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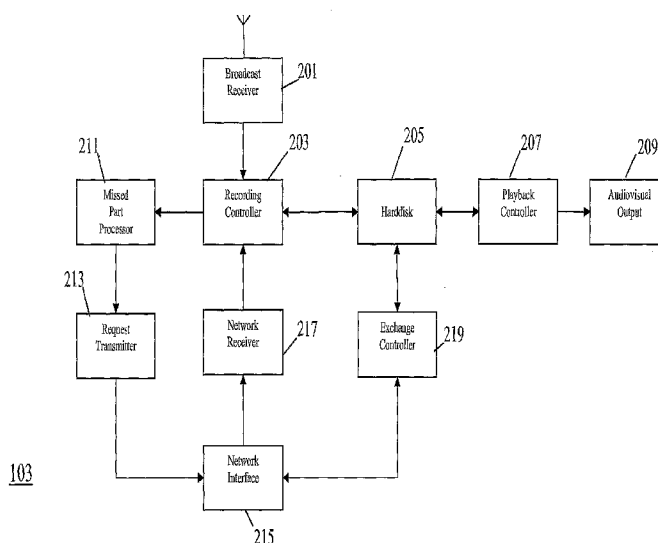
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(54) Title: CONTENT ITEM DISTRIBUTION



(57) Abstract: A content item distribution system comprises content item presentation devices (103, 105, 107) with receivers (201) for receiving content items from a broadcast transmitter (101) via a broadcast communication system. The devices comprise a recording controller (203) which can detect that a broadcast of a selected content item is ongoing. A processor (211) determines a missed part of the selected content item and in response a request transmitter (213) transmits a request to external sources using a different communication system than the broadcast communication system. A network receiver (217) receives the missed part of the content item via the different communication system and the recording controller (203) combines this with a remaining part received via the broadcast communication system to generate a complete content item.

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CONTENT ITEM DISTRIBUTION

Field of the invention

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The invention relates to content item distribution and in particular, but not exclusively, to distribution of television programmes.

10

Background of the Invention

Efficient distribution of content such as audiovisual content is of increasing importance. Conventionally,
15 wireless broadcasting of content has been widely used for scenarios where a large number of users in a large geographical area are to be reached. For example, from the early days of television, distribution has been by wireless broadcasting from a relatively low number of
20 television transmitters.

Broadcasting of content items such as television programmes provide an efficient distribution with a relatively low air interface resource requirement.
25 However, traditional broadcasting also has a number of disadvantages.

Most significantly, the shared broadcasting results in all users being provided with the same content items at
30 the same time. Traditionally users of television systems have been forced to start watching or recording a desired television programme from the time the broadcasts start,

which is highly inconvenient and limits the user's freedom in using the broadcast service.

Furthermore, as the amount and variety of content which
5 is provided to the consumer has increased substantially
in the last decade, it is becoming increasingly difficult
and inconvenient to keep track of the broadcast times of
desired content items as well as to coordinate between
different broadcasts. For example, in the last decade the
10 average number of television channels available to the
user has increased substantially and it has become
increasingly impractical and cumbersome to identify and
plan for the watching and recording of selected
programmes.

15 Specifically, because broadcast sessions are time-
bounded, it frequently occurs that a user misses the
beginning of a specific content item being broadcast. For
short broadcasts, which are repeatedly transmitted, this
20 may not be a significant problem as the user may simply
wait until next broadcast starts. However for longer and
more irregular broadcasts, this may be a significant
problem, especially for television programmes where
missing the beginning of a programme may reduce user
25 satisfaction as there is currently no way to overcome
this problem and the user is forced to either miss the
beginning of the programme, to ignore the programme or to
wait for a repeat.

30 In some closed Video on Demand (VoD) distribution
systems, it has been proposed to include functionality
for additionally transmitting part of a content item to
devices that have missed the beginning of the content

item. Specifically, traditional VoD service employs a client-server unicast distribution model. Each client sets up its own connection with the server over a unicast channel. As the service popularity increases, the server
5 soon becomes the bottleneck. One common technique which is used for saving bandwidth - called batching - consists in waiting for some additional peers before starting a multicast. This delay however significantly decreases the user perceived quality of service. In order to address
10 this issue, it has been proposed to use dynamic multicasting. In this approach, the multicast destinations are not static during the multicasting but can be dynamically expanded to accommodate new clients requesting the same content item. A patching technique is
15 then used to allow a new client to join an existing multicast. In such a case, the server initiates a patching stream which transmits the missing initial part of the content item from the server to the client. When the playback of the missing part is completed, the client
20 continues to play back the remainder of the content using the data that has been buffered on the local disk in the meantime. In some VoD systems, it has been proposed to use peer-to-peer patching wherein patching can involve other clients rather than just the server.

25

However, such systems are based on a complex and integrated management and control operation involving both the server and clients. Furthermore, the VoD systems are designed as an alternative to existing broadcast
30 services and do not interwork with broadcast services. Thus, the deployment of VoD systems is typically expensive and requires significant initial investment and

tends to have high running cost partly due to high communication resource requirements.

Hence, an improved content item distribution would be
5 advantageous and in particular a system allowing increased flexibility, enhanced user service/experience, compatibility with e.g. existing broadcast services and/or improved performance would be advantageous.

10

Summary of the Invention

Accordingly, the Invention seeks to preferably mitigate, alleviate or eliminate one or more of the above mentioned
15 disadvantages singly or in any combination.

According to a first aspect of the invention there is provided a content item distribution system comprising a plurality of content item presentation devices, at least
20 a first content item presentation device comprising: first receiving means for receiving content items from a broadcast transmitter broadcasting content items to a plurality of content item presentation devices via a broadcast communication system; means for detecting that
25 a broadcast of a selected content item is ongoing; means for determining a missed part of the selected content item; first transmitting means for transmitting a request for the missed part to at least one external source using a different communication system than the broadcast
30 communication system; and second receiving means for receiving the missed part of the content item via the different communication system.

- The invention may allow improved content item distribution performance and may e.g. provide increased flexibility, improved user experience, and/or an improved user service. The invention may allow an additional
- 5 service to be provided to content item presentation devices for receiving broadcast transmissions. The invention may allow enhanced functionality for content item broadcasts without requiring the involvement, modification and/or even knowledge of the broadcast
- 10 communication system or the operator thereof. The invention may be compatible with existing broadcast services and may for example provide an additional service for a broadcast television service.
- 15 The first and second receiving means may be arranged to receive signals through different communication mediums. The broadcast communication system and the different communication system may be independently managed and controlled. For example, completely different and
- 20 independent communication resources may be used. The different communication system may for example be a cellular communication system or a wired or wireless local area network.
- 25 According to an optional feature of the invention, the first content item presentation device further comprises means for generating a complete selected content item by combining the missed part of the selected content item with a remaining part received from the broadcast
- 30 transmitter by the first receiving means.

