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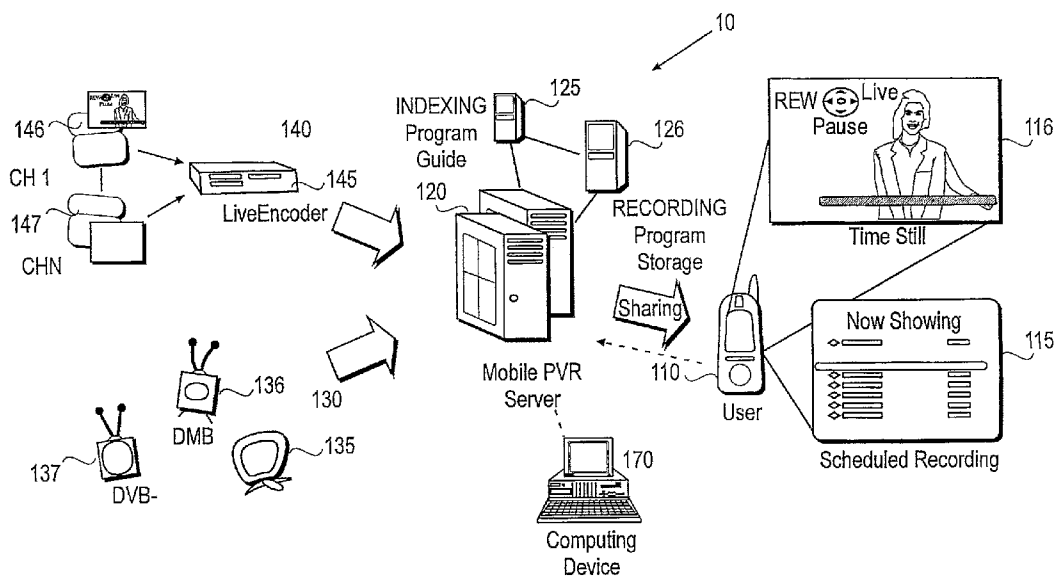
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(54) Title: METHOD AND APPARATUS FOR MOBILE PERSONAL VIDEO RECORDER



(57) Abstract: Methods and apparatuses for remotely recording video content on a personal video recording server, at the request of a user of a mobile device, and obtaining that recorded content on the mobile device, in some embodiments, at a later time.

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METHOD AND APPARATUS FOR MOBILE PERSONAL VIDEO RECORDER

FIELD OF THE INVENTION

- 5 The present invention relates generally to the field of mobile devices, in particular, to methods and apparatuses for remotely recording video content and obtaining that recorded content on a mobile device.

BACKGROUND OF THE INVENTION

- 10 Conventional mobile devices often provide a great amount of functionality in addition to standard voice communication functions. Additional functionality may include text messaging, selection, retrieval and playback of various audio (e.g., MP3 files, ringtones, etc.) and video products (e.g., mpegs, music videos, etc.), and the like. The downloaded content may be accessed upon
15 receipt, stored for later use (if sufficient storage is available), or some combination of the two.

Conventional mobile devices often access content by streaming the content from content providers and displaying the content as the content is received.

- 20 Unfortunately, conventional mobile devices may not be equipped to download large volumes of content for later use because of storage limitations, due to the size of currently available storage media. Additionally, conventional devices may not be equipped to identify desired televised content and store the desired content for later use, such as watching a recorded movie or a
25 recorded live televised program.

There are devices available to record video telecasts, such as digital video recorders (DVRs). Unfortunately, DVR technology is not a realistic

technological application for mobile devices due to the size constraints of mobile devices, most notably the storage limitations of mobile devices.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:
- Figure 1** illustrates an overview of the invention, in accordance with various embodiments;
- 10 **Figure 2** illustrates an exemplary mobile device, in accordance with various embodiments;
- Figures 3a-3b** illustrate flow diagrams of selected operations of a method for requesting the recording of content on a PVR system, and of requesting and receiving previously recorded content;
- 15 **Figure 4** illustrates a flow diagram of selected operations of a method for controlling the received content, such as time shifting the reception of the content;
- Figure 5** illustrates a first exemplary computing device of a personal video recording server, in accordance with various embodiments; and
- 20 **Figure 6** illustrates a second exemplary computing device of a personal video recording server, in accordance with various embodiments.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS OF THE
INVENTION

5 Illustrative embodiments of the present invention include, but are not limited to
methods and apparatuses for receiving, by a mobile device, an index listing
one or more media contents that are available for recording currently or at a
future time, and/or one or more previously recorded media contents, the one
or more previously recorded media contents having been recorded in
response to one or more requests from a user of the mobile device. In
10 various embodiments, the mobile device may also facilitate a mobile device
user in selecting at least one of the media contents that are available for
recording and/or at least one of the previously recorded media contents listed
by the index. Further, the mobile device may request of a media recording
server, in response to the selection by the mobile device user of the at least
15 one of the media contents, recording of the at least one of the media contents,
and/or may request of the media recording server, in response to the
selection by the mobile device user of the at least one of the previously
recorded media contents, providing of the at least one of the previously
recorded media contents to the mobile device.

20 In some embodiments, the mobile device may also or instead receive a live
streaming of a media content, the live streaming provided to the mobile device
via a media recording server. Further, the mobile device may facilitate a
mobile device user in selecting a time shifting operation to affect playing of the
25 live streaming, the time shifting operation requiring recording of at least a
portion of the live streaming by the media recording server. The mobile
device may then request of the media recording server, performance of the
time shifting operation. In response to receiving the request, the media

recording server may perform the time shifting operation, including recording of at least a portion of the live streaming.

5 Various aspects of the illustrative embodiments will be described using terms commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. However, it will be apparent to those skilled in the art that alternate embodiments may be practiced with only some of the described aspects. For purposes of explanation, specific numbers, materials, and configurations are set forth in order to provide a thorough
10 understanding of the illustrative embodiments. However, it will be apparent to one skilled in the art that alternate embodiments may be practiced without the specific details. In other instances, well-known features are omitted or simplified in order not to obscure the illustrative embodiments.

15 Further, various operations will be described as multiple discrete operations, in turn, in a manner that is most helpful in understanding the illustrative embodiments; however, the order of description should not be construed as to imply that these operations are necessarily order dependent. In particular, these operations need not be performed in the order of presentation.

20

The term “media recording server”, as used herein, refers to one or more computing devices capable of performing some or all of the operations described herein as being performed by the media recording server. In some embodiments, such as those illustrated by **Figure 1**, the media recording
25 server may include a PVR server **120**, an indexing system **125**, and a recording system **126**. In other embodiments, the media recording server may comprise a PVR server, such as the PVR server illustrated by **Figure 5**, and a program schedule server, such as the program schedule server

illustrated by **Figure 6**. In yet other embodiments, the media recording server may only comprise one computing device.

