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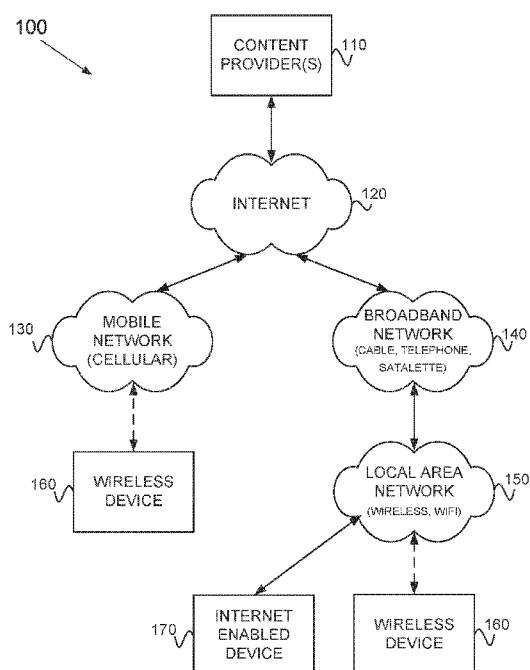


FIG. 1

(57) Abstract: A wireless device may send a request to one or more wireless networks to download content associated therewith (e.g., currently playing, on a play list for future consumption). Request may be sent when wireless device is remote from one or more wireless networks or when wireless device is connected to wireless network and available bandwidth is limited. Request may include information about content, current playback position of content, and location of wireless device. Wireless network may receive request and determine an estimated arrival time for wireless device and an estimated playback location for currently-playing content. Wireless network may download content from content provider off line and store content in storage device connected to wireless network. Wireless device may access stored content when connected to wireless network and play content from storage or copy content thereto.

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DOWNLOADING AND STORING VIDEO CONTENT OFFLINE TO MANAGE VIDEO PLAYBACK

BACKGROUND

[001] More and more content is available via the Internet. The content may be live content or may be prerecorded content. The content may be viewed on any device having an Internet connection and a display. The devices may range from stationary devices such as Internet enabled televisions or entertainment systems to portable devices such as cellular phones, tablet computers, lap top computers and portable media players. Many of the portable devices may be capable of connecting to the Internet either via a mobile network or via a local area network providing wireless communications, often referred to as a wireless network or a WiFi network. The WiFi network is connected to a broadband network and the broadband network connects to the Internet.

[002] **FIG. 1** illustrates an example system diagram **100** showing how wireless devices **160** may receive content via the Internet **120** from a content provider (or content providers) **110**. The content provider(s) **110** may be, for example, a network (e.g., NBC, CNN, ESPN, HBO) providing broadcast programming content (e.g., either pre-recorded or live streaming) or a repository of content that can be selected for on-demand viewing (e.g., Netflix, Hulu, or any of the networks). The content provider(s) **110** may be connected to the Internet **120**. The wireless devices **160** may connect to the Internet **120** and access content from the content providers **110** via a mobile network **130**, such as a cellular network provided by any of the cellular carriers. The wireless devices **160** may also connect to the Internet **120** and access content from the content providers **110** via a broadband delivery network (wide area network) **140**. The delivery

network **140** may be, for example, a cable network, a telephony network, or a satellite network. The wireless devices **160** may connect to the delivery network **140** via a wireless local area network **150**, such as a WiFi network, that is connected to the delivery network **140**. In order to connect to the WiFi network **150** the wireless devices **160** need to be in close proximity to an access point for the WiFi network **150**. The access point may be, for example, a wireless router. Other devices (e.g., Internet enabled devices) **170** may also connect to the access point for the WiFi network **150** via wired connections.

[003] Regardless of the manner in which the wireless devices **160** connect to the content providers **110**, for pre-recorded content the content may be downloaded to the wireless device **160** and stored thereon. The content may be then be played from storage so as to not have to stream in real time. However, all of the content need not be downloaded prior to playback. Rather after some initial content has been downloaded the content can be played while additional content is downloaded. The quality of the playback may vary based on the bandwidth that is available for, and the signal strength of, the network (e.g., mobile **130**, wireless **150**). If adaptive streaming is operational, the download bit rate may vary depending on the network bandwidth and signal strength and the quality and/or resolution of the content may vary according (e.g., low bandwidth and/or low signal strength equals low bit rate and accordingly low quality and/or low resolution).

[004] When a WiFi network **150** is available, it is desirable to connect to the WiFi network **150** as the use of a WiFi network **150** and delivery network **140** is more cost effective than the mobile network **130**. However, when a user is on the go and is not located within a known location the ability to connect to a WiFi network **150** may not be available and the only choice may be to connect via the mobile network **130**. Accordingly, when a user is away from a

WiFi network **150** and they want to view content the content is provided over the mobile network **130**. When the user returns to where they can connect to the WiFi network **150**, the wireless device may connect to the WiFi network **150** and the content may be provided therefrom.

[005] However, the content download and playback on the WiFi network **150** depends on a number of factors including, but not limited to, available bandwidth, congestion on the network (e.g., how many devices are connected thereto), frequency bands supported (e.g., 2.4 GHz, 5 GHz). If the WiFi network **150** has available bandwidth and is not congested then when a wireless device **160** returns home and connects thereto, the playback quality may increase from that provided by the mobile network **130**. However, if the WiFi network **150** is congested (many devices connected thereto) then the playback quality may actually decrease when the wireless device **160** connects to the WiFi network **150**. In some situations, it is possible that the WiFi network **150** is so congested that the download and playback of content at that time may not be possible.

SUMMARY

[006] A method for utilizing a local area network to manage video playback on a wireless device associated with the local area network. The method includes receiving a message from the wireless device that includes information about content associated with the wireless device and a request for the local area network to download the content. The content is downloaded from a content provider offline via the local area network. The content is stored on a storage device connected to the local area network. A determination is made as to when the

wireless device is connected to the local area network. The wireless device is provided access to the stored content.

[007] A device to provide a wireless device an access point to a local area network and to manage video playback on the wireless device. The device includes a wireless interface to communicate with one or more wireless devices. A processor is communicatively coupled to a memory for storing network configuration information including network topology. A computer-readable storage medium to store instructions that when executed by the processor cause the processor to receive a message from the wireless device that includes information about content associated with the wireless device and a request for the local area network to download the content. The content is downloaded from a content provider offline via the local area network and stored on a storage device connected to the local area network. A determination is made as to when the wireless device is connected to the local area network. The wireless device is provided access to the stored content.

