to control the remote decoder.

19 Claims, 5 Drawing Sheets



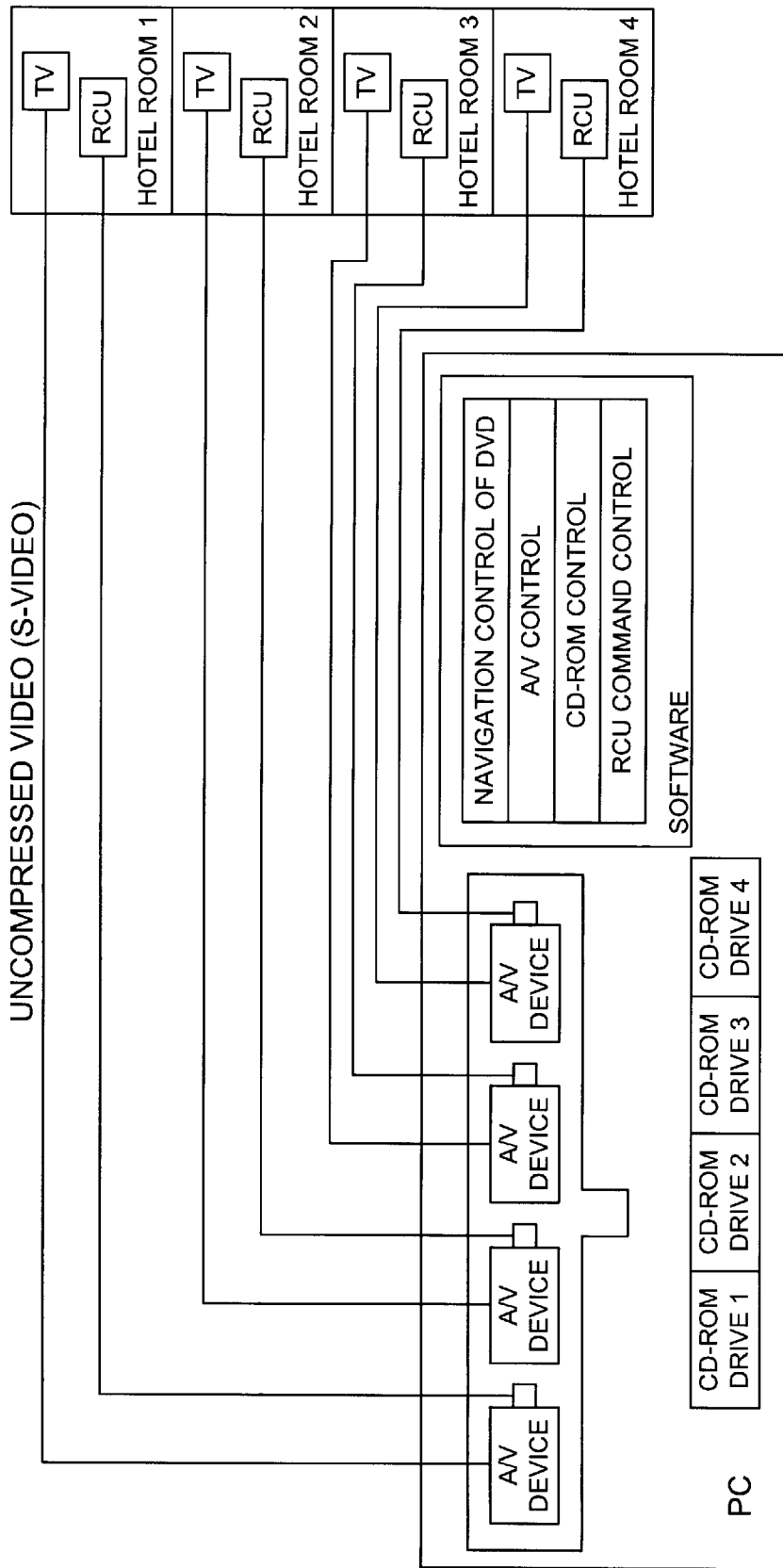


FIG. 1
(CONVENTIONAL)