5 The phrase “in one embodiment” is used repeatedly. The phrase generally does not refer to the same embodiment; however, it may. The terms “comprising,” “having,” and “including” are synonymous, unless the context dictates otherwise. The phrase “A/B” means “A or B”. The phrase “A and/or B” means “(A), (B), or (A and B)”. The phrase “at least one of A, B and C” means “(A), (B), (C), (A and B), (A and C), (B and C) or (A, B and C)”. The
10 phrase “(A) B” means “(B) or (A B)”, that is, A is optional.

Figure 1 illustrates an overview of the invention, in accordance with various embodiments. As illustrated, a communication system **10** may include mobile device **110**, a personal video recorder (PVR) server **120** (hereinafter PVR
15 server **120**), broadcast media **130**, and unicast media **140**. Such a communication system **10** may be a wireless and/or cellular communication network for transmitting and receiving voice and/or data communication to mobile devices. Mobile device **110** may be a two-way wireless and/or telecommunications device that may be compatible with communication
20 system **10** and, as illustrated, may be currently operating within communication system **10**. Typically, mobile device **110** has a relatively small form factor, designed for portability, e.g. the size of a hand held device. The term “mobile device” as used herein covers a broad range of such portable devices, but does not include devices affixed or otherwise installed on a
25 movable platform, such as a radio installed in an automobile or a ship. PVR server **120** may be a computing system that may be in communication with mobile device **110**, such as via a mobile telephone switching office (MTSO) or a remote, wirelessly-accessible server system. PVR server **120** may receive instructions from mobile device **110** and may send data to mobile device **110**

based on the received instructions. For example, PVR server **120** may provide mobile device **110** with one or more indices comprising an index (hereinafter "index"), the index listing media contents and may receive from mobile device **110** requests to record contents listed in the index or to stream
5 previously recorded contents. PVR server **120**, in some embodiments, may also include an indexing system **125** and a recording system **126**. In some embodiments, indexing system **125** may provide the index to the mobile device **110**. Broadcast media **130** may be a pool of content providers (**135-137**) in communication with PVR server **120** that provide content (e.g., live
10 content) to PVR server **120**, such as by establishing a data session and communicating using a multicast or broadcast methodology. Unicast media **140** may be a pool of content providers (**145-147**) in communication with PVR server **120** that provide live content to PVR server **120**, such as by utilizing a unicast methodology. Contents provided by broadcast media **130** and unicast
15 media **140** may include television programs, movies, video clips, pictures, songs, audio files, and/or portions of a television program, a movie, a video clip, a picture, a song, and/or an audio file.

As is also shown, mobile device **110** may include a scheduled recording
20 application **115** and a time shifting application **116**. Scheduled recording application **115** may include a graphical user interface (GUI) for displaying to a mobile device **110** user the above-mentioned index and for facilitating the user in selecting one or more of the items listed in the index. Scheduled recording application **115** may then request of PVR server **120** the recording
25 of the selected item(s). Time shift application **116** may be a streaming client that allows the user to control the delivery of content to the mobile device **110**, such as the controlling of the streamed content at mobile device **110**, for example controlling the viewing of the streamed content (e.g., pause, rewind, fast-forward, and the like) on the GUI of mobile device **110**.

Mobile device **110** may be one of a cellular phone, a personal digital assistant, and a media player, and may be configured for two-way communication with PVR server **120** including voice communication and data streaming. Mobile device **110** may include a graphical user interface (GUI) capable of displaying operational content associated with applications **115** and **116**. In one embodiment, mobile device **110** may be capable of operating in a plurality of modes, such as a data mode, a call mode, and a messaging mode. In data mode, mobile device **110** may communicate with PVR server **120** to send and receive media contents, indexes, and requests relating thereto. In call mode, mobile device **110** may send and receive cellular or IP telephony phone calls, and in messaging mode, mobile device **110** may send and receive text messages and emails. Mobile device **110** may further comprise any mechanism known in the art for switching between modes. Also, an exemplary mobile device **110** is shown in **Figure 2** and is described in greater detail below.

Scheduled recording application **115** may be an application allowing the user to schedule the recording of content at PVR server **120** for later download and viewing. Examples of scheduled recording application **115** may include a wireless application protocol (WAP) or Web page accessed via a session between the mobile device **110** and the service provider utilizing a mobile browser, an application running on a mobile device, a network-connected personal computer (PC) application, and the like. Scheduled recording application **115** may receive from PVR server **120** an index of previously recorded content currently available for streaming as well as content available immediately or at one or more future points in time for recording from content providers, such as broadcast media **130** and unicast media **140**, to a recording portion of PVR server **120**. In one embodiment, the indexing

system **125** of PVR server **120** may generate and provide the index to mobile device **110**. In various embodiments, the previously recorded media content may have been recorded in response to one or more requests from a user of the mobile device **110**. Scheduled recording application **115** may then
5 provide that received index to users of the mobile device **110** to facilitate the users in selecting an item for receiving and playing or for recording.

Methodologies for receiving programming index data by scheduled recording application **115** may include receiving via a cellular network, receiving via a
10 wired network utilizing the Internet, receiving utilizing a combination of a cellular network and a wired network utilizing the Internet, and the like. In one embodiment, the programming index data may be requested by the mobile device **110** of the indexing system **125** and received when the user activates schedule recording application **115**. In another embodiment, the
15 programming index data may be updated on a regular/scheduled basis. Upon receiving and displaying the index to the mobile device **110** user, the scheduled recording application **115** may facilitate the user in selecting content to record at a PVR server **120**. The scheduled recording application may then submit the instructions for which contents to record to the PVR
20 server **120** for implementation, such as with a client-side PVR server **120** available from nCUBE. In one embodiment, the media contents may include a series of related discrete contents rendered or presented at different points in time, and the scheduled recording application **115** may facilitate the mobile device **110** user requesting recording of the related discrete contents of the
25 series at the different points in time. Such a series of related discrete contents may include a repeating program, a channel, or a time slot.

In various embodiments, the scheduled recording application **115** may also facilitate the user in selecting previously recorded content listed by the index

for streaming, may submit instructions to the PVR server **120** requesting streaming of the recorded content, and may receive and facilitate display of the previously recorded content on the mobile device **110**. In one embodiment, the previously recorded media contents may have been recorded based on one or more mobile device **110** user requests, the requests based at least in part on a previous index that was received by the mobile device **110**, the previous index listing the one or more previously recorded media contents as one or more media contents that are available for recording. In a further embodiment, the previously recorded media content may have been recorded based on a mobile device **110** user request, the request submitted through a computing device **170** of the mobile device **110** user, the computing device **170** separate and distinct from the mobile device **110**.

As previously mentioned, time shift application **116** may be a streaming client that allows the user to control the delivery of content to the mobile device **110**, such as the controlling of the streamed content at mobile device **110**, for example controlling the viewing of the streamed content on the GUI of mobile device **110**. Such control may include one or more time shifting operations known in the art, such as a pause operation, a rewind operation, a fast-forward operation, and the like. In some embodiments, the time shifting application **116** may be adapted to initiate a live streaming session between PVR server **120** and mobile device **110**, and to receive content at mobile device **110** from PVR server **120**. In one embodiment, the received content may be the content identified and selected via the scheduled recording application **115**, as described above. Time shifting application **116** may then provide the received content to a mobile device **110** user through a graphical user interface (GUI) of the mobile device. In various embodiments, time

shifting application **116** may then facilitate the user in selecting a time shifting operation through the GUI.