[008] A system to manage video playback on a wireless device associated with a local area network. The system includes a mobile agent and a router agent. The mobile agent is to prepare a message including information about content associated with the wireless device, location of the wireless device and a request to download the content and send the message to the local area network. The router agent is to receive the message from the wireless device, download the content from a content provider offline, store the content on a storage device connected to the local area network, determine when the wireless device is connected to the local area network and provide the wireless device access to the stored content.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] Various features of the embodiments described in the following detailed description can be more fully appreciated when considered with reference to the accompanying figures, wherein the same numbers refer to the same elements.

[010] FIG. 1 illustrates an example system diagram showing how wireless devices may receive content via the Internet from content providers.

[011] FIG. 2 illustrates an example high level functional diagram of a wireless device that can be utilized to retrieve and play content, according to one embodiment.

[012] FIG. 3 illustrates an example high level functional diagram of an access point, such as a gateway/router for a WiFi network, according to one embodiment.

[013] FIG. 4 illustrates an example process flow for a mobile agent operating on a wireless device, according to one embodiment.

[014] FIG. 5 illustrates an example process flow for a router agent operating on an access point (e.g., router), according to one embodiment.

[015] FIG. 6 illustrates an example process flow of a wireless device transitioning from actively downloading content to using content previously downloaded offline and stored on a local area network for content currently playing thereon, according to one embodiment.

[016] FIG. 7 illustrates an example process flow of a wireless device transitioning from actively downloading content to using content previously downloaded offline and stored on a local area network for content included in a wish list, according to one embodiment.

[017] FIG. 8 illustrates an example process flow of a wireless device connected to a local area network transitioning from playing actively downloading content to offline

downloading and storing of the content and playing the stored content, according to one embodiment.

[018] FIG. 9 illustrates an example process flow of a local area network downloading and storing content offline and a wireless device copying the content thereto for later playback thereon, according to one embodiment.

DETAILED DESCRIPTION

[019] Providing communication and coordination between a wireless device and a wireless local area network (WiFi) network that the wireless device may connect to can ensure that content playback can occur on the WiFi network. Furthermore, the communications and coordination may ensure that the quality of the playback of content does not decrease when the wireless device connects to the WiFi network from a mobile network. The communications and coordination may include the wireless device sharing with an access point for the WiFi network the content that it is playing and/or is scheduled to be played on the wireless device. The WiFi network may utilize the information to download at least portions of the appropriate content in advance to avoid issues associated with congestion of the WiFi network.

[020] In order for this communication to occur between the wireless device and the WiFi network (access point), the wireless device may include a mobile agent and the access point may include a router agent. The functions of the mobile agent and the router agent and the communications therebetween will be discussed in more detail below.

[021] **FIG. 2** illustrates an example high level functional diagram of a wireless device **200** that can be utilized to retrieve and play content. The wireless device **200** may include a mobile interface **210**, a wireless interface **220**, a video processor **230**, a display **240**, a GPS

module **250**, a processor **260**, memory **270**, and a user interface (UI) **280**. The mobile interface **210** may be to provide communications via a mobile network (e.g., cellular) **130**, including connecting to the Internet. The mobile interface **210** may include a radio for transmitting and receiving data and associated protocols for enabling communications. The wireless interface **220** may be to provide communications directly with other wireless devices or with a wireless network **150** that may provide connectivity to the other wireless devices or with a broadband delivery network **140** for connecting to the Internet. The wireless interface **220** may be, for example, WiFi (wireless local area networking based on the IEEE 802.11), Bluetooth (IEEE 802.15.1) or NFC (near field communications). The wireless interface **220** may include a radio for transmitting and receiving data and associated protocols for enabling communications.

[022] The video processor **230** may be to prepare audio video content for presentation on the wireless device **200**. The video processor **230** may have to decompress the video content prior to presentation. The display **240** may be to present the content to the user, including the playback of video content. The GPS module **250** is to determine the location of the wireless device **200**. The processor **260** is to control the operation of the mobile device **200** and execute processor executable instructions (e.g., software, apps). For example, the processor **260** may execute instructions that cause it to act as a mobile agent as will be discussed in more detail below. The memory **270** is to store the processor executable instructions and/or other data. The other data may include content that is to be displayed on the wireless device **200**. The memory **270** may be located on the processor **260** and/or may be separate from the processor **260**. The memory **270** storing the processor executable instructions may be processor readable memory so that the processor **260** can read and execute the processor executable instructions. The UI **280** may be to provide information to the subscriber and enable the subscriber to interact with the

device **200**. As one skilled in the art would recognize, the types of UIs **270** may vary greatly based on the device **200**.

[023] **FIG. 3** illustrates an example high level functional diagram of an access point, such as a gateway/router **300** for a local area network (LAN) providing wireless (WiFi) communications. Such a network may be referred to as a LAN, wireless network, or WiFi network. The gateway/router **300** may include a broadband network interface **310**, a first WiFi interface (antenna) **320**, a second WiFi interface (antenna) **330**, a wired interface **340**, a processor **350**, memory **360** and a user interface **370**. Network extenders may have similar functional diagrams, but likely do not include the broadband network interface **310**. In addition, some network extenders may not include multiple WiFi interfaces but rather may be limited to operating at a single WiFi frequency.

[024] The broadband network interface **310** is to provide connectivity to and communications with a broadband network **140**. The network interface **310** may include a connector, for example, a coaxial connector for receiving a coaxial cable and associated protocols for providing the necessary communications with the broadband network **140** (e.g., receiving data from and transmitting data to). The broadband network **140** provides access to external content and external systems including the Internet.

[025] The first and second WiFi interfaces (antennas) **320**, **330** are to provide WiFi communications between the gateway/router **300** and wireless devices (establish WiFi networks). The first WiFi interface **320** may be to establish a WiFi network operating at a first frequency (e.g., 5 GHz network pursuant to IEEE 802.11a) and the second WiFi interface **330** may be to establish a WiFi network operating at a second frequency (e.g., 2.4 GHz network pursuant to IEEE 802.11b,g). According to one embodiment, it is possible that a single chip

includes multiple antennas and can provide communications at different frequencies (e.g., 2.4 and 5 GHz network pursuant to IEEE 802.11n). The wireless devices may utilize the gateway/router **300** to communicate with other wireless devices within the location or may use it as an access point to connect to the broadband network **140**.