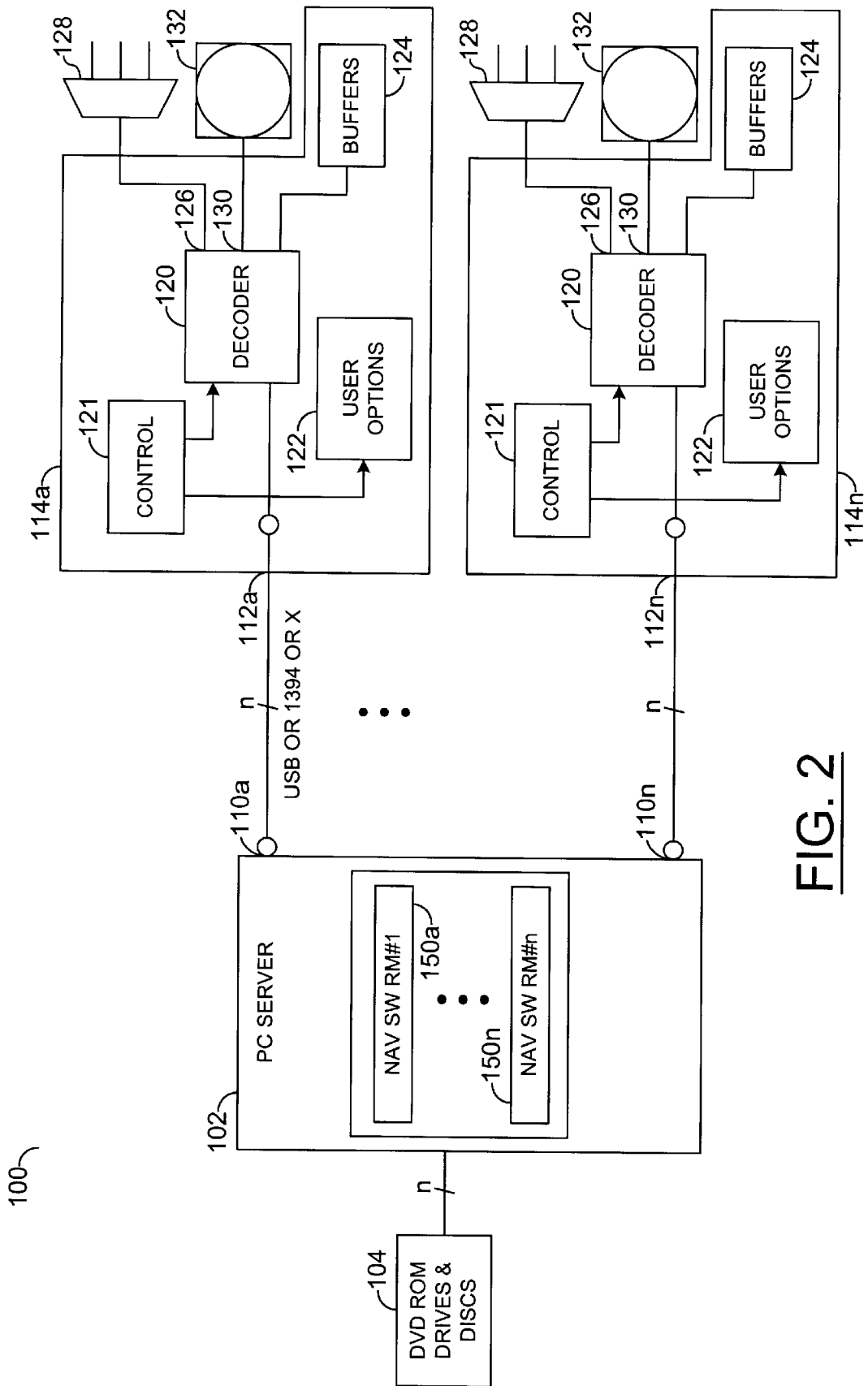


FIG. 2

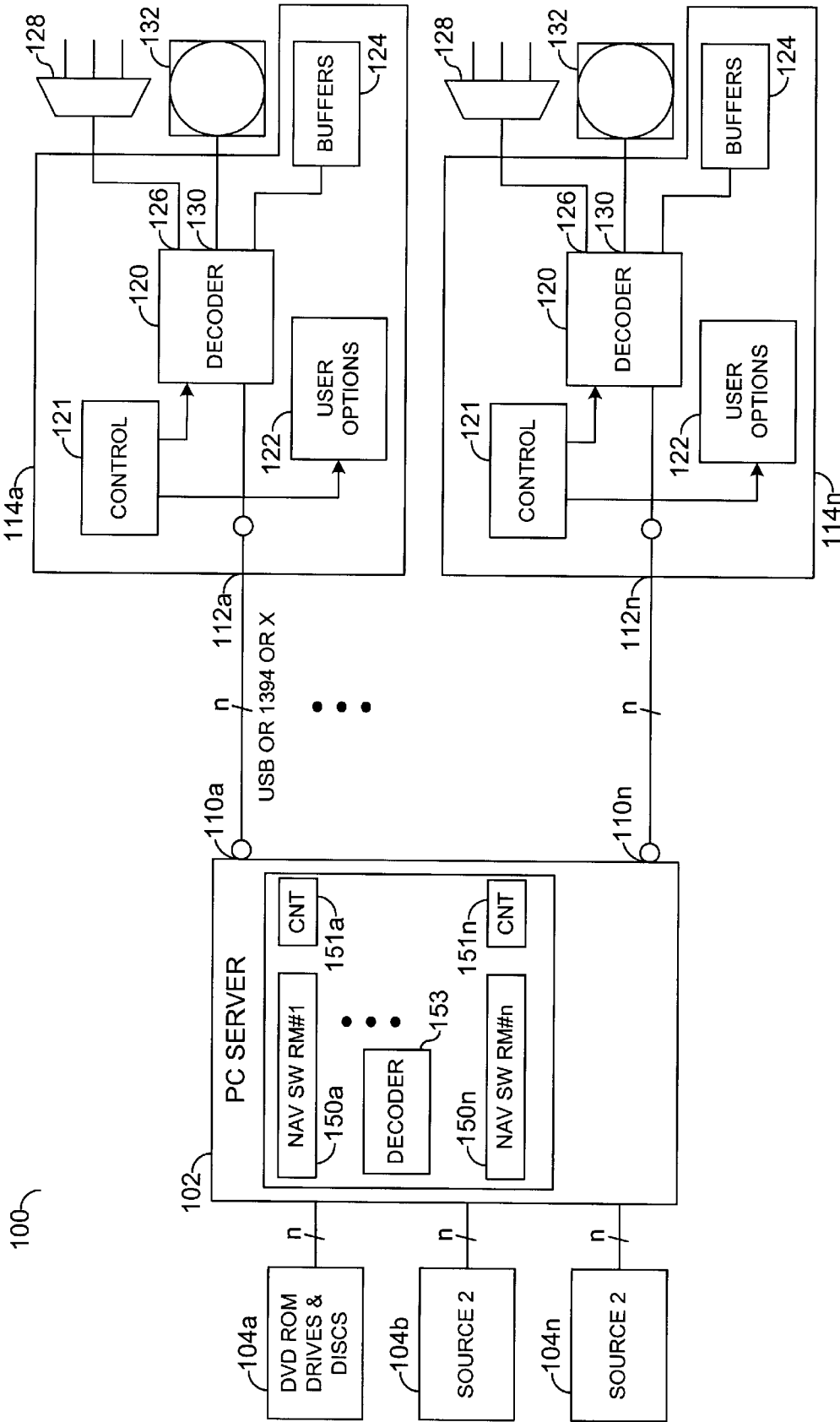


FIG. 3

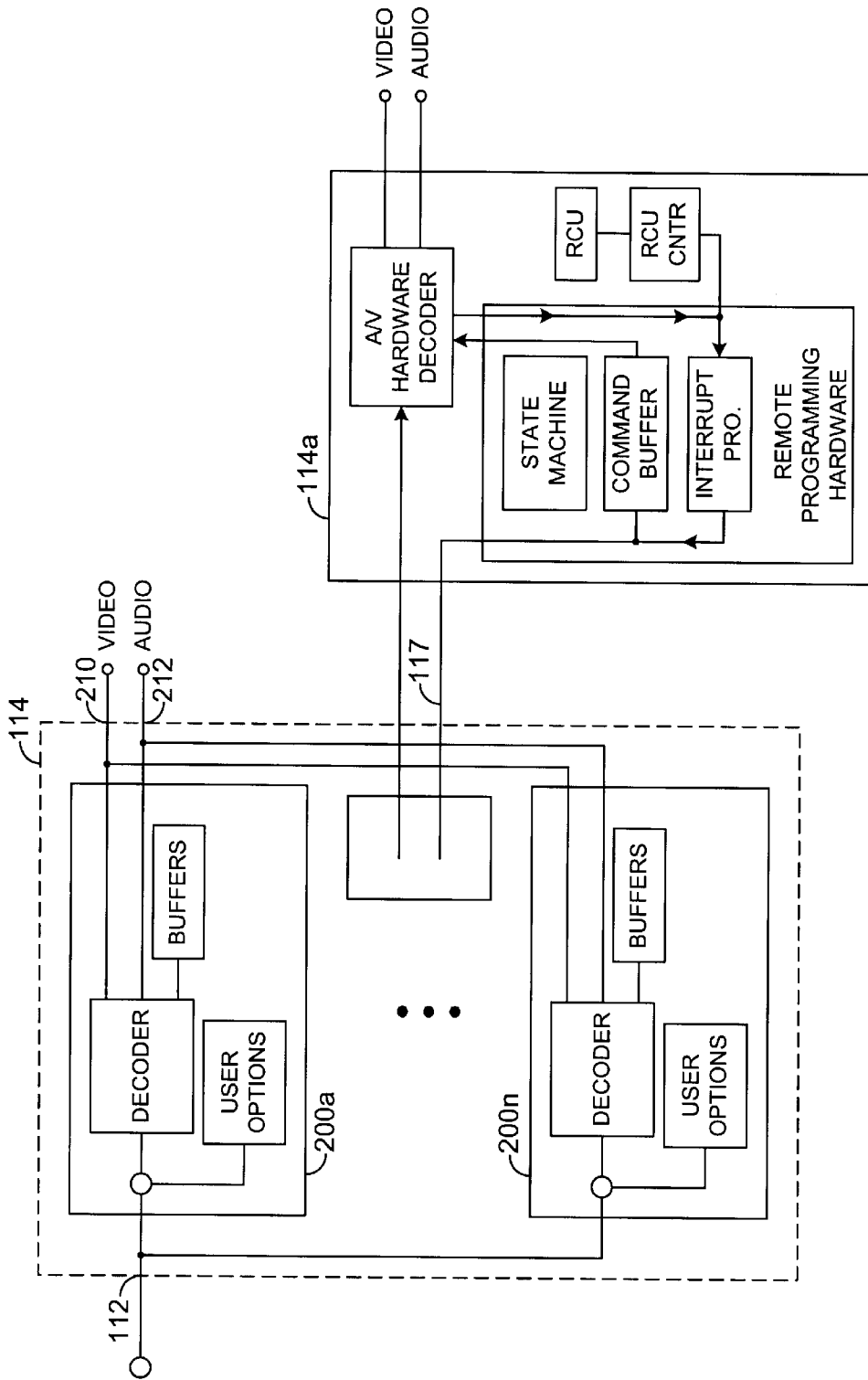


FIG. 4

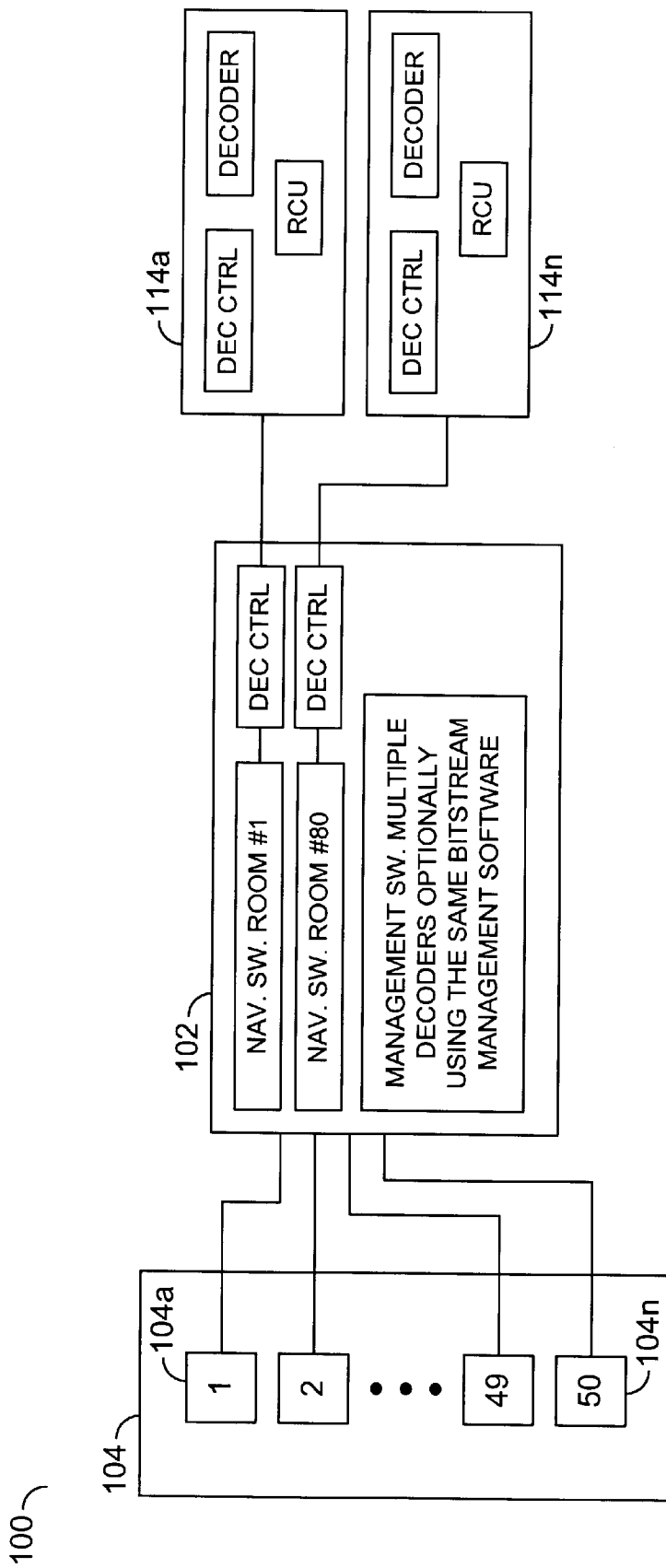


FIG. 5

VIDEO ON DEMAND DVD SYSTEM

FIELD OF THE INVENTION

The present invention relates to video on demand systems generally and, more particularly, to a video on demand DVD system.

BACKGROUND OF THE INVENTION

Conventional digital video disk (DVD) players are implemented as stand-alone systems. In a multi-user environment, such as a hotel (or apartment) complex, a separate DVD player would have to be implemented in each room.

Conventional video on demand (VOD) systems provide a centralized storage location that may present independent video and audio programming to a number of rooms. Such a conventional video on demand system is shown in FIG. 1. Since conventional video on demand systems use S-video cables between the decoders and the monitors, the distance between the remote locations and the decoders can be hundreds of feet. However, with a DVD player, extensive decoding is included within the DVD players that prohibits use in a video on demand system. Additionally, personal computers (PCs) may