In one embodiment, the selected time shifting operation may be a pause
5 operation, and the received content may be manipulated by pausing the
content to be provided to the GUI. For example, in a live session, the “Fast
Forward” and “Rewind” buttons may be disabled in the GUI. However, a user
may select ‘PAUSE’ for a live session. In response to the user’s selection of
the ‘PAUSE’ button, the mobile device **110** may request performing of the
10 ‘PAUSE’ time shifting operation by the PVR server **120**, and the PVR server
120 may start recording the live streaming session in the PVR server **120**
side. When the user selects the ‘PLAY’ button, the PVR server **120** may
continue streaming from the point of pausing using the recorded stream. In
this case, the PVR server **120** may be continuously recording the live session
15 because the PVR server **120** may actually be streaming past content even if it
is a live session. However, because it may not be reasonable to record large
amounts of data for lengthy amounts of time (e.g., pausing), the amount of
time allocated for pausing the stream of data may be configurable at the PVR
server **120** side. For example, if the amount of time allocated for pausing is
20 set to 10 minutes, the PVR server **120** may only support time shifting for an
amount of time allocated for pausing that may be less than the proscribed 10
minutes. In this example, if amount of time allocated for pausing exceeds 10
minutes, the PVR server **120** may use the input stream from a live source
without using the recorded stream. Additionally, the amount of time allocated
25 for pausing feature may be disabled by configuration while allowing the PVR
server **120** to record the live stream regardless of any time limitation.

In another example, during a live session, the PVR server **120** may initiate a
streaming session, such as a file streaming session, with a lengthy duration.

In this example, the 'Fast Forward' and 'Rewind' buttons on the GUI may not be disabled because the mobile device understands the session as a file streaming session. In this example, the PVR server **120** may continue recording a live streaming session simultaneously with providing the live streaming of the content to the mobile device **110**. For pausing, the PVR server **120** may function as described above. In this example, a user may use the 'Fast Forward' and 'Rewind' buttons as well. If the 'Fast Forward' and 'Rewind' buttons are selected by the user, the PVR server **120** may use the recorded stream to respond to the user's button selection. However, the range of 'Fast forward' may be limited to the position of currently serviced live stream.

PVR server **120** may be any sort of computing device known in the art and may also include or be associated with an indexing system **125** and a recording system **126**. In one embodiment, illustrated by **Figure 5**, PVR server **120** may only include a recording system **126**, and indexing system **125** may belong to another computing device of the media recording server. Indexing system **125** may be a computing system that may be configured to query and receive information from broadcast media **130** and unicast media **140** describing available and scheduled (e.g., future scheduled live and broadcast) content. Indexing system **125** may generate an index of the received information and may provide the index to mobile device **110** via PVR server **120** for use by a user. Indexing system **125** may also generate an index of previously recorded media contents by querying the PVR server **120** and/or recording system **126** for previously recorded media contents. Indexing system **125** may then generate an index of the previously generated media contents, which in some embodiments may be part of the same index as the scheduled and available content. In one embodiment, illustrated by **Figure 6**, indexing system **125** may be a separate computing device of the

media recording server, different from PVR server **120** and recording system **126**. Recording system **126** may include a plurality of storage media and may be configured to receive and store specific content, such as specific content identified by a user utilizing mobile device **110**.

5

Upon generation of the index by the indexing system **125**, the indexing system **125** may provide the index to the mobile device **110**, either directly or indirectly, through PVR server **120**. In other embodiments, the index may be accessed via a web page utilizing a computing device **170**, such as a PC,

10

associated with the mobile device **110** user through an Internet connection. When the user selects desired content from the index, the PVR server **120** may schedule the content to be recorded to recording system **126** for storage and later retrieval. In various embodiments, the index may be generated and provided at pre-determined intervals, upon demand from a mobile device **110**,

15

or both. At some time after providing the index, PVR server **120** may receive a request for recording of content listed by the index. In response, PVR server **120** may have recording server **126** record the desired content at its scheduled time.

20

Also, PVR server **120** may receive a request for providing of previously recorded content listed in the index. In response, PVR server **120** may stream or otherwise provide the recorded content from the recording system **126** to the mobile device **110** for playing on mobile device **110**. In various embodiments, PVR server **120** may also provide a live streaming of content to a mobile device **110**. In one embodiment, PVR server **120** may record the content to recording system **126** simultaneously with streaming the content. PVR server **120** may then receive a request for a time shifting operation from mobile device **110**, as described in greater detail above. In response to a pause operation, for example, PVR server **120** may begin recording.

25

In **Figure 2**, the mobile device **20** may be any handheld computing device, such as a cellular telephone, a personal digital assistant with cellular connectivity, or the like. In this example, mobile device **20** may include a
5 processor unit **204**, a memory **208**, and a storage medium **213**. The processor unit **204** may advantageously include a microprocessor or a special-purpose processor such as a digital signal processor (DSP), but may in the alternative be any conventional form of processor, controller, microcontroller, or state machine. Mobile device **20** may also include
10 additional components not relevant to the present discussion.

The processor unit **204** may be coupled to the memory **208**, which may be advantageously implemented as RAM memory holding software instructions that may be executed by the processor unit **204**. In this embodiment, the
15 software instructions stored in the memory **208** may include one or more applications **212** (e.g., scheduled recording application **115** and time shift application **116**), a media control component **211**, and an operating system **210**. The memory **208** may be on-board RAM, or the processor unit **204** and the memory **208** could collectively reside in an Application Specific Integrated
20 Circuit (ASIC). In an alternate embodiment, the memory **208** may be composed of firmware or flash memory, such as a SmartMedia card.

The processor unit **204** may also be coupled to the storage medium **213**, which may be implemented as any nonvolatile memory, such as ROM
25 memory, flash memory, or a magnetic disk drive, just to name a few. The storage medium **213** may also be implemented as any combination of those or other technologies, such as a magnetic disk drive with cache (RAM) memory, or the like. In this particular embodiment, the storage medium **213**

may be used to store data during periods when the mobile device **201** may be powered off or without power.

5 The mobile device **20** may also include a communications module **221** that enables bidirectional communication between the mobile device **201** and one or more other computing devices. The communications module **221** may include components to enable RF or other wireless communications, such as a cellular telephone network, Bluetooth connection, Mobile WiMax, or a wireless local or wide area network. Alternatively, the communications
10 module **221** may include components to enable land line or hard wired network communications, such as an Ethernet connection, universal serial bus connection, or the like (such as for allowing a user to operate scheduled recording application **115** on mobile device **20** to send a schedule request via a wired connection).

15

In operation, a user may access scheduled recording application **115** and time shift application **116** that are running in application **212** via media control component **211**. The applications may be running on processing unit **204**.