[026] The wired interface **340** is to provide wired communications between the gateway/router **300** and other devices that can communicate via a wired interface. The other devices may use the gateway/router **300** to communicate with wireless devices (or wired devices) within the location. The other devices may use the gateway/router **300** to access, for example the Internet, via the broadband network **140**. The other devices may be capable of wireless communications even if they connect via the wired interface **340**. The other devices may be network extenders that extend the range of the wireless network within the location. The other devices may be various computing devices and/or Internet enable devices, including but not limited to a set top box (STB), an entertainment system, storage device and appliance. The wired interface **340** may include a connector (e.g., coaxial, Ethernet, USB) to receive an appropriate cable and associated protocols for receiving and transmitting data thereover.

[027] The processor **350** is to control the operation of the gateway/router **300**. The processor **350** is to execute computer-executable instructions (e.g., software, apps). The computer executable instructions, when executed, may cause the processor **350** to control the operations of the gateway/router **300** and perform various functions including, but not limited to, network configuration, activity monitoring and analysis (e.g., statistics, analytics), and adjusting the network configuration, device connectivity, and/or device operations as required. Some of the functions performed by the processor **350** are based on data that is collected about the

network and the devices connected thereto. In addition, the processor **350** may execute instructions that cause it to act as a router agent as will be discussed in more detail below.

[028] The memory **360** is to store the computer-executable instructions and/or other data. The other data may include, for example, configuration data (e.g., set-up of the wireless network), connectivity data (e.g., wireless devices actively connected to the wireless network, signal strength of connected devices, congestion of access points) and/or activity data (e.g., when a wireless device connects to an access point and whether it was a new connection or a transfer from another access point, when a device losses connectivity to an access point). The gateway/router **300** may receive data related to what is connected to the network extenders from the network extenders. The data may be received from the network extenders, for example, when wireless devices connect or disconnect from the network extenders, when the wireless devices communicate with the broadband network **140** which requires communications with the gateway/router **300** and/or at defined intervals (e.g., every few seconds).

[029] The memory **360** may be located on the processor **350** and/or may be separate from the processor **350**. The memory **360** storing the computer-executable instructions may be computer-readable memory so that the processor **350** can read and execute the computer-executable instructions.

[030] The memory **360** may be supplement with external memory that may be located in other access points, in a set top box (STB) or any other device having storage that is connected to the wireless network (via a wireless or wired connection) and/or is in the cloud and can be accessed via a broadband network.

[031] The user interface **370** may include, for example, lights to provide a user an indication about the operational status thereof. The user interface **370** may also include, for

example, switches, buttons or the like to enable the user to, for example, power on/off and/or reset the gateway/router **300**.

[032] The mobile agent within a wireless device is to communicate with the router agent within an access point (e.g., router) for one or more wireless (WiFi) local area networks that the wireless device often connects to. The mobile agent is to communicate information about content that the wireless device is playing or desires to play with the one or more WiFi networks. The mobile agent may also utilize location data about wireless device and the one or more WiFi networks in order to determine when the wireless device will be available to connect to the one or more WiFi networks. It may also utilize the location information to determine if content that is currently playing will be complete when the wireless device connects to the one or more WiFi networks at which time the wireless device may switch to receiving the content from the WiFi network.

[033] **FIG. 4** illustrates an example process flow for a mobile agent **400** operating on a wireless device. The mobile agent **400** may receive information regarding content **410** that the wireless device is currently playing or has scheduled to be played, information related to wireless (WiFi) networks **420** that the wireless device has previously connected to, and information related to location **430** of the wireless device. The content information **410** may be at least some portion of the meta data related to the content including, but not limited to, title of the content, location where the content is being downloaded from (e.g., content server), audio-video format of the content, media container format, and duration of the content. The content information **410** may also include other information, such as current playback position for content currently being played and order of proposed content playback for content included in a wish list.

[034] The WiFi network information **420** may include an indication of whether the wireless device is currently connected to a WiFi network and a list of WiFi networks that the wireless device has connected to (e.g., home network, work network, gym network, restaurant network). The WiFi network information **420** may also include connection details for these WiFi networks, including but not limited to, location of the WiFi network, day and time the WiFi connection was established and day and time the WiFi connection was terminated. The WiFi network information **420** may include statistics and/or analytics that were calculated for these WiFi networks including, but not limited to, details regarding when the wireless device typically connects to these WiFi networks (e.g., every evening around 6pm, Mon-Fri around 9am, weekends around 7am), how often the wireless device connects to these WiFi networks (e.g., twice a day, once a week), how long the wireless device stays connected to these WiFi networks (e.g., 10 hours, 6 hours, 30 minutes), how long the wireless device is typically connected to a mobile network before it connects to these WiFi network (e.g., 20 minutes, 1 hour), whether the wireless device typically comes from another WiFi network prior to connecting to these WiFi networks (e.g., from work WiFi) and whether the wireless device typically goes to another WiFi network after disconnecting from a WiFi network (e.g., to home WiFi).

[035] The wireless device location information **430** may include information about the location of the wireless device, whether the wireless device is moving and what direction the wireless device is headed. The wireless device location information **430** may be captured by the GPS module **250**.

[036] The mobile agent **400** may become active when the wireless device is playing content (or is scheduled to play content). Once activated, the mobile agent **400** may receive the content information **410**, the WiFi network information **420** and the wireless device location

information **430** and may begin processing the information received. Initially, the mobile agent **400** may make a determination about where the wireless device may be headed (e.g., is it headed to a specific WiFi network, are any WiFi networks excluded). It should be noted that the determination of which WiFi network the wireless device may or may not be headed to may be limited to those networks that the mobile agent **400** will have permission to communicate with and utilize the resources of (e.g., personal networks, home networks). That is, the mobile agent **400** may not be authorized to communicate with or use resources of a WiFi network that the wireless device connects to at, for example, a restaurant, a store or a gym.

[037] The initial determination may be made based on historical data that has been collected about the wireless device. For example, at the end of a work day the wireless device may typically travel home and connect to the home WiFi network. On weekends, the wireless device may typically head to a cabin and connect to the cabin WiFi network. The initial determination may be augmented or replaced by comparing the movement of the wireless device captured in the wireless device location information **430** to locations of the WiFi networks captured in the WiFi network information **420**. For example, if the device is traveling in a north bound direction and one or more of the WiFi networks are south from a current location of the device those WiFi networks may be excluded. The mobile agent **400** may interact with a mapping program (e.g., Google Maps ®) **440** in order to compare the location and movement of the wireless device to the location of the WiFi networks. The interaction with the mapping program **440** may be via the Internet **120**.

[038] Once a set of possible WiFi networks is identified, the mobile agent **400** may determine an estimated time of arrival at each of the possible WiFi networks. The mobile agent **400** may interact with the mapping program **440** in order to determine the expected arrival time

at each of the WiFi networks. The mobile agent **400** may compare the estimated travel time to the remaining content duration for currently-playing content to determine if the content will still be playing when the wireless device arrives at the WiFi network.