The invention may allow an efficient and flexible service for providing a complete content item to a content item

presentation device even if a part of a broadcast of the content item has been missed. An efficient communication resource may be achieved and the service may be provided by a service provider which is independent of the
5 broadcast service provider.

According to an optional feature of the invention, the first content item presentation device further comprises means for presenting the complete selected content item
10 to a user.

The invention may allow an efficient and flexible service for providing a complete content item to a user of the content item presentation device even if a part of a
15 broadcast of the content item has been missed. An efficient communication resource may be achieved and the service may be provided by a service provider which is independent of the broadcast service provider.

20 According to an optional feature of the invention, the first content item presentation device further comprises storage means for storing the complete selected content item to a user of the content item presentation device.

25 The invention may allow an efficient and flexible service for storing or recording a complete content item even if a part of a broadcast of the content item has been missed. An efficient communication resource may be achieved and the service may be provided by a service
30 provider which is independent of the broadcast service provider.

According to an optional feature of the invention, the different communication system is independent of the broadcast communication system.

- 5 The different communication system and the broadcast communication system may specifically have separate resource allocation, network management, network operators/service providers and/or may be operating in accordance with different and separate standards and
10 technical specifications.

According to an optional feature of the invention, the broadcast communication system is a television broadcast communication system.

15

The invention may allow an improved or enhanced service for users of a television broadcast service.

- According to an optional feature of the invention, the
20 broadcast communication system is a wireless broadcast communication system.

- The broadcast to the content item presentation devices may be by wireless means. Thus, the broadcast function
25 may be achieved by wireless transmission such as for example by transmission of electromagnetic signals. This may allow for efficient performance. The different communication system may be a wired communication system.

- 30 According to an optional feature of the invention, the content item distribution system further comprises a server, the server comprising: third receiving means for receiving requests for missed parts of content items from

content item presentation devices; means for obtaining missed parts of content items; and second transmitting means for transmitting missed parts of content items to content item presentation devices.

5

This may allow an efficient implementation and/or advantageous operation in many embodiments. In particular, it may allow facilitated service provider control, facilitated deployment for existing broadcast
10 system and/or reduced complexity in many embodiments.

According to an optional feature of the invention, the means for obtaining comprises: means for, in response to receiving the request from the first content item
15 presentation device, requesting the missed part from at least one other content item presentation device; and means for receiving the missed part from at least one other content item presentation device; and wherein the second transmitting means is arranged to transmit the
20 missed part to the first content item presentation device.

This may allow an efficient implementation and/or advantageous operation in many embodiments.

25

According to an optional feature of the invention, the server comprises means for receiving storage information from content item presentation devices, the storage information indicating content items stored at the
30 content item presentation devices; and wherein the means for obtaining comprises means for identifying a first content item presentation device having stored the missed part in response to the storage information.

This may allow an efficient implementation and/or advantageous operation. For example, a faster identification and/or retrieval of required content item
5 parts may be achieved and/or the communication resource requirement may be reduced.

According to an optional feature of the invention, the server comprises storage means for storing at least parts
10 of content items; and wherein the means for obtaining is arranged to determine if requested missed parts are stored in the storage means and if so to retrieve the requested parts from the storage means.

15 This may allow an efficient implementation and/or advantageous operation. For example, a faster identification and/or retrieval of required content item parts may be achieved and/or the communication resource requirement may be reduced.

20

According to an optional feature of the invention, the first transmitting means is arranged to transmit the request to at least one other content item presentation device; and the second receiving means is arranged to
25 receive the missed part of the content item from the at least one other content item presentation device.

The missed part may be obtained directly from another content item presentation device without the involvement
30 of a server. The request may be transmitted or broadcast to a plurality of content item presentation devices and any content item presentation device having the requested missed part may transmit this back. The feature may allow

10

a de-centralised system and may facilitate implementation and/or improve operation in many embodiments.

According to an optional feature of the invention, the
5 different communication system is a peer-to-peer communication network.

This may allow an efficient implementation and/or advantageous operation.

10

According to an optional feature of the invention, the request comprises an identification of the missed part.

This may allow an efficient implementation and/or
15 advantageous operation.

According to an optional feature of the invention, the identification comprises at least one indication selected from the group consisting of: a real time indication of
20 an event of the missed part; a duration of the missed part; a frame number of an event of the missed part; a content item time indication of an event of the missed part; and an identification of the selected content item.

25 This may allow an efficient implementation and/or advantageous operation. The event of the missed part may for example be a start or an ending of the missed part and may specifically correspond to the start time of the content item or to the time from which the broadcast is
30 received.

According to an optional feature of the invention, the first content item presentation device further comprises:

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means for storing at least parts of received content items; means for receiving a request for a part of a content item from a requesting source; means for determining if at least some of the part of the content
5 item is stored in the means for storing; and means for transmitting the least some of the part of the content item to the requesting source.

This may allow an efficient implementation and/or
10 advantageous operation. The requesting source may be another content item presentation device and/or may be a server providing missed parts of content items to requesting content item presentation devices.

15 According to an optional feature of the invention, the content item presentation device is a personal video recorder.

The invention may allow an improved service to be
20 provided by a personal video recorder.

According to another aspect of the invention there is provided a server for a content item distribution system including a plurality of content item presentation
25 devices for receiving content items from a broadcast transmitter broadcasting content items to the plurality of content item presentation devices via a broadcast communication system, the server comprising: receiving means for receiving requests for missed parts of content
30 items from content item presentation devices; means for obtaining missed parts of content items; and transmitting means for transmitting missed parts of content items to the content item presentation devices.

According to another aspect of the invention there is provided a method of operation for a content item distribution system including a plurality of content item presentation devices, the method comprising at least a first content item presentation device performing the steps of: receiving content items from a broadcast transmitter broadcasting content items to a plurality of content item presentation devices via a broadcast communication system; detecting that broadcast of a selected content item is ongoing; determining a missed part of the selected content item; transmitting a request for the missed part to at least one external source using a different communication system than the broadcast communication system; and receiving the missed part of the content item via the different communication system.

These and other aspects, features and advantages of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

Brief Description of the Drawings

Embodiments of the invention will be described, by way of example only, with reference to the drawings, in which

FIG. 1 illustrates an example of content item distribution system in accordance with some embodiments of the invention;

FIG. 2 illustrates an example of a content item presentation device in accordance with some embodiments of the invention;

5 FIG. 3 illustrates an example of a server in accordance with some embodiments of the invention; and

FIG. 4 illustrates an example of a method of retrieving a missed part of a content item in accordance with some
10 embodiments of the invention.