20 The resulting streamed media content that mobile device **20** may receive via communication module **221** may be temporarily stored at storage medium **213** prior to being passed to the GUI (not shown) for display to the user.

Figures 3a-3b illustrate flow diagrams of selected operations of a method for requesting the recording of content on a PVR system, and of requesting and
25 receiving previously recorded content. As illustrated in **Figure 3a**, a mobile device may first receive a collection of one or more indices listing one or more media contents that are available for recording currently or at one or more future points in time, block **302**. In some embodiments, the mobile device may be one of a cellular phone, a personal digital assistant, or a media player.

In various embodiments, the one or more media contents that are available for recording may include at least one of a unicast, a broadcast, or a multicast of media contents, and may be one or more of television programs, movies, video clips, pictures, songs, audio files, and/or portions of a television program, a movie, a video clip, a picture, a song, and/or an audio file. Upon receiving the collection of indices, the mobile device may facilitate a mobile device user in selecting at least one of the media contents listed by the collection of indices, block **304**. The mobile device may then request of a media recording server, in response to the selection by the mobile device user of the at least one of the media contents, recording of the at least one of the media contents, block **306**. In various embodiments, the media contents may include a series of related discrete contents rendered or presented at different points in time, and the requesting recording of the at least one of the one or more media contents that are available for recording comprises requesting recording of the related discrete contents of the series at the different points in time, block **306**, comprises requesting recording of the repeating series. Also, as is shown, said receiving, facilitating, and requesting may be performed in a data mode of the mobile device, and the mobile device may switch to either a call mode of the mobile device to facilitate the mobile device user in making or receiving a phone call using the mobile device, or a messaging mode of the mobile device to facilitate the mobile device user in sending or receiving a message using the mobile device, block **308**.

As illustrated in **Figure 3b**, a mobile device may first receive a collection of one or more indices listing one or more previously recorded media contents, the one or more previously recorded media contents having been recorded in response to one or more requests from a user of the mobile device, block **312**. In some embodiments, the mobile device may be one of a cellular phone, a personal digital assistant, or a media player. In various

embodiments, the one or more previously recorded media contents may include at least one of a unicast, a broadcast, or a multicast of media contents, and may be one or more of television programs, movies, video clips, pictures, songs, audio files, and/or portions of a television program, a movie, a video clip, a picture, a song, and/or an audio file. Additionally, in one embodiment, the one or more previously recorded media contents may have been recorded based on one or more mobile device user requests, the requests based at least in part on a previous collection of indices that was received by the mobile device, the previous collection of indices listing the one or more previously recorded media contents as one or more media contents that are available for recording. Also, in some embodiments, the one or more previously recorded media contents may have been recorded based on one or more mobile device user requests, the requests submitted through a computing device of the mobile device user, the computing device separate and distinct from the mobile device. Upon receiving the collection of indices, the mobile device may facilitate a mobile device user in selecting at least one of the media contents listed by the collection of indices, block **314**. The mobile device may then request of a media recording server, in response to the selection by the mobile device user of the at least one of the previously recorded media contents, providing of the at least one of the previously recorded media contents to the mobile device, block **316**. Upon receiving the at least one of the previously recorded media contents, the mobile device may play the at least one of the previously recorded media contents on the mobile device, block **318**. Also, as is shown, said receiving, facilitating, and requesting may be performed in a data mode of the mobile device, and the mobile device may switch to either a call mode of the mobile device to facilitate the mobile device user in making or receiving a phone call using the mobile device, or a messaging mode of the mobile device to facilitate the

mobile device user in sending or receiving a message using the mobile device, block **320**.

Figure 4 illustrates a flow diagram of selected operations of a method for
5 controlling the providing content, such as time shifting the providing of the
content. As illustrated, a media recording server may provide a live stream of
media content to a recipient mobile device, block **402**. In various
embodiments, the media recording server may simultaneously record the
media content while providing the live streaming of the media content, block
10 **404**. While providing the live stream of the media content, the media
recording server may receive a request from the recipient mobile device, the
request specifying a time shifting operation to affect playing of the live stream,
the time shifting operation having been requested by a mobile device user
through the recipient mobile device, block **406**. The media recording server
15 may then perform the time shifting operation, including recording of at least a
portion of the live stream, block **408**. In some embodiments, the time shifting
operation may be one of a pause, a rewind, and a fast forward. In various
embodiments, the recording by the media recording server may further
comprise recording a portion of the media content in response to receiving a
20 request for a pause operation. Also, in one embodiment, the media recording
server may have a maximum time threshold for recording in response to
receiving a pause operation request.

Figure 5 illustrates a first exemplary computing device of a personal video
recording server, in accordance with various embodiments. As shown, mobile
PVR server **500** may include one or more processors **502**, and system
memory **504**. Additionally, mobile PVR server **500** may include mass
storage devices **506** (such as diskette, hard drive, CDROM and so forth),
input/output devices **508** (such as keyboard, cursor control and so forth) and

communication interfaces **510** (such as network interface cards, modems and so forth). The elements may be coupled to each other via system bus **512**, which represents one or more buses. In the case of multiple buses, they may be bridged by one or more bus bridges (not shown).

System memory **504** and mass storage **506** may be employed to store a working copy and a permanent copy of the programming instructions implementing one or more aspects of the live media relay and recorder **515** and mobile streaming server **520**, as well as to store recorded media and their indices **530** (storage **530**). The programming instructions may be implemented in assembler instructions supported by processor(s) **502** or high level languages, such as C, that may be compiled into such instructions. The permanent copy of the programming instructions may be placed into permanent storage **506** in the factory, or in the field, through e.g. a distribution medium (not shown) or through communication interface **510** (from a distribution server (not shown)).

As is also shown, mobile PVR server **500** may be communicatively coupled to various unicast and multicast networks to receive media via those networks, to a program schedule server (illustrated in **Figure 6** and described in greater detail below), and to one or more mobile devices. Further, mobile PVR server **500** may be any one or more computing devices and its components may perform some or all of the operations described above with regard to the PVR server **120**.

Live media relay and recorder **515** may record unicast and/or multicast media from the above-mentioned networks, upon receipt of a request either directly from a mobile device or indirectly through the program schedule server. The recorded content may be stored in storage **530** for future retrieval. Also, live

media relay and recorder **515** may relay live streams of content to mobile streaming server **520** for mobile streaming server to provide the content to a mobile device. In some embodiments, mobile PVR server **500** may also receive requests for streaming of recorded content, and mobile streaming server **520** may retrieve the recorded content from storage **530** and stream it to the mobile device. In one embodiment, mobile PVR server **500** may further receive from mobile devices requests to record content listed in an index that the mobile device received from program schedule server. Mobile PVR server **500** may then either store the request itself or store the request in storage of the program schedule server, and may, at the appropriate time, record the content.