[039] The mobile agent **400** may send messages to each of the possible WiFi networks. The messages may act as a request to download content and may include an actual request. The messages may be sent to router agents **500** for the possible WiFi networks. The messages may include, but is not limited to, information about any content being played (e.g., title, duration, current playback position, audio-video format, media container format), any content included in a wish list for the wireless device (e.g., title, duration, audio-video format, media container format), and location of the wireless device. The messages may be sent via the Internet **120**. As the WiFi network (access point) is connected to the Internet **120** via the delivery network **140**, the messages may be routed through the delivery network **140**.

[040] **FIG. 5** illustrates an example process flow for the router agent **500** operating on an access point (e.g., router). The router agent **500** may receive the messages from the mobile agent **400**. As noted above, the messages may act as a request to download content and may include an actual request. The router agent **500** may utilize the information regarding the location of the wireless device from the messages and the location information about where it is located and determine an estimated time of arrival for the wireless device. The router agent **500** may interact with a mapping application **510** in order to determine the estimated arrival time. The mapping application **510** may be the same as the mapping application **440** or may be a different application.

[041] For content currently being played on the wireless device, the router agent **500** may determine an estimated playback point at the time that the wireless device arrives at the

location (e.g., will be 44 minutes into the 60 minute movie, will have 16 minutes of the movie remaining).

[042] The router agent **500** may communicate with the content providers **110** to download content. The content may be downloaded offline (e.g., not while the user is consuming it). The content may be downloaded by the access point (e.g., router) or the router agent may instruct other devices to download the content. The content may be downloaded via available wireless bandwidth or wired bandwidth. The downloaded content may be stored in storage **520** connected to the WiFi network. The storage **520** may be for example, a hard drive of a STB, available storage within any device connected to the WiFi network (e.g., entertainment system, computer) or a storage device connected to the WiFi network. The download of the content may be the entire content or at least a portion thereof so that the wireless device can play that portion from the storage **520** while additional content continues to be downloaded offline.

[043] The router agent **500** may communicate the location of the storage **520** where the content is being stored to the mobile agent **400** when the wireless device connects to the WiFi network and the timing for switching to the stored content from the downloading of the content to provide a seamless transition. The switching to downloaded content when the user connects to the WiFi network should ensure that the quality of the content playback is maintained or increased as any bandwidth limitations with the WiFi network should not affect quality. Furthermore, as the wireless device need not connect to the Internet **120** via the WiFi network in order to obtain the content at that point, the impact to bandwidth of the wireless device joining the WiFi network is reduced.

[044] **FIG. 6** illustrates an example process flow of a wireless device transitioning from actively downloading content to using content previously downloaded offline and stored on a

local area network (WiFi) for content currently playing thereon **600**. Initially the wireless device is determined to be watching content while the wireless device is traveling and is connected to the mobile network **610**. The mobile agent calculates travel time to arrive at one or more possible local area (WiFi) networks that the wireless device may be headed to **620**. The mobile agent calculates an estimated playback location of the content at the WiFi networks based on the current playback location and the estimated arrival times at the WiFi networks **630**. For the WiFi networks where it is estimated that the content will still be playing when the wireless device arrives, the mobile agent may send messages to the WiFi network (router agent) **640**. As described above, the messages may include information about the content, the current playback location in the content and the current location of the wireless device.

[045] When the routing agent receives the message, the routing agent may calculate an estimated arrival of the wireless device **650** and an estimated playback location of the content at the arrival time **660**. The routing agent may then instruct the router or other device connected to the WiFi network (either via wireless connection or wired connection) to connect with the content providers **110** to download the content from the estimated playback location **670**. The content may be downloaded at an appropriate bit rate offline. The content may be stored in a storage device connected to the WiFi network. The routing agent may detect when the wireless device connects to the WiFi network **680**. It should be noted that if the message from the mobile agent was sent to more than one router agent, that a subset of the router agents may not detect the arrival of the wireless device. Once the wireless device has been detected by the WiFi network, the mobile agent and the router agent may communicate to have the content being presented switch from an active download to the stored content **690**.

[046] The method 600 is in no way intended to be limited to the illustrated processes. Rather, additional processes can be added, processes can be combined, processes can be deleted, processes can be modified and/or the order of the processes can be modified without departing from the current scope.

[047] FIG. 7 illustrates an example process flow of a wireless device transitioning from actively downloading content to using content previously downloaded offline and stored on a local area network (WiFi) for content on a wish list 700. Initially the wireless device is determined to be watching content while the wireless device is traveling and is connected to the mobile network 710. The user adds content to a wish list for the wireless device 720. The wireless device may be configured to continue to play content including content on the wish list in sequential order. The mobile agent may send messages to router agents associated with one or more possible local area (WiFi) networks that the wireless device may be headed to 730. As described above, the messages may include information about the content in the wish list and the current location of the wireless device.

[048] When the routing agent receives the message, the routing agent may calculate an estimated arrival of the wireless device 740. The routing agent may then instruct the router or other device connected to the WiFi network (either via wireless connection or wired connection) to connect with the content providers 110 to download the content from the wish list 750. The content may be downloaded at an appropriate bit rate offline. The content from the wish list is then stored in a storage device connected to the WiFi network. The routing agent may detect when the wireless device connects to the WiFi network 760. It should be noted that if the message from the mobile agent was sent to more than one router agent, that a subset of the router agents may not detect the arrival of the wireless device. Once the wireless device has been

detected by the WiFi network, the mobile agent and the router agent may communicate so that when the content from the wish list is to be played that the content is taken from the stored content (and need not download) **770**.

[049] The method **700** is in no way intended to be limited to the illustrated processes. Rather, additional processes can be added, processes can be combined, processes can be deleted, processes can be modified and/or the order of the processes can be modified without departing from the current scope.

[050] FIGs. 6 and 7 focus on downloading content to a WiFi network before the wireless device connects to the WiFi network in order to prevent playback issues that may be associated with the WiFi network being congested (not having sufficient bandwidth available to download the content in real time) and affecting the quality of the content being presented as the connectivity switches from the mobile network **120** to the WiFi network. The issues associated with content playback when a wireless device enters the WiFi network may also exist when the wireless device is connected to the WiFi network. That is, congestion may affect the quality of content that is presented on a wireless device when the wireless device is connected to the WiFi network and actively downloading the content it is presenting.