Detailed Description of Some Embodiments of the Invention

15 The following description focuses on embodiments of the invention applicable to broadcasting of television signals and in particular to a Personal Video Recorders (PVRs) for a television broadcasting system. However, it will be appreciated that the invention is not limited to
20 this application but may be applied to many other systems and services.

FIG. 1 illustrates an example of content item distribution system in accordance with some embodiments
25 of the invention.

FIG. 1 illustrates a television broadcast transmitter 101 which is a conventional broadcast transmitter that broadcasts analogue or digital television signals to a
30 large number of users in a relatively large geographical area. For clarity and brevity, the following description will focus on distribution of digital content items in the form of digitally encoded (e.g. by MPEG-2 encoding)

television programmes but it will be appreciated that the described principles may be applicable to many other types of content items. Although the television broadcast transmitter 101 is illustrated in FIG. 1, it need not be
5 part of the content item distribution system but can e.g. be considered part of an existing, independent and separate television broadcast system. Thus, the service provided by the content item distribution system may be an additional or enhanced service for a television
10 broadcast system provided by completely independent hardware and software and by an independent service provider.

The content item distribution system comprises a large
15 number of devices for receiving the television broadcasts. For brevity and clarity, FIG. 1 illustrates three Personal Video Recorders (PVRs) 103, 105, 107 and the embodiments will be described with reference to this. It will be appreciated that the system may alternatively
20 or additionally comprise other broadcast receiving means and user presentation devices.

The PVRs 103, 105, 107 are able to receive the television broadcasts from the television broadcast transmitter 101
25 and can record these programs on a local storage. The PVRs 103, 105, 107 also comprise functionality for retrieving programmes from the local storage and for outputting the corresponding audiovisual signal, for example to a television.

30

The PVRs 103, 105, 107 are coupled together via a network 109. The network may for example be a wired or wireless

Local Area Network and can be a public or proprietary network. Specifically, the network can be the Internet.

In the example of FIG. 1, the network 109 is furthermore
5 coupled to a server 111 which is arranged to communicate with the PVRs 103, 105, 107 in order to distribute missed parts of television programmes as will be described in more detail in the following.

10 In a broadcast system, the transmissions of content items, such as television programmes, are time constrained and the content items are inherently transmitted to all receivers at the same time. In such a system, it can often occur that a user misses the
15 beginning of a specific programme. This may cause user frustration and degrade the user experience.

The system of FIG. 1 may provide a mechanism for the users to obtain the missed part of a content item from
20 the server or from another user who is receiving and has recorded the same content item. Specifically, if a user is interested in recording a complete content item but has missed the beginning, the PVR can record the rest of the broadcast of the content item and can in addition
25 request the missing part from another device or from the server.

In the specific example, the system includes functionality for the PVR to unambiguously identify the
30 television programme for which the beginning has been missed as well as the size (e.g. duration) of the missing part. In addition, the system can identify another device (potentially including the server) which has recorded the

same television programme. The missing part of the programme can then be transmitted from this device to the requesting PVR which can combine the missed part of the beginning with the rest of the content item received
5 directly by the broadcast.

As a specific example, a user may realize (e.g. when turning on the television or changing channel) that a television programme is of interest but that the
10 beginning of this television programme has been missed. The user then requests the PVR (e.g. by pressing a button on the remote) to retrieve the beginning of the television programme. The television programme may be
15 broadcast date and time or via a unique identifier, such as those typically assigned in Electronic Program Guides (EPG).

First, the system temporary stops playing the television
20 programme to the user and starts recording the television programme from the current instant. Concurrently, the system contacts the server 111 and transmits the unique identifier as well as the indication of the size of the missed part. In its simplest form, this consists in the
25 current time from which the planned (or actual) start time will be subtracted by the server to get the missed duration. In more advanced versions, it may consists in the frame number of the MPEG stream from which the number of the first frame of the television programme will be
30 subtracted by the server to get the size of the missed section.

The server 111 can optionally check the request for appropriate service policies. If the request is acceptable, the server 111 then searches for another device 105, 107 (including the server itself 111) that is
5 recording the television programme. In order to avoid an exhaustive search by contacting all devices 105, 107, each device 105, 107 may inform the server 111 of the television programme which it has recorded or is recording. For privacy concerns, this list of recordings
10 can be cleared periodically (e.g. once the maximum missed duration has passed, the information is removed).

Eventually, the server 111 requests the identified device 105, 107 to transmit the missing part to the requesting
15 PVR 101. The missed part can e.g. be identified by two timestamps (beginning time and end time) in time synchronized systems (e.g. in systems where the devices 103, 105, 107 periodically obtain the current system time from the server, e.g. using the widely deployed NTP
20 protocol) or by a MPEG frame number and a duration.

This transmission of the missed part to the PVR 101 may in different embodiments e.g. be direct or via the server 111. In the latter case, the server 111 can receive the
25 missed part and forward it to the requesting PVR 101. For optimization purposes, the server may also temporary store the missed section in its own local storage. For instance if the server 111 already received x minutes from a first request, a subsequent request for the same
30 television programme of a longer missed section (e.g. of y minutes) may result in only the additional y-x minutes being retrieved from the identified device 105, 107 and the previously received part of x minutes being directly

provided by the server 111. Specifically, the server 111 can recombine the two sections and transfer the entire y minutes to the requesting device.

5 When the missed part is received, the requesting device can combine the parts received from the TV broadcast transmitter 101 and from the server 111 e.g. using the MPEG frame numbers. The complete television programme can then be stored and can be presented to the user. If the
10 missed beginning cannot be retrieved, the PVR 101 may e.g. allow the user to select between watching the end of the television programme (the part that has been received from TV broadcast transmitter 101) or to search for a future broadcast in the EPG.

15

FIG. 2 illustrates an example of a content item presentation device in accordance with some embodiments of the invention. The content item presentation device may specifically be the first PVR 103 of FIG. 1 and will
20 be described with reference to this.

The first PVR 103 comprises a broadcast receiver 201 which can receive the television programmes broadcast from the TV broadcast transmitter 101.

25

The broadcast receiver 201 is coupled to a recording controller 203 which receives the received content items. The recording controller 203 is arranged to control the recording operation of the first PVR 103 and specifically
30 is arranged to store content items on a hard disk 205 coupled to the recording controller 203.

During typical operation, the recording controller 203 can receive a user input requesting that a specific television programme is recorded. In response, the recording controller 203 stores the digital data stream
5 of that television programme on the hard disk 205.

The hard disk 205 is furthermore coupled to a playback controller 207 which controls the playback operation of the first PVR 103. Specifically, the playback controller
10 207 is coupled to an audiovisual output 209 and is operable to retrieve a selected recording from the hard disk 205 and to forward it to the audiovisual output 209 for presentation to a user. Specifically, the audiovisual output 209 can itself comprise a display for presenting
15 the television programme or can e.g. comprise output circuitry for coupling to an external presentation device such as a television.