Further, in various embodiments, mobile PVR server **500** may receive requests specifying time shifting operations while providing a live stream of content to a mobile device. In response, mobile PVR server **500** may record some or the entire stream of content. Further details regarding time shifting operations are described above in greater detail in the description associated with **Figure 1**.

Figure 6 illustrates a second exemplary computing device of a personal video recording server, in accordance with various embodiments. As illustrated, a program schedule server may include a scheduling module **610**, a module for showing recorded media lists **620**, and storage for recording schedules of user **630**. In various embodiments, the program schedule server and its components may perform the operations described above with regard to the indexing system **125**. The program schedule server may also be a part of the media recording server, and may be comprised of any one or more computing devices. As is shown, the program schedule server may be communicatively coupled to a mobile PVR server (illustrated in **Figure 5** and described in greater detail

above), one or more mobile devices, and, optionally, computing devices associated with users of the mobile devices.

The scheduling module **610** may generate an index of media content available
5 now or at one or more future points in time, and may provide that index to one or both of the mobile devices and computing devices, automatically or upon request. The scheduling module **610** may then also store the generated index in the storage for recording schedules of users **630**. In one embodiment, scheduling module **610** may also receive a request from a mobile device or
10 computing device for recording, by the mobile PVR server, of content listed in the index. These requests may also be stored in storage **630**. The mobile PVR server may then retrieve the requests from the storage **630** and record the requested content. Upon finishing recording, the mobile PVR server may provide an indication that recording is complete to program schedule server,
15 which may be stored in storage **630**.

As is further shown, module for showing recorded media lists **620** may generate an index of previously recorded media contents. Module **620** may retrieve a list of such contents from storage **620**, if stored there as described above, or directly
20 from the mobile PVR server. Module **620** may then provide the index of recorded contents to the mobile device and/or the PC.

Although specific embodiments have been illustrated and described herein for purposes of description of the preferred embodiment, it will be appreciated by
25 those of ordinary skill in the art that a wide variety of alternate and/or equivalent implementations may be substituted for the specific embodiment shown and described without departing from the scope of the present invention. Those with skill in the art will readily appreciate that the present invention may be implemented in a very wide variety of embodiments. This

application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A method comprising:
receiving, by a mobile device, a collection of one or more indices listing
5 one or more media contents that are available for recording currently or at one
or more future points in time;
facilitating, by the mobile device, a mobile device user in selecting at
least one of the media contents listed by the collection of indices; and
requesting of a media recording server, by the mobile device, in
10 response to the selection by the mobile device user of the at least one of the
media contents, recording of the at least one of the media contents.
2. The method of claim 1, wherein the media contents are one or more of
television programs, movies, video clips, pictures, songs, audio files, and/or
15 portions of a television program, a movie, a video clip, a picture, a song,
and/or an audio file.
3. The method of claim 1, wherein the one or more media contents that
are available for recording include at least one of a unicast, a broadcast, or a
20 multicast of media contents.
4. The method of claim 1, wherein the mobile device is one of a cellular
phone, a personal digital assistant, or a media player.
- 25 5. The method of claim 1, wherein the media contents include a series of
related discrete contents rendered or presented at different points in time, and
the requesting recording of the at least one of the one or more media contents
that are available for recording comprises requesting recording of the related
discrete contents of the series at the different points in time.

6. The method of claim 1, wherein said receiving, facilitating, and requesting are performed in a data mode of the mobile device, and the method further comprises switching the mobile device to either a call mode of the mobile device to facilitate the mobile device user in making or receiving a phone call using the mobile device, or a messaging mode of the mobile device to facilitate the mobile device user in sending or receiving a message using the mobile device.

10 7. A method comprising:
receiving, by a mobile device, a collection of one or more indices listing one or more previously recorded media contents, the one or more previously recorded media contents having been recorded in response to one or more requests from a user of the mobile device;
15 facilitating, by the mobile device, the mobile device user in selecting at least one of the previously recorded media contents listed by the collection of indices; and
requesting of a media recording server, by the mobile device, in response to the selection by the mobile device user of the at least one of the previously recorded media contents, providing of the at least one of the
20 previously recorded media contents to the mobile device.

8. The method of claim 7, wherein the one or more previously recorded media contents were recorded based on one or more mobile device user requests, the requests based at least in part on a previous collection of indices that was received by the mobile device, the previous collection of indices listing the one or more previously recorded media contents as one or more media contents that are available for recording.

9. The method of claim 7, wherein the one or more previously recorded media contents were recorded based on one or more mobile device user requests, the requests submitted through a computing device of the mobile device user, the computing device separate and distinct from the mobile device.
- 5
10. The method of claim 7, further comprising playing the at least one of the previously recorded media contents on the mobile device.
- 10 11. The method of claim 7, wherein the previously recorded media contents are one or more of television programs, movies, video clips, pictures, songs, audio files, and/or portions of a television program, a movie, a video clip, a picture, a song, and/or an audio file..
- 15 12. The method of claim 7, wherein the one or more previously recorded media contents include at least one of a unicast, a broadcast, or a multicast of media contents.
- 20 13. The method of claim 7, wherein mobile device is one of a cellular phone, a personal digital assistant, or a media player.
- 25 14. The method of claim 7, wherein said receiving, facilitating, and requesting are performed in a data mode of the mobile device, and the method further comprises switching the mobile device to either a call mode of the mobile device to facilitate the mobile device user in making or receiving a phone call using the mobile device, or a messaging mode of the mobile device to facilitate the mobile device user in sending or receiving a message using the mobile device.

15. A method comprising:
providing, by a media recording server, a live stream of a media
content to a recipient mobile device;
receiving, by the media recording server, while said providing the live
5 stream of the media content, a request from the recipient mobile device, the
request specifying a time shifting operation to affect playing of the live stream,
the time shifting operation having been requested by a mobile device user
through the recipient mobile device; and
performing, by the media recording server, the time shifting operation,
10 including recording of at least a portion of the live stream.

16. The method of claim 15, wherein the time shifting operation is one of a
pause, a rewind, or a fast forward.

15

17. The method of claim 15, further comprising simultaneously recording,
by the media recording server, the media content while providing the live
stream of the media content.

20 18. The method of claim 15, wherein said recording further comprises
recording a portion of the media content in response to receiving a request for
a pause operation.

25 19. The method of claim 18, wherein the media recording server has a
maximum time threshold for recording in response to receiving the pause
operation request.

20. A mobile device comprising:
a processor; and

logic operated by the processor and adapted to:

receive a collection of one or more indices listing one or more media contents that are available for recording currently or at one or more future points in time,

5 facilitate a mobile device user in selecting at least one of the media contents listed by the collection of indices, and

request of a media recording server, in response to the selection by the mobile device user of the at least one of the media contents, recording of the at least one of the media contents.

10

21. The mobile device of claim 20, wherein the one or more media contents that are available for recording include at least one of a unicast, a broadcast, or a multicast of media contents.

15 22. The mobile device of claim 20, wherein said receive, facilitate, and request are performed in a data mode of the mobile device, and the logic is further adapted to switch the mobile device to either a call mode of the mobile device to facilitate the mobile device user in making or receiving a phone call using the mobile device, or a messaging mode of the mobile device to
20 facilitate the mobile device user in sending or receiving a message using the mobile device.