[051] **FIG. 8** illustrates an example process flow of a wireless device connected to a local area (WiFi) network transitioning from playing actively downloading content to downloading and storing of the content offline and playing the stored content **800**. Initially the wireless device is playing content while connected to a WiFi network **810**. The content is being downloaded and played in real time and there may be some quality issues associated therewith. For example, a particular WiFi frequency band that the wireless device supports (e.g., 2.4 GHz, 5 GHz) may be congested. The mobile agent may send a message to the router agent regarding

the content that is being played **820**. The message may include a request for downloading the currently-playing content via some other means (e.g., different wireless frequency band, wired connection). The router agent may find available bandwidth via alternative means, such as on alternative frequency bands (e.g., 5 GHz, 2.4 GHz) or wired connection **830**. The router agent may then instruct the router or devices connected to the WiFi network (e.g., a wireless device, a wired device) to download the content offline and store it in a storage device connected to the WiFi network **840**. The portion of the content that is downloaded and stored may be configurable (e.g., entire content, from current playback position, from a certain time after the current playback position). Once the content is downloaded, the router agent may switch the presentation of the content from active download to the stored content **850**.

[052] The method **800** is in no way intended to be limited to the illustrated processes. Rather, additional processes can be added, processes can be combined, processes can be deleted, processes can be modified and/or the order of the processes can be modified without departing from the current scope.

[053] FIGs. 6-8 have focused on downloading content to a WiFi network so that when the content is played on the wireless device when the wireless device is connected to the WiFi network the content can be played from storage rather than actively downloading the content for presentation. Sometimes content may be downloaded for storage on the wireless device so that the content can be played at a later time, possibly when there is no Internet connectivity via the mobile network **120** or a WiFi network. The downloading of the content to the wireless device via the mobile network **120** or a WiFi network may result in bit rate problems based on the signal strength and bandwidth available.

[054] **FIG. 9** illustrates an example process flow of a local area (WiFi) network downloading and storing content offline and a wireless device copying the content thereto for later playback thereon **900**. Initially the wireless device defines content that it would like to store thereon for later playback **910**. The content may be added at any point (e.g., while connected to mobile network, while connected to WiFi network). The mobile agent may send messages to one or more possible WiFi networks (router agents) that the wireless device may connect to **920**. As described above the messages may include information about the content and the current location of the wireless device. It should be noted that if the content is added while the wireless device is connected to a WiFi network the message may simply be sent to that router agent and the location of the wireless device may not be included in the message.

[055] When the routing agent receives the message, the routing agent may instruct the router or other devices connected to the WiFi network, to connect with the content providers **110** to download and store the content in a storage device connected to the WiFi network **930**. The content may be downloaded at an appropriate bit rate offline. If the wireless device was not connected to the WiFi network at the time the message was sent, the routing agent may detect when the wireless device connects to the WiFi network **940**. After the content has been downloaded and the wireless device is connected to the WiFi network, the router agent may provide the wireless device with a location where the content is stored **950**. The wireless device may then copy the content from the location where it is stored **960**. Once the content has been copied to the wireless device the wireless device may view the content regardless of being connected to the Internet.

[056] The method **900** is in no way intended to be limited to the illustrated processes. Rather, additional processes can be added, processes can be combined, processes can be deleted,

processes can be modified and/or the order of the processes can be modified without departing from the current scope.

[057] Computer-executable instructions (e.g., software, apps) may be stored on a computer-readable storage medium (e.g., **270, 360**). The computer-executable instructions when executed by a processor (e.g., **260, 350**) may cause the processor to perform any of the methods **600-900**.

[058] The various embodiment described above have been described with respect to the wireless device connecting to a local area (WiFi) network that they control (e.g., personal network, home network). The disclosure is in no way intended to be limited thereto. For example, a hotel may include access to a WiFi network and storage connected thereto as part of a reservation. A mobile agent may communicate with a router agent for the WiFi network to perform any of the functions described above in FIGs 6-9. That is, the WiFi network may download and store content offline and make the content accessible to the wireless device when the wireless device connects to the WiFi network. The use of business networks in this manner is not limited to hotels. Rather, various businesses (e.g., restaurants, gyms, convention centers) may provide this type of service without departing from the current scope.

[059] Although the disclosure has been illustrated by reference to specific embodiments, it will be apparent that the disclosure is not limited thereto as various changes and modifications may be made thereto without departing from the scope. Reference to “one embodiment” or “an embodiment” means that a particular feature, structure or characteristic described therein is included in at least one embodiment. Thus, the appearances of the phrase “in one embodiment” or “in an embodiment” appearing in various places throughout the specification are not necessarily all referring to the same embodiment.

[060] The various embodiments are intended to be protected broadly within the spirit and scope of the appended claims.

CLAIMS

We claim:

1. A method for utilizing a local area network to manage video playback on a wireless device associated with the local area network, the method comprising
receiving a message from the wireless device that includes information about content associated with the wireless device and a request for the local area network to download the content;
downloading the content from a content provider offline via the local area network;
storing the content on a storage device connected to the local area network;
determining when the wireless device is connected to the local area network; and
providing the wireless device access to the stored content.
2. The method of claim 1, wherein the receiving the message includes receiving the message that includes information about a currently-playing content that is currently being played on the wireless device including current playback position of the content.
3. The method of claim 2, wherein
the currently-playing content is currently being played via a mobile network;
the receiving the message includes receiving the message that includes location of the wireless device;
further comprising determining an approximate playback position of the currently-playing content when the wireless device connects to the local area network; and

the downloading includes downloading the currently-playing content from the approximate playback position.

4. The method of claim 3, wherein the providing the wireless device access to the stored content includes switching playback of the currently-playing content from active downloading to the currently-playing content stored in the storage device at an appropriate point.

5. The method of claim 2, wherein:

the currently-playing content is currently being played via a first wireless frequency band of the local area network and bandwidth associated with the first wireless frequency band is limited and playback of content is below desired quality;

the step of receiving the message includes receiving the message that includes a request for downloading the currently-playing content via an alternative to the first wireless frequency band;

the method further comprises finding available bandwidth on the local area network as the alternative to the first wireless frequency band; and

the step of downloading includes downloading the content via the available bandwidth.

6. The method of claim 5, wherein

the step of finding the available bandwidth includes finding the available bandwidth on a wired connection to the local area network or on a wireless connection operating at a different frequency band; and

the step of downloading the content via the available bandwidth includes downloading the content via the wired connection to the local area network or via the wireless connection operating at the different frequency band.

7. The method of claim 1, wherein the step of receiving the message includes receiving the message that includes information about content that is on a wish list for the wireless device.