implement DVD drives, but suffer from the same limitations of stand-alone players. Specifically, an individual PC would have to be dedicated to each room in the multi-user environment.

Video on demand systems used for MPEG1 VCD or MPEG2 titles are typically implemented as personal computers with peripheral connect interface (PCI) add-on cards that support four or more video decoders. The decoders are implemented centrally at the PC level. Such centralized systems are used with hotel video on demand systems. A drive running a title and a decoder are dedicated to each hotel room. The uncompressed video from the dedicated video compact disc (VCD) is wired to the room with, for example, S-Video cable. A separate cable allowing a remote control to control user options (e.g., stop, fast forward, rewind, etc.) is used as a feedback back to the player in the central location.

DVD titles use Macrovision copyright security as a required component encoded on each DVD player. When VOD systems are upgraded to support DVD, for applications where Macrovision copyright security on uncompressed video is not adequate, the infrastructure needs to be upgraded to a support compressed video feed to a decoder that resides in the room, but before the television. Macrovision application license restrictions include limiting the length of cable. It would be desirable to implement a DVD video on demand system without the requirement (and associated cost) of implementing a DVD Player for each remote location.

SUMMARY OF THE INVENTION

The present invention concerns an apparatus comprising a drive server, a control server and one or more decoder devices. The drive server may be configured to present one or more compressed data streams in response to one or more first control signals. The control server may be configured to present one or more of the compressed data streams in response to (i) one or more request signals and (ii) the one or more compressed data streams. The decoder devices may be configured to present a decoded video signal and a decoded audio signal in response to (i) one or more second control signals and (ii) the one or more compressed data streams.

The objects, features and advantages of the present invention include providing a video on demand DVD system that may (i) be enabled to have navigation software local to host server, while a remote source decoder is in another room, (ii) be enabled to control a remote source decoder directly, (iii) implement navigation software on a host server and/or (iv) implement a number of shared DVD drivers at a centralized location.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features and advantages of the present invention will be apparent from the following detailed description and the appended claims and drawings in which:

FIG. 1 is a diagram of a conventional video on demand system;

FIG. 2 is a diagram of a preferred embodiment of the present invention;

FIG. 3 is a diagram of an alternate embodiment of the present invention;

FIG. 4 is a diagram of an alternate implementation of the decoder of FIG. 3; and

FIG. 5 is another alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 2, a block diagram of a DVD video on demand system **100** is shown in accordance with a preferred embodiment of the present invention. The video on demand system **100** generally comprises a server **102** and a disk library **104**. The disk library **104** generally comprises one or more DVD drives and associated disks that present one or more signals to the server **102**. The server **102** may be implemented as a personal computer or other appropriate server.