23. A mobile device comprising:
a processor; and

25 logic operated by the processor and adapted to:

receive a collection of one or more indices listing one or more previously recorded media contents, the one or more previously recorded media contents having been recorded in response to one or more requests from a mobile device user,

facilitate the mobile device user in selecting at least one of the previously recorded media contents listed by the collection of indices, and

5 request of a media recording server, in response to the selection by the mobile device user of the at least one of the previously recorded media contents, providing of the at least one of the previously recorded media contents to the mobile device.

10 24. The mobile device of claim 23, wherein the one or more previously recorded media contents were recorded based on one or more mobile device user requests, the requests based at least in part on a previous collection of indices that was received by the mobile device, the previous collection of indices listing the one or more previously recorded media contents as one or more media contents that are available for recording.

15

25. The mobile device of claim 23, wherein the logic is further adapted to play the at least one of the previously recorded media contents on the mobile device.

20 26. A mobile device comprising:
a processor; and

logic operated by the processor and adapted to:

receive a live stream of a media content, the live stream provided to the mobile device via a media recording server,

25

facilitate a mobile device user in selecting a time shifting operation to affect playing of the live stream, the time shifting operation requiring recording of at least a portion of the live stream by the media recording server, and

request of the media recording server, in response to the selection by the mobile device user of the time shifting operation, performance of the time shifting operation.

5 27. The mobile device of claim 26, wherein the time shifting operation is one of a pause, a rewind, or a fast forward.

28. The mobile device of claim 26, wherein the media recording server simultaneously records the media content while providing the live stream of
10 the media content.

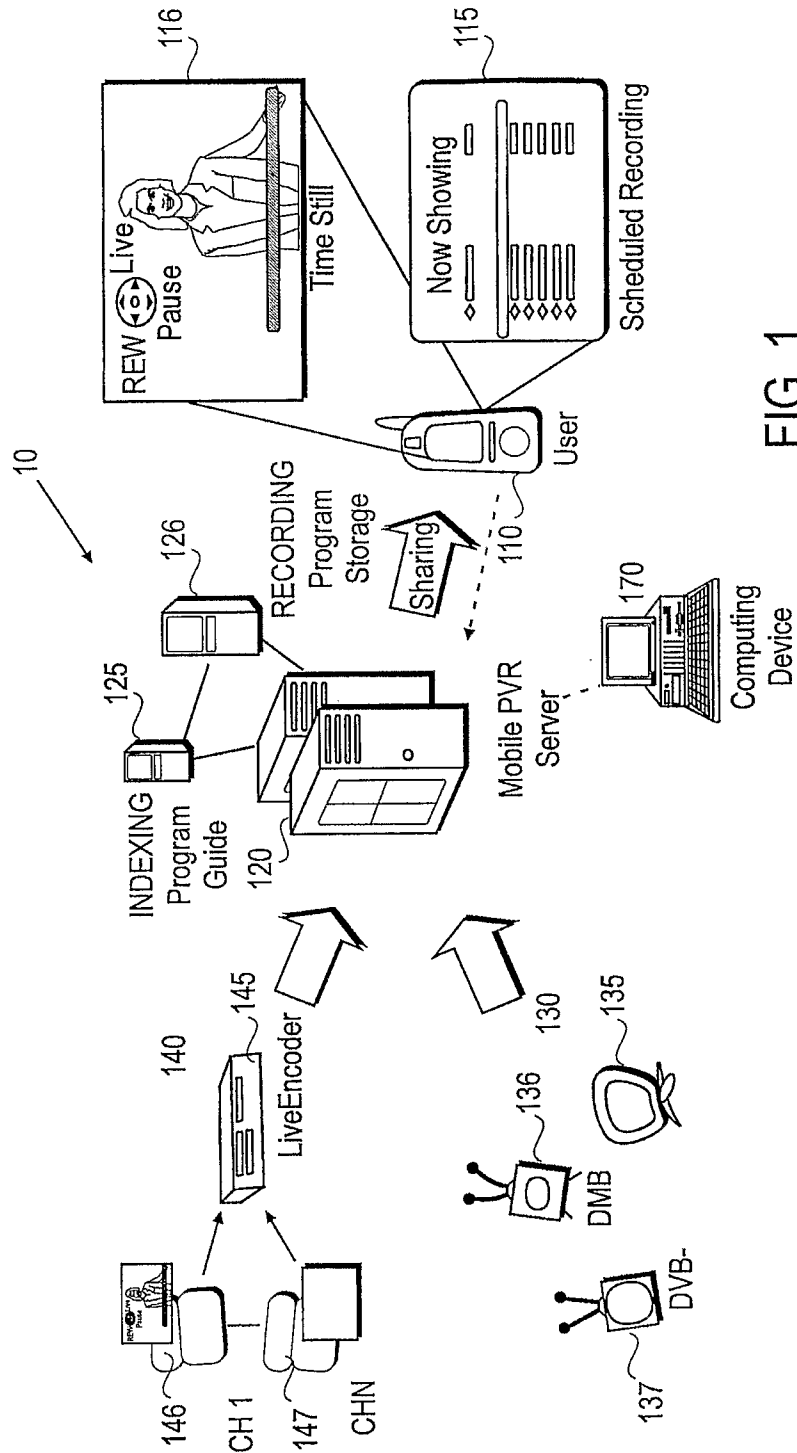


FIG. 1

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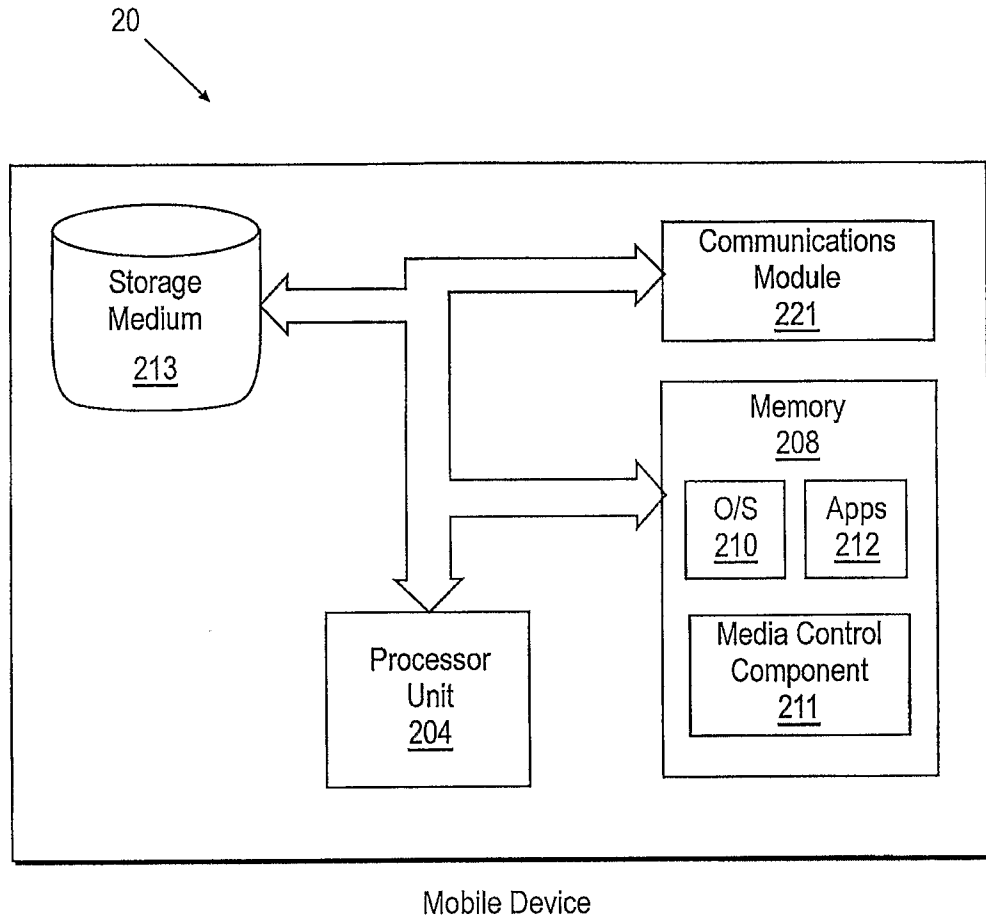