8. The method of claim 7, wherein the step of providing the wireless device access to the stored content includes enabling playing of the content on the wish list from the content stored in the storage device.

9. The method of claim 7, wherein the step of providing the wireless device access to the stored content includes enabling copying of the content on the wish list from the content stored in the storage device to the wireless device.

10. A device to provide, to a wireless device, an access point for a local area network and to manage video playback on the wireless device, the device comprising:

- a wireless interface to communicate with one or more wireless devices;
- a processor communicatively coupled to a memory for storing network configuration information, wherein the network configuration information includes network topology; and
- a computer-readable storage medium to store instructions that when executed by the processor cause the processor to:

receive a message from the wireless device that includes information about content associated with the wireless device and a request for the local area network to download the content;

download the content from a content provider offline via the local area network;

store the content on a storage device connected to the local area network;

determine when the wireless device is connected to the local area network; and

provide the wireless device access to the stored content.

11. The device of claim 10, wherein when the instructions are executed they further cause the processor to:

receive a message that includes current playback position of a currently-playing content that is currently being played on the wireless device and current location of the wireless device;

determine an approximate playback position of the currently-playing content when the wireless device connects to the local area network, and

download the currently-playing content from the approximate playback position.

12. The device of claim 11, wherein when the instructions are executed they further cause the processor to instruct the wireless device to switch playback of the currently-playing content from active downloading to the currently-playing content stored in the storage device at an appropriate point.

13. The device of claim 10, wherein when the instructions are executed they further cause the processor to

receive a request for downloading currently-playing content via an alternative to current frequency band associated with the wireless device that has limited bandwidth that causes playback of content to be below desired quality;

find available bandwidth on the local area network as the alternative to the current frequency band, wherein the available bandwidth may be on a wired connection to the local area network or on a wireless connection operating at a different frequency band;

download the currently-playing content via the available bandwidth; and

instruct the wireless device to switch playback of the currently-playing content from active downloading to the currently-playing content stored in the storage device at an appropriate point.

14. The device of claim 10, wherein when the instructions are executed they further cause the processor to

receive a message that identifies content that is on a wish list for the wireless device; and

enable the wireless device to play the content on the wish list from the content stored in the storage device.

15. The device of claim 10, wherein when the instructions are executed they further cause the processor to

receive a message that identifies content that is on a wish list for the wireless device; and

enable the wireless device to copy the content on the wish list from the content stored in the storage device to the wireless device.

16. A system to manage video playback on a wireless device associated with a local area network, the system comprising:

a mobile agent configured to:

prepare a message including information about content associated with the wireless device, location of the wireless device and a request to download the content; and

send the message to the local area network; and

a router agent configured to:

receive the message from the wireless device;

download the content from a content provider offline;

store the content on a storage device connected to the local area network;

determine when the wireless device is connected to the local area network; and

provide the wireless device access to the stored content.

17. The system of claim 16, wherein

the mobile agent is further configured to include current playback position of a currently-playing content that is currently being played on the wireless device in the message; and

the router agent is further configured to:

determine an approximate playback position of the currently-playing content when the wireless device connects to the local area network;

download the currently-playing content from the approximate playback position;

and

instruct the wireless device to switch playback of the currently-playing content from active downloading to the currently-playing content stored in the storage device at an appropriate point.

18. The system of claim 16, wherein
the mobile agent is further configured to include current frequency band utilized for playback and an indication the current frequency band has limited bandwidth that causes playback of content to be below desired quality in the message; and

the router agent is further configured to:

find available bandwidth on the local area network as an alternative to the current frequency band, wherein the available bandwidth may be on a wired connection to the local area network or on a wireless connection operating at a different frequency band;

download a currently-playing content via the available bandwidth; and

instruct the wireless device to switch playback of the currently-playing content from active downloading to the currently-playing content stored in the storage device at an appropriate point.

19. The system of claim 16, wherein
the mobile agent is further configured to include content on a wish list in the message;
and

the router agent is further configured to enable the wireless device to play the content on the wish list from the content stored in the storage device.