The recording controller 203 may in some cases receive a
20 request for the recording of a programme which is currently being received by the broadcast receiver 201 but for which an initial part has not been recorded. In such cases, the recording controller 203 can detect that the selected television programme is currently undergoing
25 and that it accordingly cannot record the complete television programme.

In such a case, the recording controller 203 proceeds to record the television programme from the current time and
30 to inform a missed part processor 211 that a currently received programme is being partially recorded. In response, the missed part processor 211 proceeds to

determine the part of the television programme which has been missed.

- For example, the missed part processor 211 can determine
5 a time instant from which the television programme is being recorded. The missed part processor 211 can further determine an identification of the television programme. For example, a unique identifier received for the television programme can be determined and/or a
10 television channel, timing and/or programme name can be determined. Thus, both an identification of the content item and an indication of which part has been missed is determined by the missed part processor 211.
- 15 This information is forwarded to a request transmitter 213 which is operable to transmit a request for the missed part to the server 111. Specifically, the request transmitter 213 is coupled to a network interface 215 which interfaces to the network 109. Thus, the request
20 transmitter 213 transmits the request message to the server 111 through a different communication medium and communication system than the one used for receiving the broadcast television programme.
- 25 The request comprises an identification of the missed part allowing the server 111 and/or other devices to identify exactly which part has been missed. Specifically, the request can comprise the identification of the television programme as well as the indication of
30 the time from which the broadcast has been recorded. The time indication may be provided as a real time indication and/or may be presented as a timing referenced to the content item itself. For example, a frame number from

which the television programme has been recorded can be included.

In some embodiments, the missed part processor 211 can
5 furthermore be arranged to determine a duration of the
missed part. For example this can be determined as the
time of the start of the recording of the received
broadcast signal minus a start time of the television
programme (for example obtained by an electronic program
10 guide).

In response to the request, the server 111 may localise a
copy of the missed part of the television programme and
forward this to the first PVR 103. Accordingly, the first
15 PVR 103 comprises the network receiver 217 which is
coupled to the network interface 215 and which is
arranged to receive the missed part from the server 111.
Thus, the first PVR 103 is arranged to receive parts of
the television programmes that are broadcast by the TV
20 broadcast transmitter 101 through a different and
independent communication system.

The network receiver 217 is coupled to the recording
controller 203 which is fed the missed part. In response,
25 the recording controller 213 proceeds to store the missed
part received from the server 111 on the hard disk 205.

The recording controller 203 is furthermore arranged to
generate a complete version of the selected television
30 programme by combining the missed part received from the
server 111 with the part received from the TV broadcast
transmitter 101 by the broadcast receiver 201. It will be
appreciated that any suitable algorithm or process for

combining the digital audiovisual signals may be used. For example, the MPEG-2 encoded files may be decoded to provide the image frames in a time interval around the borderline. The frame numbers can then be used to align
5 the two sections such that a continuous sequence of frames is achieved by selecting frames from either one or the other section. The resulting video may be re-encoded using the MPEG-2 video encoding protocol.

10 It will be appreciated, that the recording controller 203 may combine the two sections as part of the recording or storage process or may subsequently retrieve the sections from the hard disk 205 for combining and subsequent storage of the complete combined television programme. It
15 will also be appreciated that in some embodiments a combination of the two different parts of sections may be achieved during playback. Specifically the functionality for combining the different sections may be comprised in the playback controller 207.

20

Thus, the first PVR 103 comprises functionality for storing the complete television programme following a combination of a section received via the broadcast communication system by the broadcast receiver 201 and a
25 section received via an independent communication system. The complete television programme may be presented to a user by the playback controller 207 and the audiovisual output 209. Thus, a user service is provided allowing recording and/or presentation of complete content items
30 even if the beginning of the broadcast of the content item has been missed.

In the specific example, the first PVR 103 furthermore

comprises functionality that allows it to provide content items which have been missed by other devices.

Specifically, the first PVR 103 comprises an exchange controller 219 which is coupled to the network interface
5 215 and to the hard disk 205.

The exchange controller 219 can receive a request from the server 111 which indicates that another device of the system is trying to retrieve a missed part of a broadcast
10 content item. In response, the exchange controller 219 can search the hard disk 205 to determine if the same content item has been recorded by the first PVR 103.

Specifically, the first PVR 103 may currently be recording a television programme for which another device
15 is seeking to retrieve a missed part. In this case, the exchange controller 219 can retrieve an appropriate section from that television programme and transmit this to the server 111 via the network interface 215 and the network 109. Thus, as well as providing an additional
20 user service to the user of the first PVR 103, the first PVR 103 can also assist in providing this user service to other devices of the system.

FIG. 3 illustrates an example of a server in accordance
25 with some embodiments of the invention. The server may specifically be the server 111 of FIG. 1 and will be described with reference to this.

The server comprises a network interface 301 which is
30 operable to interface to the network 109. The network interface 301 is coupled to a request receiver 303 which is arranged to receive requests for missed parts of content items from devices of the system. Specifically,

the request receiver 303 can receive the request for the missed part of the television programme from the first PVR 103.

- 5 The request receiver 303 is coupled to a retrieval controller 305 which is operable to obtain missed parts of content items. In the example, the retrieval controller 305 can obtain a section of the content item from an internal storage or from another device of the system. However, it will be appreciated than in other 10 embodiments the retrieval controller 305 may be capable of only obtaining the section from either an external storage or from another device of the system.
- 15 In the specific example, when the request receiver 303 receives the request from the first PVR 103, the retrieval controller 305 proceeds to attempt to retrieve the requested part of the television programme.
- 20 The retrieval controller 305 is coupled to a transmit controller 307 which is arranged to transmit missed parts of content items to requesting devices. Specifically, if the retrieval controller 305 is successful in obtaining the missed part requested by the first PVR 103, this is 25 fed to the transmit controller 307 and transmitted to the first PVR 103 via the network interface 301 and the network 109. If the retrieval controller 305 is unsuccessful, a message informing the first PVR 103 of this can be transmitted.
- 30 In more detail, the retrieval controller 305 of FIG. 3 comprises a localisation processor 309 which is coupled to the request receiver 303. The localisation processor

309 comprises functionality for determining exactly which part of which content item is requested in response to the information comprised in the request. Specifically, the localisation processor 309 can extract information
5 identifying the television programme as well as the time from which the first PVR 103 is recording the programme.