FIG. 2

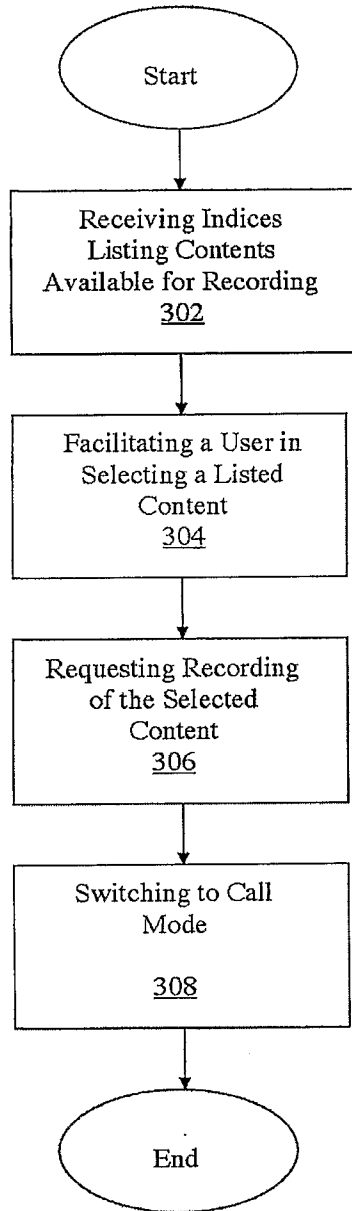


FIG. 3A

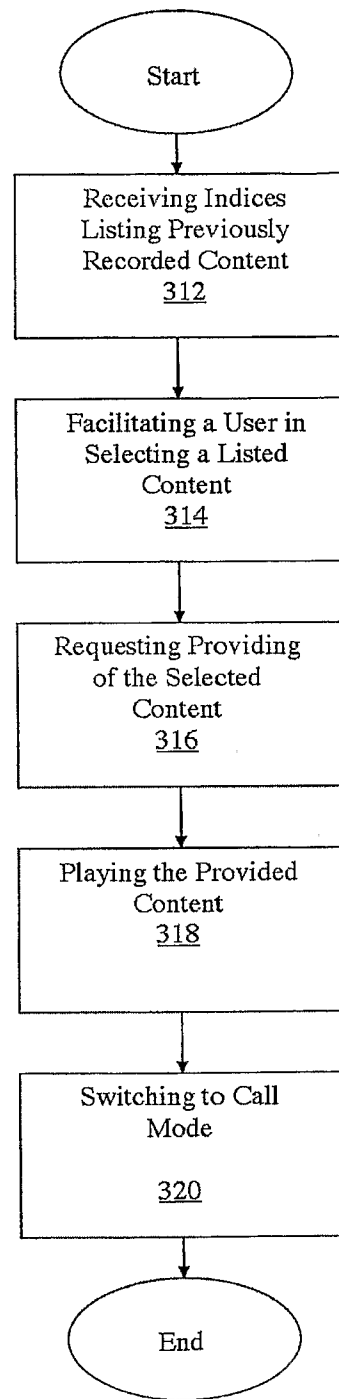


FIG. 3B

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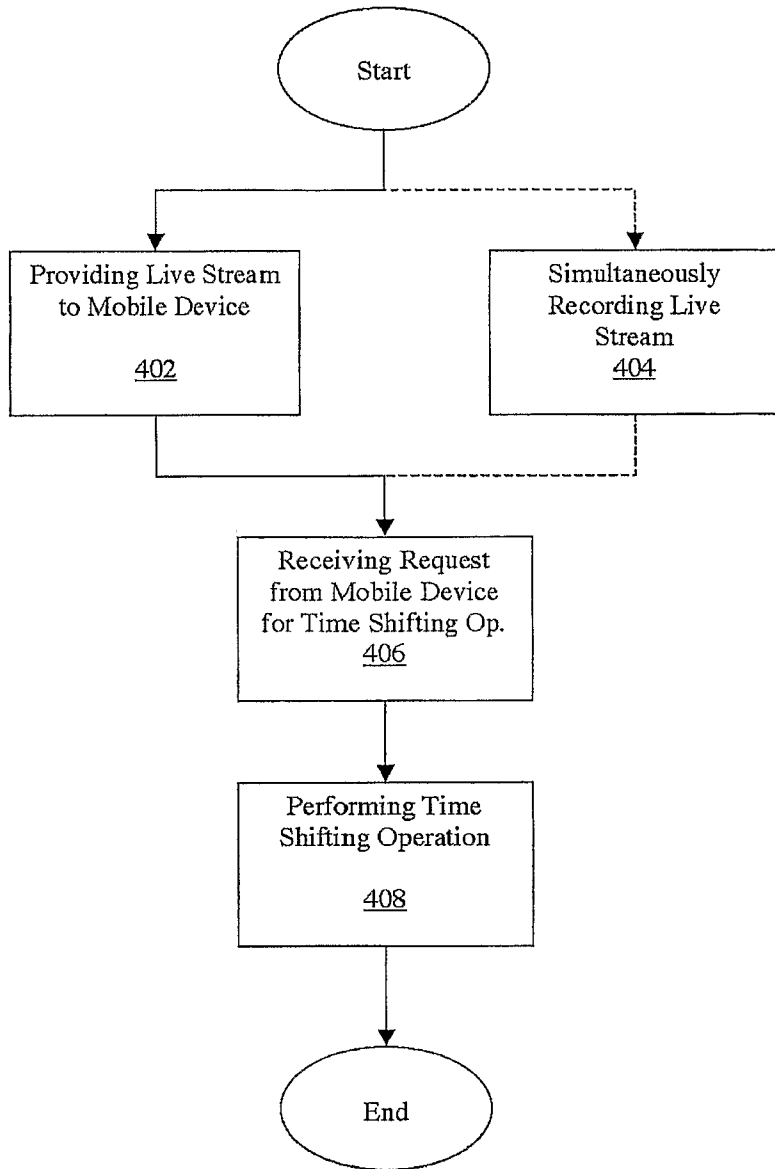