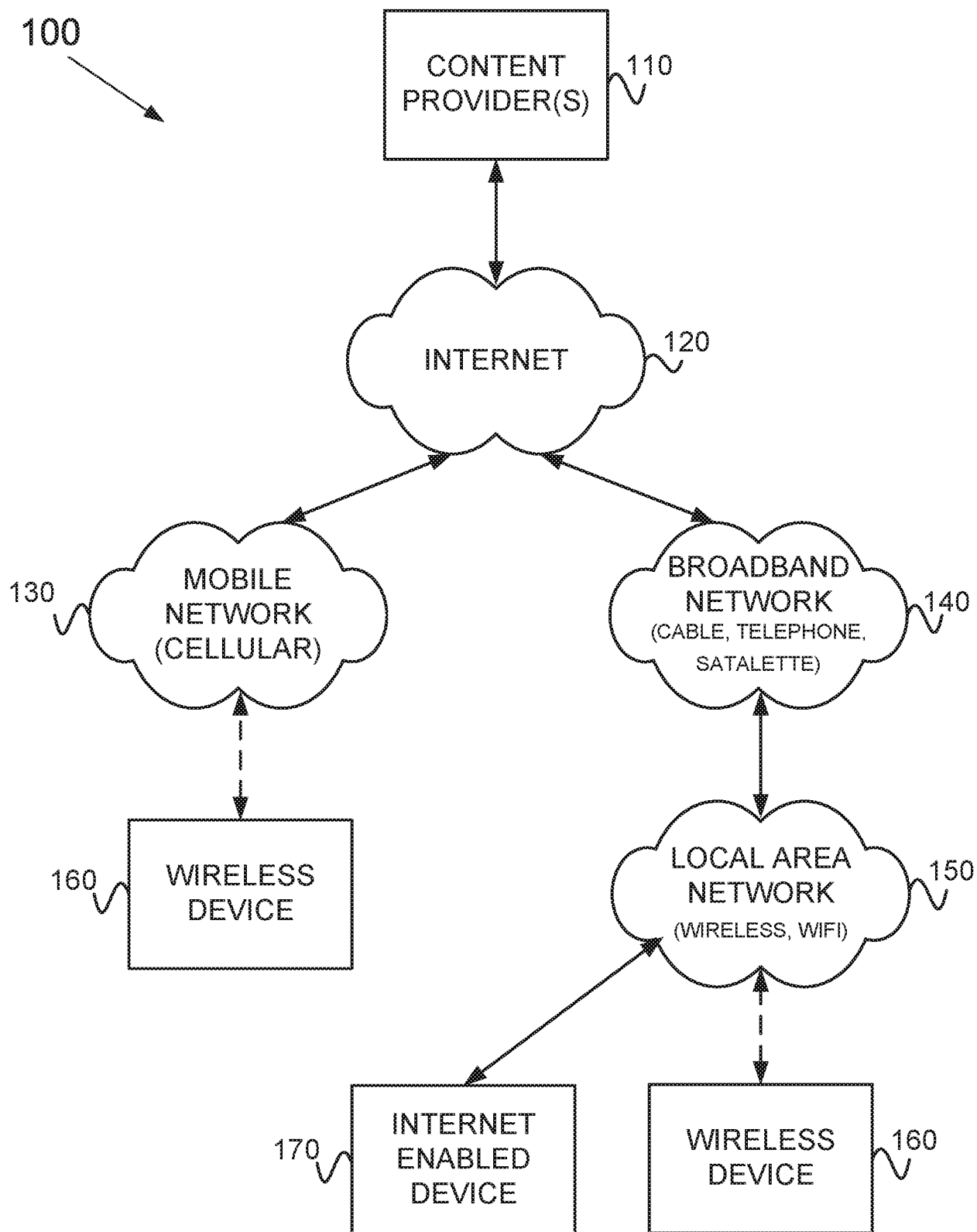
20. The system of claim 16, wherein

the mobile agent is further configured to include content on a wish list in the message;

and

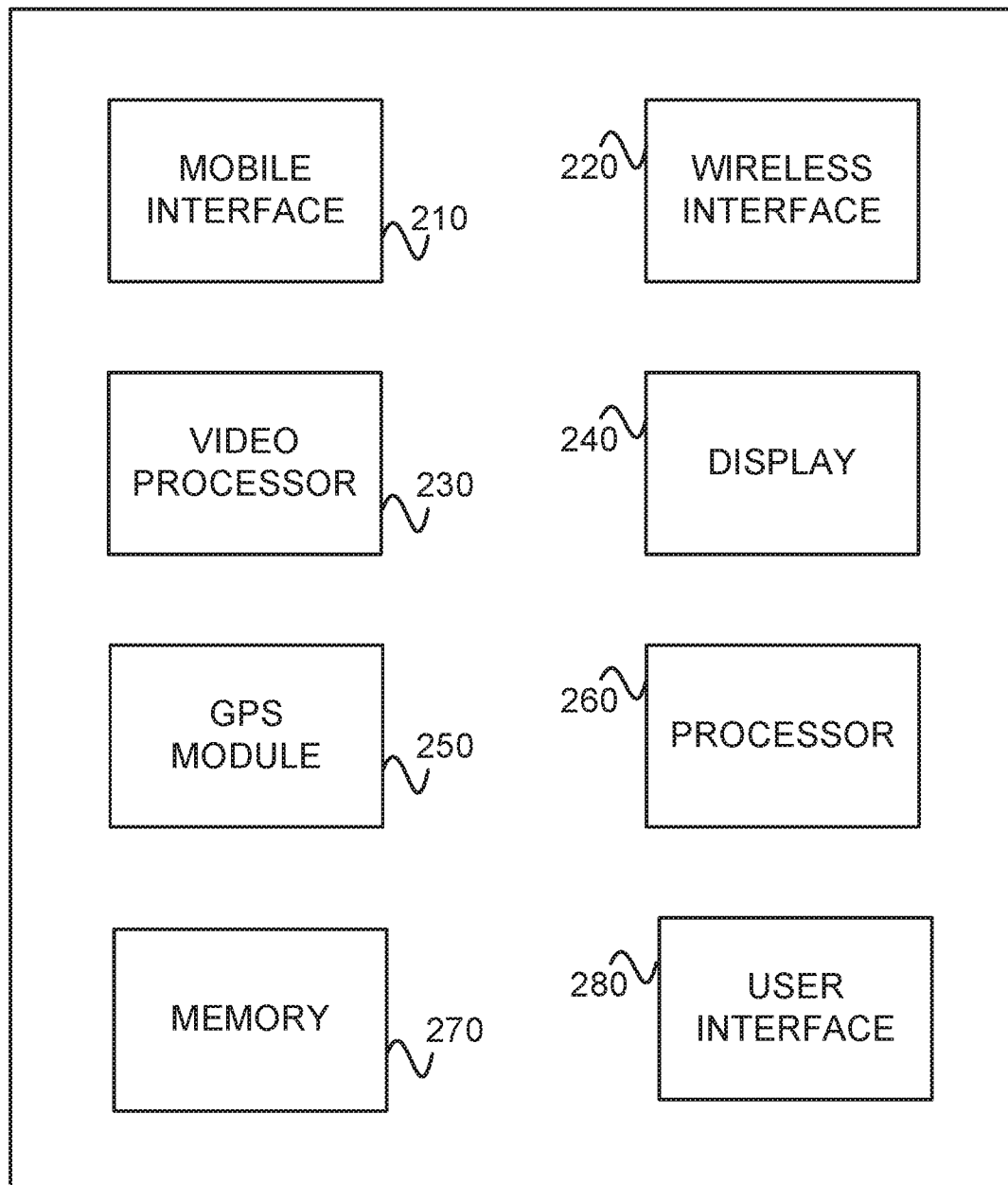
the router agent is further configured to enable the wireless device to copy the content on the wish list from the content stored in the storage device to the wireless device.