The server **102** may present a number of compressed bitstreams (e.g., DVD bitstreams) at a number of outputs **110a-110n** that may be received at a number of inputs **112a-112n**. The inputs **112a-112n** are generally located in a number of individual remote decoders **114a-114n**, that may be located, in one example, in a set-top box. In another example, the remote decoders **114a-114n** may be built into the tuner section of a television. In either implementation, the remote decoders **114a-114n** may be located in one or more remote locations, such as rooms in a hotel or apartment. The remote decoders **114a-114n** may be implemented, in another example, as a component of a multifunction decoding device (to be described in more detail in connection with FIG. 3).

Each of the remote decoders **114a-114n** generally comprise a decoder portion (or circuit) **120**, a control portion (or circuit) **121**, a user options input interface **122**, and one or more buffers **124**. The control circuit **121** may be implemented as a host processor or state machine control device. The decoder **120** may present a decoded audio signal at an output **126** that is generally presented to one or more speakers **128**. The decoder **120** may also present a decoded video signal at an output **130** that may be presented to a video display **132** (e.g., a television screen or a computer monitor). The decoded audio signal may be a monophonic channel, a dolby digital two channel signal, a dolby digital 5.1 channel signal, a DTS 5.1 channel signal, or other appropriate single or multi-channel audio signal. In general, the audio signals presented at the output **126** are line level

signals that may be presented to an audio amplifier (not shown) to power one or more speakers. The amplifier may be built into the display 132 or may be implemented as a separate multi-channel amplifier.

To upgrade a video on demand infrastructure, the decoder 120 is generally physically located within a few feet of the display device 132. The compressed DVD bitstreams are generally feed to the remote decoders 114a-114n from the server 102. The decoder 120 decodes the video and audio portions of compressed DVD bitstream. The navigation software (i.e., the software that controls functions such as fast forward, rewind, pause, etc.) may be implemented locally to the decoder 120, similar to conventional DVD players. Alternately, since the video signals are generally received from a centralized server, the server 102 may be implemented to run all the navigation software. The navigation software may interpret user options (e.g., request signals) received from a user remote control (not shown). The request signals from the user remote control may be received from a separate cable that feeds back to the server 102. The circuit 100 illustrates n cables connected between each of the outputs 110a-110n and each of the inputs 112a-112n. Since such a cable system may already be in place, the only upgrade necessary may be the remote decoder 114 in the room, the navigation software running on the server, and the DVD drive server.

In one example, the decoder 120 may be implemented as a dedicated optimized hardware audio and video decoder. Additionally, the user options circuit 122 and the buffers circuit 124 may also be implemented on a single chip along with the decoder 120. However, separate chip solutions may also be implemented to meet the design criteria of a particular implementation.

A cost savings may result by having the navigation software for all the decoders 120 in each of the remote decoders 114a-114n run on the server 102. The user may be given a DVD control template to select a particular option. Since most of the processing may be done by the server 102, the remaining needs for the remote decoders 114a-114n may be limited. For example, the remote decoders 114a-114n may need to receive the uncompressed video, via Universal Serial Bus (USB), 1394 bus or other appropriate interface/bus configuration. A feedback of the user options may be implemented, in one example, using the same control system previously used for VCD. Centralizing the navigation controls may greatly reduce memory and processor performance requirements for the remote decoders 114a-114n, further reducing cost.

For the connections between the outputs 110a-110n and the inputs 112a-112n, USB or 1394 may be needed, since DVD bitstreams have 2 to 10 Mbps data rate. One of a number of decoder navigation modules 150a-150n running on the server 102 may be dedicated to each remote decoder 114a-114n. The control of the source decoder may be received from the buffers 124. One or more simple state machines may control the read and write operations sent to the decoder 120 in each of the remote decoders 114a-114n. The decoder 120 may include host registers as well as buffer interrupts (not shown). The control of the decoders 121a-121n may be embedded in the communication media and may be a different structure from the DVD bitstream, as in the case of USB or 1394.