The localisation processor 309 then proceeds to determine the size of the missing part. In many embodiments, the
10 requesting device does not know the exact time of when the broadcast of the content item actually started. There are several solutions to this problem. A simple approach is to use information from programme guides (possibly adding a small margin to support the inaccuracy typical
15 of such schedules). The broadcast operator may also record the first frame number for each television programme which can then be subtracted from the first frame recorded by the requesting device. The frame number may also be reset to zero at the beginning of each
20 television programme. The broadcast operator may also put special tags in the broadcast stream at the beginning of each show for the recording device to detect the first frame. It will be appreciated that in various embodiments, the exact size of the missed part may be
25 determined by the devices, by the server or by both the requesting device and the server in combination.

The localisation processor 309 is coupled to a retrieval processor 311 which retrieves the missing part of the
30 content item in response to the information received from the localisation processor 309.

The retrieval processor 311 is coupled to a remote retrieval processor 313 which is arranged to retrieve the missing part from another device of the system.

Specifically the remote retrieval processor 313 is
5 coupled to the network interface 301 and is arranged to transmit a request for the missed part to other devices in the system.

It will be appreciated, that in some embodiments the
10 remote retrieval processor 313 can transmit this request to different devices without knowing if these devices are likely to have the missed part. Specifically, the remote retrieval processor 313 may blindly transmit requests to a number of devices in the hope that one these of will be
15 able to provide the missed part. In other embodiments, the localisation processor 309 may provide an indication of a specific device which is likely to have the missed part. In such a situation, the remote retrieval processor 313 may only transmit the request to this specific
20 device.

If the request is received by a device which has recorded the missed part, this is transmitted back to the server 111 and received by the remote retrieval processor 313
25 from where it is forwarded to the retrieval processor 311. The retrieval processor 311 then forwards the missed part to the transmit controller 307 which transmits it to the requesting device.

30 In some embodiments, the server 111 comprises a local content item storage 315 for storing complete or part content items. For example, whenever a missed item is received from a device of the system, this may

temporarily be stored in the content item storage 315. As another example, this server 111 may itself comprise a broadcast receiver for receiving content items from the TV broadcast transmitter 101. These content items may be
5 stored in the content item storage 315.

The retrieval processor 311 is coupled to the content item storage 315. If the content item storage 315 comprises the missed part, the retrieval processor 311
10 can retrieve this directly therefrom and forward it to the transmit controller 307 for transmission to the first PVR 103.

In some embodiments, the retrieval processor 311 may
15 search through the content items stored in the content item storage 315 to determine if the missed part is stored therein.

In the example of FIG. 3, the retrieval controller 305
20 comprises a recording list processor 317 which is coupled to the network interface 301. In this example, some or all of the devices in the system comprise functionality for transmitting information of which content items are recorded to the server 111. This information is received
25 by the recording list processor 317 which is coupled to a recording list storage 319 in which the recording list processor 317 maintains a list indicating which content items are currently stored at the individual devices.

30 In this case, the localisation processor 309 can be coupled to the recording list storage 319. Whenever a request is received, the localisation processor 309 can search through the recording list storage 319 in order to

identify any device that may have the corresponding missed part. It can then proceed to provide the retrieval processor 311 with the device address of this device. The remote retrieval processor 313 can then proceed to
5 directly request the content item from the identified device thereby facilitating operation and reducing delay and communication resource usage.

Thus, the described system provides an enhanced user
10 service that enhances a broadcast system. Furthermore, the user service is provided without any reliance on the broadcast communication system and by using a different communication system which can be independent of the broadcast communication system. This may for example
15 allow a service provider who is independent of the broadcast service provider to provide an added value service without requiring the approval or involvement of the broadcast service provider.

20 Furthermore, the different communication system may be a system that is better suited to a more targeted communication than the broadcast communication system. For example, whereas the TV broadcast transmitter 101 of FIG. 1 is a conventional wireless broadcast television
25 transmitter, the network 109 may be a wired network or any other suitable network for coupling the devices together. Thus, whereas the broadcast communication system is inherently a one-to-many architecture, the other communication system can be a communication system
30 much which is better suited for communication between individual network nodes. Specifically, the network 109 may be the Internet.

FIG. 4 illustrates an example of a method of retrieving a missed part of a content item in accordance with some embodiments of the invention. The method may specifically be executed by the system of FIG. 1.

5

It will be appreciated, that although the previous description focused on a centralised implementation, a decentralised implementation may be used in other embodiments. For example, the individual devices may
10 directly communicate with each other without a central server and may specifically send requests for missed parts directly to other devices and can equivalently receive missed parts directly from the other devices. Thus, the network may be a peer-to-peer communication
15 network.

As a specific example, the principles may be applied to a mobile television domain (such as DVB-H) without including a centralised server. Rather, communication may
20 achieved by relying on unlicensed short range communication protocols such as WiFiTM or BluetoothTM.

E.g. if a user enters a DVB-H cell in which a broadcast has started for a short period of time, their device can
25 search within the WiFiTM or BluetoothTM range for another device that has recorded the beginning of the broadcast. This process follows a similar process to the approach previously described but with the recording device transferring the missing section over the short range
30 communication protocol.

The described systems may enhance the user experience by avoiding that the user has to either miss the start of a

broadcast or wait for a later transmission. The missed section can be transmitted as a unicast transmission as the majority of the content item is typically received via the broadcast system.

5

It will be appreciated that the above description for clarity has described embodiments of the invention with reference to different functional units and processors. However, it will be apparent that any suitable

10 distribution of functionality between different functional units or processors may be used without detracting from the invention. For example, functionality illustrated to be performed by separate processors or controllers may be performed by the same
15 processor or controllers. Hence, references to specific functional units are only to be seen as references to suitable means for providing the described functionality rather than indicative of a strict logical or physical structure or organization.

20

The invention can be implemented in any suitable form including hardware, software, firmware or any combination of these. The invention may optionally be implemented at least partly as computer software running on one or more
25 data processors and/or digital signal processors. The elements and components of an embodiment of the invention may be physically, functionally and logically implemented in any suitable way. Indeed the functionality may be implemented in a single unit, in a plurality of units or
30 as part of other functional units. As such, the invention may be implemented in a single unit or may be physically and functionally distributed between different units and processors.

Although the present invention has been described in connection with some embodiments, it is not intended to be limited to the specific form set forth herein. Rather, 5 the scope of the present invention is limited only by the accompanying claims. Additionally, although a feature may appear to be described in connection with particular embodiments, one skilled in the art would recognize that various features of the described embodiments may be 10 combined in accordance with the invention. In the claims, the term comprising does not exclude the presence of other elements or steps.