FIG. 4

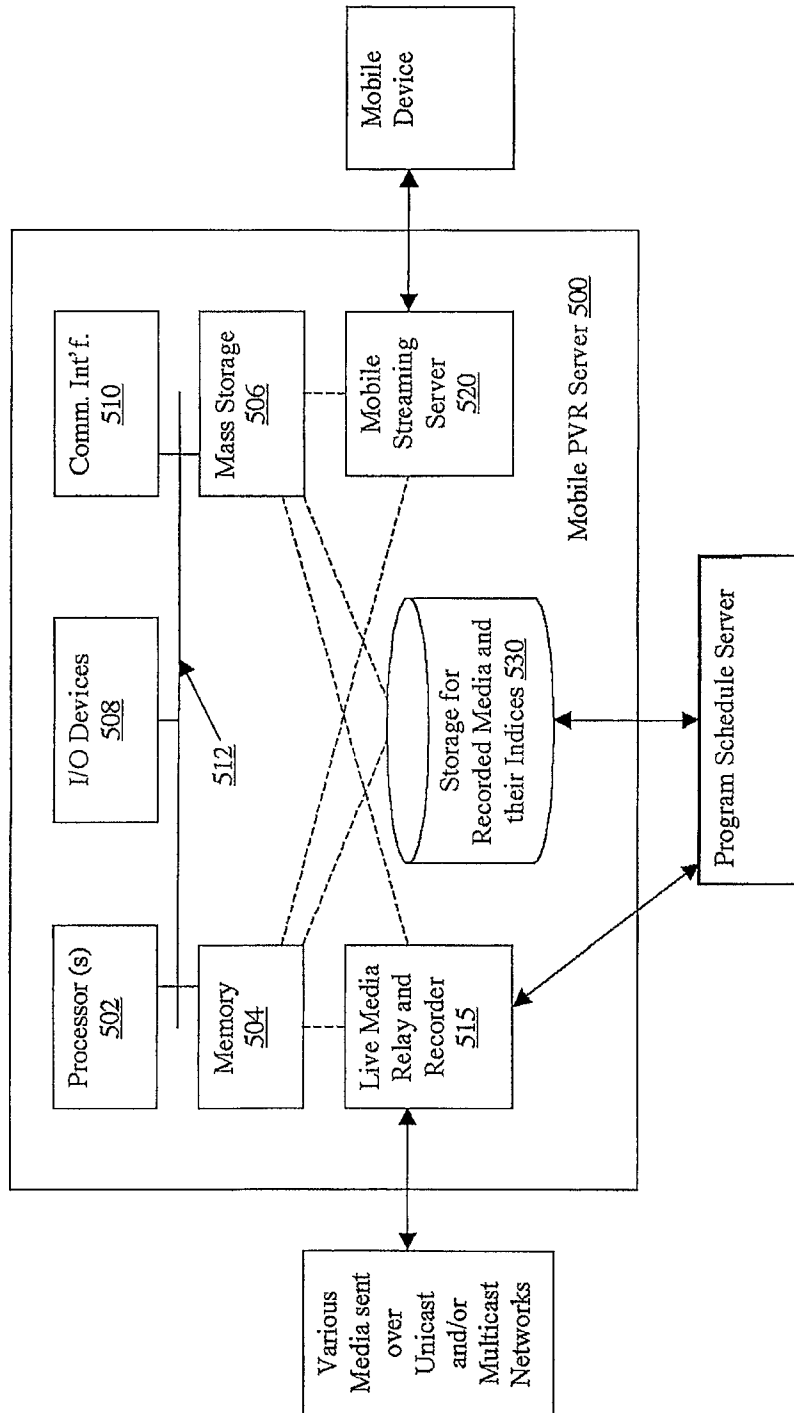


FIG. 5

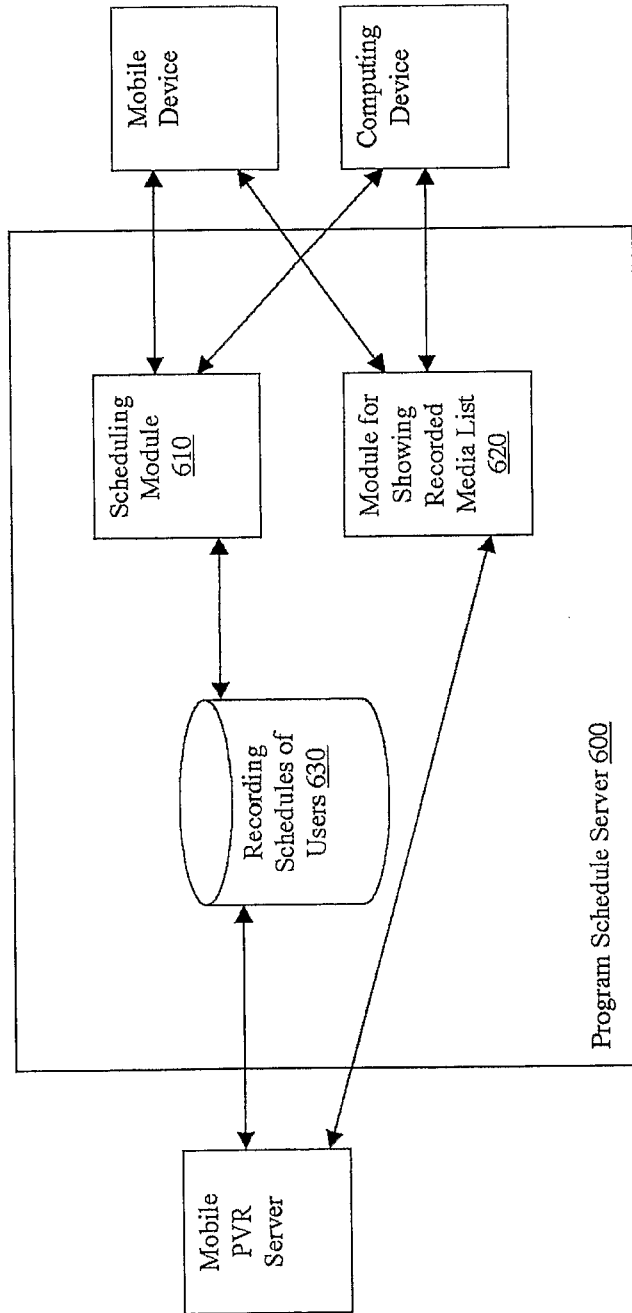


FIG. 6