The present invention may provide navigation software traditionally local to the DVD player or DVD PC at the server 102 of a VOD system, enabling low cost decoder boxes at destination televisions. The navigation software on

the server 102 may parse the DVD bitstream and may process user options such that the remote decoders 114a-114n may be remotely controlled. The communication media between the server 102 and the remote decoders 114a-114n may support the DVD bitstream as well as the programming of the decoder 120. Appropriate navigation software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will also be apparent to those skilled in the relevant art(s).

The present invention may enable a cost effective solution to DVD VOD systems. For example, if a DVD Player costs \$500, and the per location solution of the present invention is \$150 per location, a significant cost savings to implement DVD in each location may result. The present invention proposes bulk drives on capable servers, with a minimal cost in the remote decoders 114a-114n.

Referring to FIG. 3, an alternate embodiment of the present invention is shown. A number of source devices 104a-104n are shown presented to the server 102. One of the source devices (e.g., 104a) may be a DVD ROM server as shown in FIG. 1. However, an additional number of source devices 104b-104n may be implemented. For example, a source for digital television (DTV) may be implemented as the source 102b, a source for a satellite may be implemented as the source 102c and a source for cable TV may be implemented as one of the sources 104a-104n. The server 102 may be implemented to select between one of the sources 104a-104n to present data to a particular one of the outputs 110a-110n. The remote decoders 114a-114n may be modified to decode the various sources 104a-104n. In such an implementation, the present invention may enable a number of remote decoders 114a-114n to support a full spectrum of video and audio formats found in the various evolving multiple broadcast standards. Furthermore, with personal computers providing a number of multimedia functions as well as audio components providing a number of multimedia functions, convergence of various formats can be supported by the remote decoders 114a-114n. For example, a MPEG-2 bitstream may be presented at the outputs 110a-110n.

Additionally, the example illustrated in FIG. 3 may provide a number of decoder control circuits 151a-151n. The a decoder control circuits 151a-151n may be optional circuits that may be used to control the particular navigation software elements 150a-150n. Additionally, a decoder 153 may be implemented that may control each of the navigation software elements 150a-150n. In one example, the decoder 114a may be connected to the decoder 114 through a universal serial bus or other appropriate interconnection 117.

Referring to FIG. 4, an example of a multifunction remote decoder 114 is shown. The remote decoder 114 generally has an input 112 that may receive one of the number of sources 110a-110n. A number of individual decoding elements 200a-200n may be provided to decode the particular source. The signal received at the input 112 may be presented to inputs of the various decoding elements 200a-200n. The outputs of the decoder elements 200a-200n may be presented to an output 210 and an output 212. A multiplexer (not shown) may be implemented to switch between the various outputs of the individual decoder elements 200a-200n. In one example, the decoder elements 200a-200n may be implemented as a single integrated circuit. However, to provide flexibility for future standards, the individual decoder elements 200a-200n may be implemented as one or more integrated circuits. For example, if the remote decoder 114 is implemented to decode three current video/audio standards, a single chip implementing

three individual decoders **200a–200n** may be used. However, to implement a fourth standard, a second integrated circuit **114a** may be implemented as a new decoder and may be configured to add to the existing decoders. The second integrated circuit **114a** may be connected to the remote decoder **114** through, for example, a USB or 1394 connection **117**.

Remote programming of the decoder, independent of the local host processor may be done for diagnostic purposes, or to reduce cost on components. In one example, the USB or 1394 process may enable remote programming of the decoder and user options presented to server.

Referring to FIG. 5, an alternate implementation of the circuit **100** is shown. A number of source devices **104a–104n** are shown presenting a number of input signals to the server **102**. Each of the devices **104a–104n** may be configured to continuously play a number of source titles. A number of decoders may select any of the source devices **104a–104n** at a particular time. The selection is generally within the constraints of the selected source **104a–104n**. Particularly, the bandwidth capabilities for handling multiple user navigations of a particular source **104a–104n** must generally be met. If enough titles are implemented in enough sources **104a–104n**, the remote decoders **114a–114n** may be able to select a particular title at a particular time. In order to solve the mentioned bandwidth capability issues, the same titles may be started at offset times, which may present the appearance of an unlimited selection of titles. In addition, a single bitstream may be sent to each of the decoders **114a–114n** to initiate a diagnostics test.

When sending a single bitstream to a number of decoders **114a–114n**, a bandwidth of 20 Mb/sec can be implemented in certain DVD drives. In such an example, up to four decoders may be supported. For example, if a DVD drive can present a 9.8 Mb/sec bit rate, and the compressed bitstream is typically 4 Mb/sec, four decoders **114a–114n** may be supported.