Furthermore, although individually listed, a plurality of 15 means, elements or method steps may be implemented by e.g. a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly be advantageously combined, and the inclusion in different claims does not imply that a 20 combination of features is not feasible and/or advantageous. Also the inclusion of a feature in one category of claims does not imply a limitation to this category but rather indicates that the feature is equally applicable to other claim categories as appropriate. 25 Furthermore, the order of features in the claims does not imply any specific order in which the features must be worked and in particular the order of individual steps in a method claim does not imply that the steps must be performed in this order. Rather, the steps may be 30 performed in any suitable order.

CLAIMS

1. A content item distribution system comprising a plurality of content item presentation devices, at least
5 a first content item presentation device comprising:
first receiving means for receiving content items from a broadcast transmitter broadcasting content items to a plurality of content item presentation devices via a broadcast communication system;
10 means for detecting that a broadcast of a selected content item is ongoing;
means for determining a missed part of the selected content item;
first transmitting means for transmitting a request
15 for the missed part to at least one external source using a different communication system than the broadcast communication system; and
second receiving means for receiving the missed part of the content item via the different communication
20 system.
2. The content item distribution system of claim 1 wherein the first content item presentation device further comprises means for generating a complete
25 selected content item by combining the missed part of the selected content item with a remaining part received from the broadcast transmitter by the first receiving means.
3. The content item distribution system of claim 1
30 wherein the first content item presentation device further comprises means for presenting the complete selected content item to a user.

4. The content item distribution system of claim 3 wherein the first content item presentation device further comprises storage means for storing the complete selected content item.

5

5. The content item distribution system of claim 1 wherein the different communication system is independent of the broadcast communication system.

10 6. The content item distribution system of claim 1 wherein the broadcast communication system is a television broadcast communication system.

7. The content item distribution system of claim 1
15 wherein the broadcast communication system is a wireless broadcast communication system.

8. The content item distribution system of claim 1 further comprising a server, the server comprising:
20 third receiving means for receiving requests for missed parts of content items from content item presentation devices;
means for obtaining missed parts of content items;
and
25 second transmitting means for transmitting missed parts of content items to content item presentation devices.

9. The content item distribution system of claim 8
30 wherein the means for obtaining comprises
means for, in response to receiving the request from the first content item presentation device, requesting

the missed part from at least one other content item presentation device; and

means for receiving the missed part from at least one other content item presentation device; and wherein
5 the second transmitting means is arranged to transmit the missed part to the first content item presentation device.

10. The content item distribution system of claim 9
10 wherein the server comprises:

means for receiving storage information from content item presentation devices, the storage information indicating content items stored at the content item presentation devices; and wherein the means for obtaining
15 comprises means for identifying a first content item presentation device having stored the missed part in response to the storage information.

11. The content item distribution system of claim 8
20 wherein the server comprises storage means for storing at least parts of content items; and wherein the means for obtaining is arranged to determine if requested missed parts are stored in the storage means and if so to retrieve the requested parts from the storage means.

25

12. The content item distribution system of claim 1 wherein the first transmitting means is arranged to transmit the request to at least one other content item presentation device; and the second receiving means is
30 arranged to receive the missed part of the content item from the at least one other content item presentation device.

13. The content item distribution system of claim 1 wherein the different communication system is a peer-to-peer communication network.
- 5 14. The content item distribution system of claim 1 wherein the request comprises an identification of the missed part.
15. The content item distribution system of claim 14
10 wherein the identification comprises at least one indication selected from the group consisting of:
- a. a real time indication of an event of the missed part;
 - b. a duration of the missed part;
 - 15 c. a frame number of an event of the missed part;
 - d. a content item time indication of an event of the missed part; and
 - e. an identification of the selected content item.
- 20 16. The content item distribution system of claim 1 wherein the first content item presentation device further comprises:
- means for storing at least parts of received content items;
 - 25 means for receiving a request for a part of a content item from a requesting source;
 - means for determining if at least some of the part of the content item is stored in the means for storing; and
 - 30 means for transmitting the least some of the part of the content item to the requesting source.

17. The content item distribution system of claim 1 wherein the content item presentation device is a personal video recorder.

5 18. A server for a content item distribution system including a plurality of content item presentation devices for receiving content items from a broadcast transmitter broadcasting content items to the plurality of content item presentation devices via a broadcast
10 communication system, the server comprising:

receiving means for receiving requests for missed parts of content items from content item presentation devices;

means for obtaining missed parts of content items;

15 and

transmitting means for transmitting missed parts of content items to the content item presentation devices.

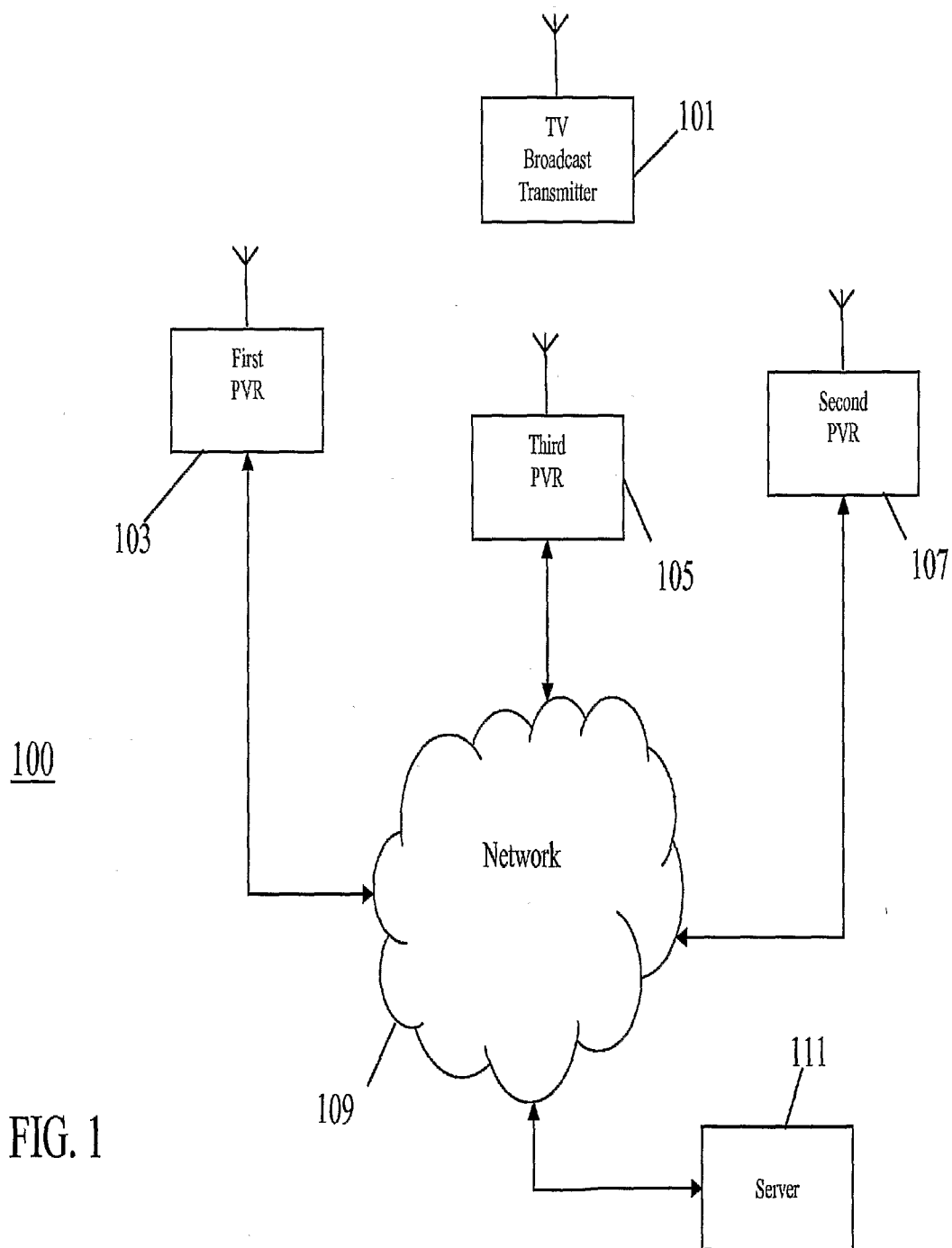
19. A method of operation for a content item
20 distribution system including a plurality of content item presentation devices, the method comprising at least a first content item presentation device performing the steps of:

receiving content items from a broadcast transmitter
25 broadcasting content items to a plurality of content item presentation devices via a broadcast communication system;

detecting that broadcast of a selected content item is ongoing;

30 determining a missed part of the selected content item;

transmitting a request for the missed part to at least one external source using a different communication system than the broadcast communication system; and receiving the missed part of the content item via
5 the different communication system.



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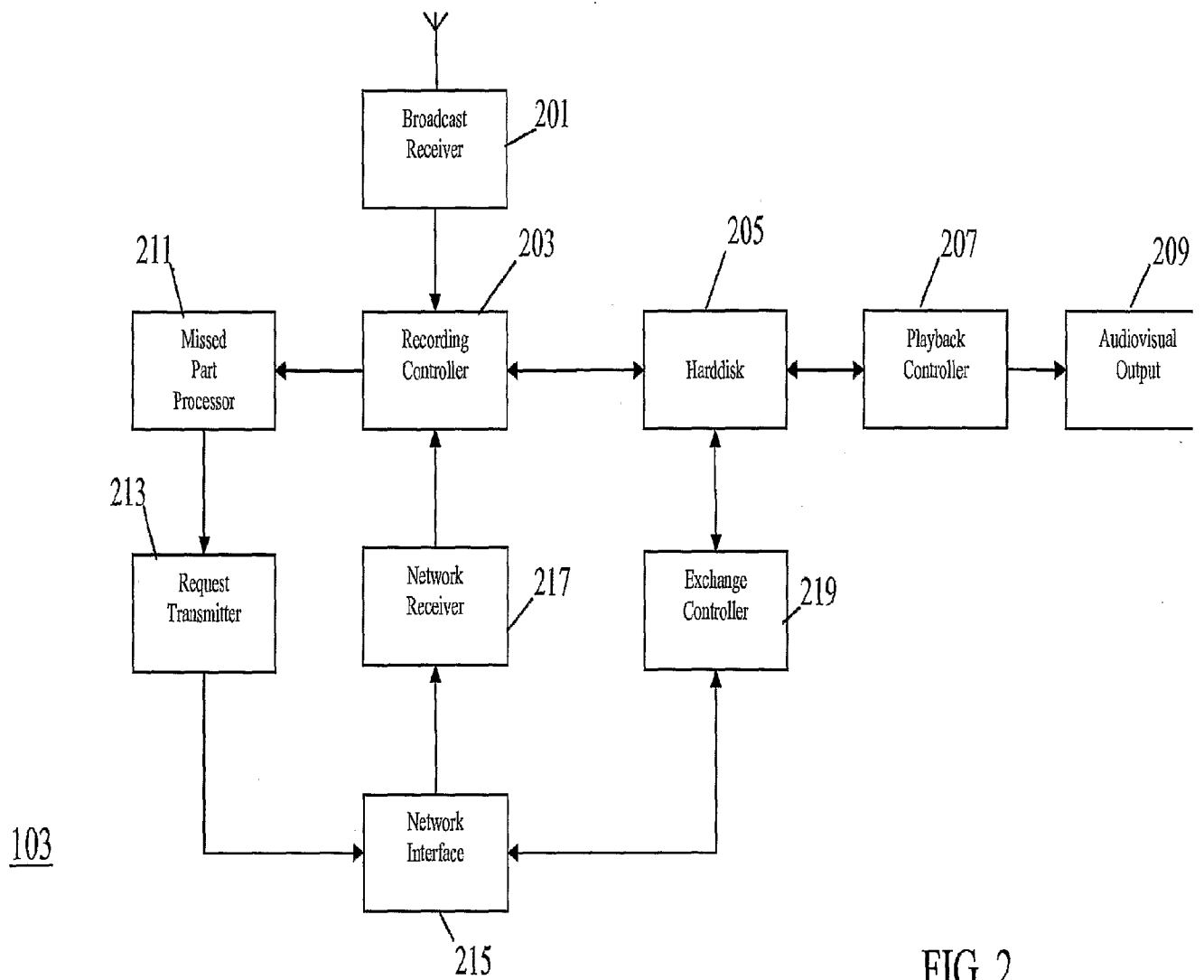
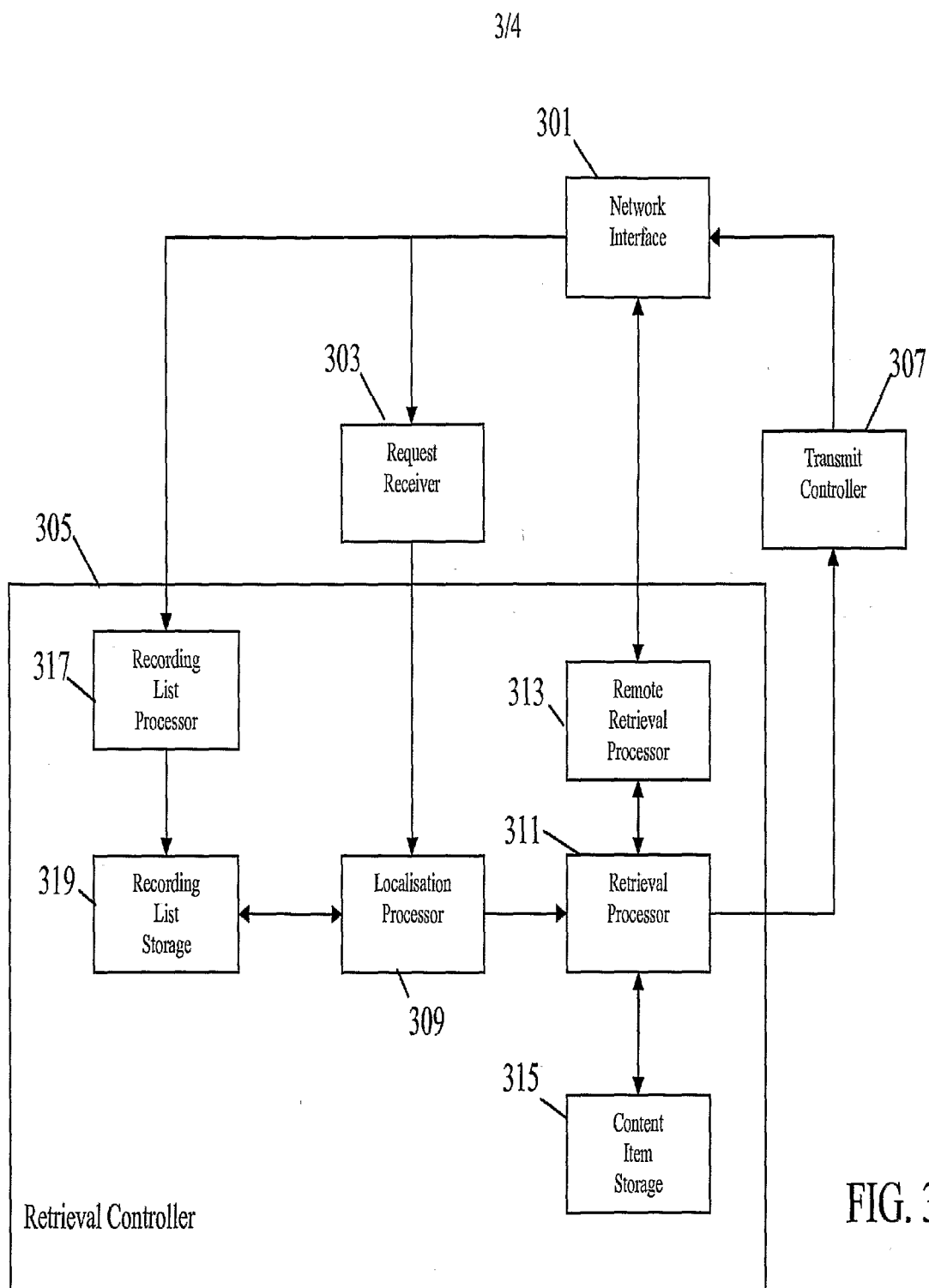