While the invention has been particularly shown and described with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus comprising:
 - a drive server configured to present a plurality of compressed data streams in response to one or more first control signals;
 - a control server configured to present said one or more compressed data streams received from said drive server in response to one or more request signals; and
 - one or more decoder devices, at least one of said one or more decoder devices being disposed in a separate room from said control server and said drive server, each of said one or more decoder devices being configured to (i) decode at least one of said one or more compressed data streams received from said control server and (ii) present at least one signal selected from a decoded video signal and a decoded audio signal in response to decoding said one or more compressed data streams, wherein a first portion of a selected one of said compressed data streams is presented to one of said decoder devices and a second portion of said selected compressed data stream is presented to another of said decoder devices.
2. The apparatus according to claim 1, wherein said one or more decoder devices are remotely controlled.

3. The apparatus according to claim 1, wherein said one or more compressed data streams comprise one or more DVD bitstreams.

4. The apparatus according to claim 1, wherein each of said compressed data streams are presented to two or more of said decoder devices.

5. The apparatus according to claim 1, wherein said plurality of compressed data streams are presented to said decoder devices in response to navigation software.

6. The apparatus according to claim 1, wherein a plurality of first portions of a plurality of said compressed data streams are presented to a plurality of said decoder devices and a plurality of second portions of another of said compressed data streams are presented to another of said decoder devices, wherein the number of said plurality of data streams is optimized to require a minimum number of said plurality of compressed data streams for a distribution to a maximum number of said plurality of decoder devices.

7. The apparatus according to claim 1, wherein said control server is connected to said one or more decoder devices using (i) one or more universal serial bus interfaces or (ii) one or more 1394 interfaces.

8. The apparatus according to claim 1, wherein said one or more compressed data streams is selected from the group consisting of a digital television (DTV) signal, a satellite signal, and a cable signal.

9. The apparatus according to claim 1, wherein a navigation software to control one or more user input signals is stored in one or more of said decoder devices.

10. The apparatus according to claim 1, wherein a navigation software to control one or more user input signals is stored in the control server.

11. The apparatus according to claim 1, wherein said decoder devices are configured to generate said decoded video signal and said decoded audio signal in further response to one or more second control signals.

12. The apparatus according to claim 11, wherein said one or more decoder devices are configured to enter a diagnostic mode in response to one of said one or more second control signals.

13. An apparatus comprising:

a drive server configured to present a plurality of DVD bitstreams in response to one or more first control signals;

a control server configured to present said one or more DVD bitstreams received from said drive server in response to one or more first remotely generated request signals; and

one or more decoder devices, at least one of said one or more decoder devices being disposed in a separate room from said control server and said driver server, each of said one or more decoder devices being configured to (i) decode at least one of said one or more DVD bitstreams received from said control server and (ii) present at least one signal selected from a decoded video signal and a decoded audio signal in response to decoding said one or more DVD bitstreams, wherein a first portion of a selected one of said DVD bitstreams is presented to one of said decoder devices and a second portion of said selected DVD bitstreams is presented to another of said decoder devices.

14. The apparatus according to claim 13, wherein said decoder devices are configured to generate said decoded video signal and said decoded audio signal in further response to one or more second control signals.

15. A method for distributing video comprising the steps of:

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- (A) presenting a plurality of compressed data streams with a drive server to a control server in response to one or more first control signals;
- (B) distributing said one or more compressed data streams received from said drive server with said control server to one or more decoder devices in response to one or more request signals;
- (C) decoding at least one of said one or more compressed data streams with said one or more decoders in response to receiving said one or more compressed data streams from said control server; and
- (D) presenting at least one signal selected from a decoded video signal and a decoded audio signal in response to decoding said at least one of said one or more compressed data streams, wherein at least one of said one or more decoders is disposed in a separate room from said control server and said driver server, wherein a first portion of a selected one of said compressed data streams is presented to one of said decoder devices and

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- a second portion of said selected compressed data stream is presented to another of said decoder devices.
- 16. The method according to claim 15, wherein said one or more compressed data streams are feed from said control server to said one or more decoders using (i) one or more universal serial bus interfaces or (ii) one or more 1394 interfaces.
- 17. The method according to claim 15, wherein said one or more compressed data streams comprise one or more DVD bitstreams.
- 18. The method according to claim 15, further comprising the step of:
storing software to control and decode said one or more compressed data streams in (i) said one or more decoder devices or (ii) a central server.
- 19. The method according to claim 15, wherein step D further responds to one or more second control signals.

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