FIG. 2



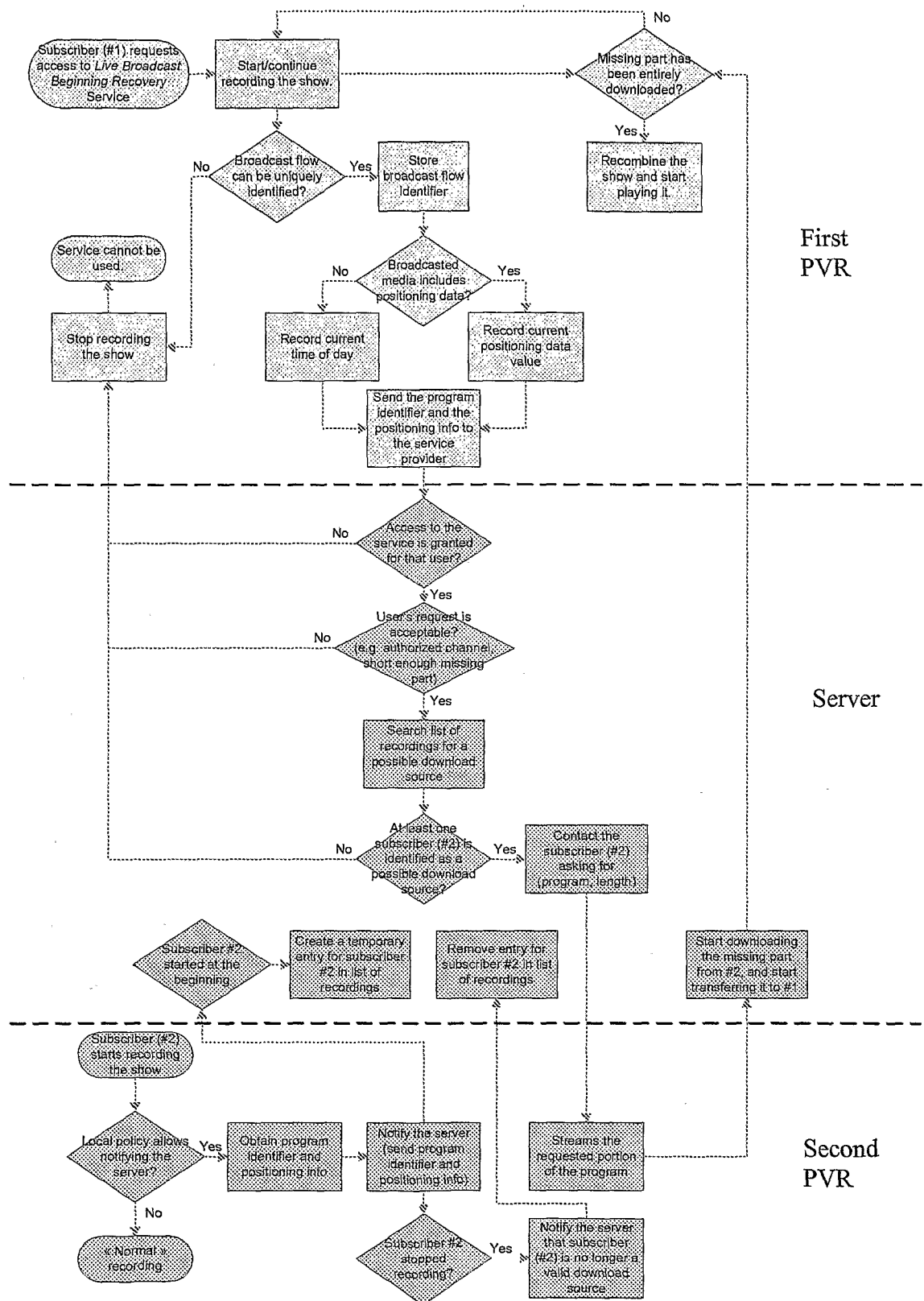


FIG. 4