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**FIG. 1**

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200

**FIG. 2**

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300

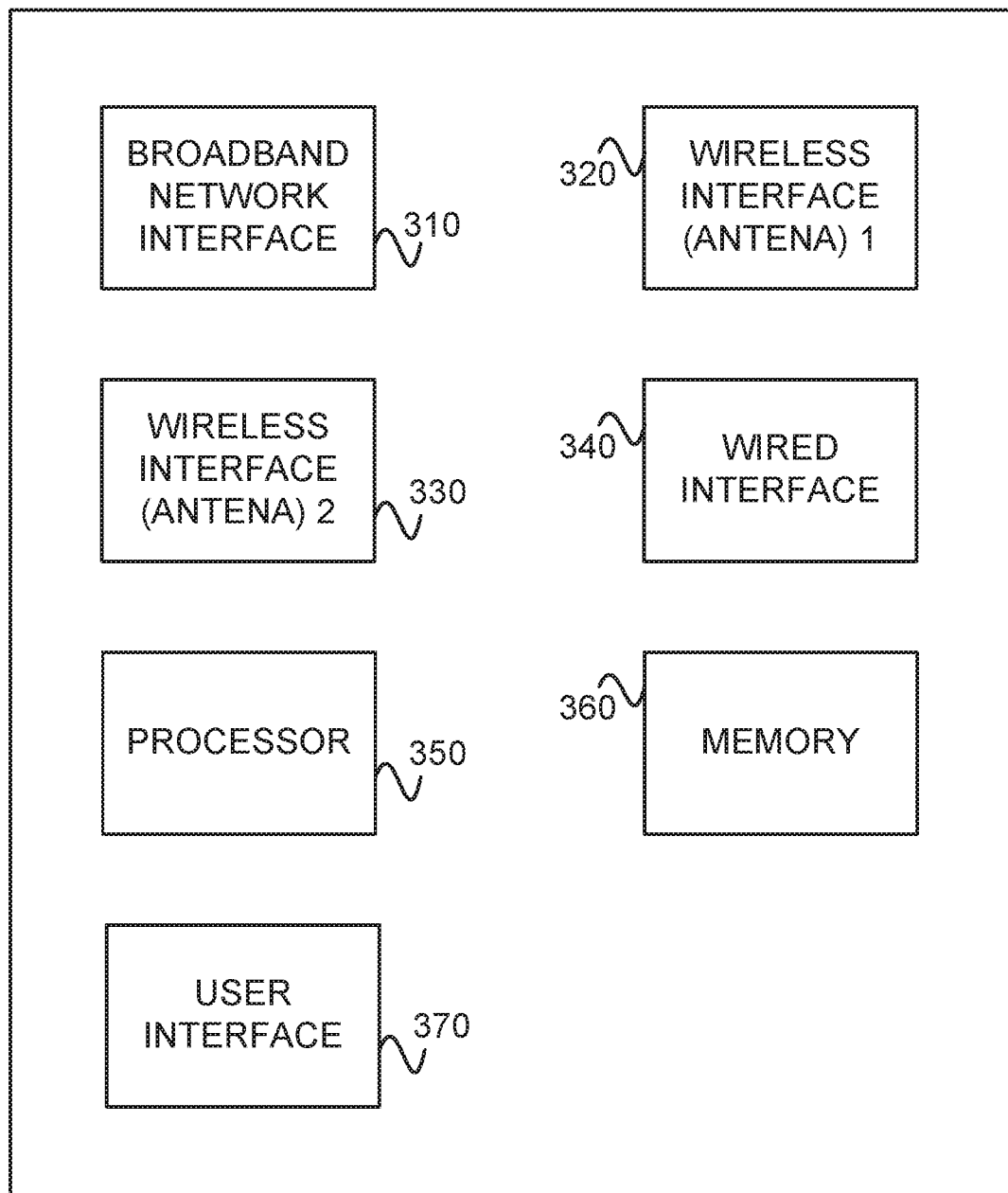
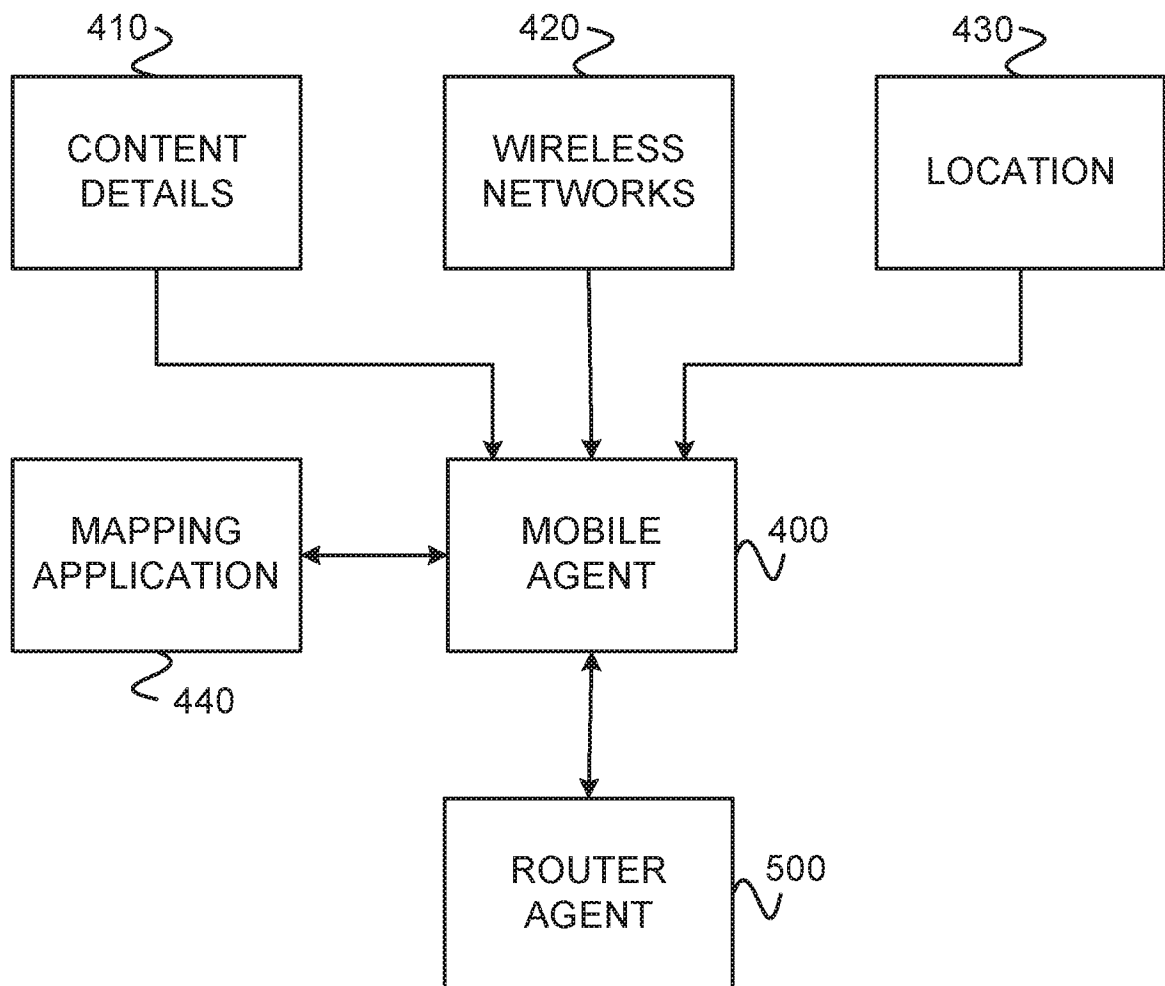
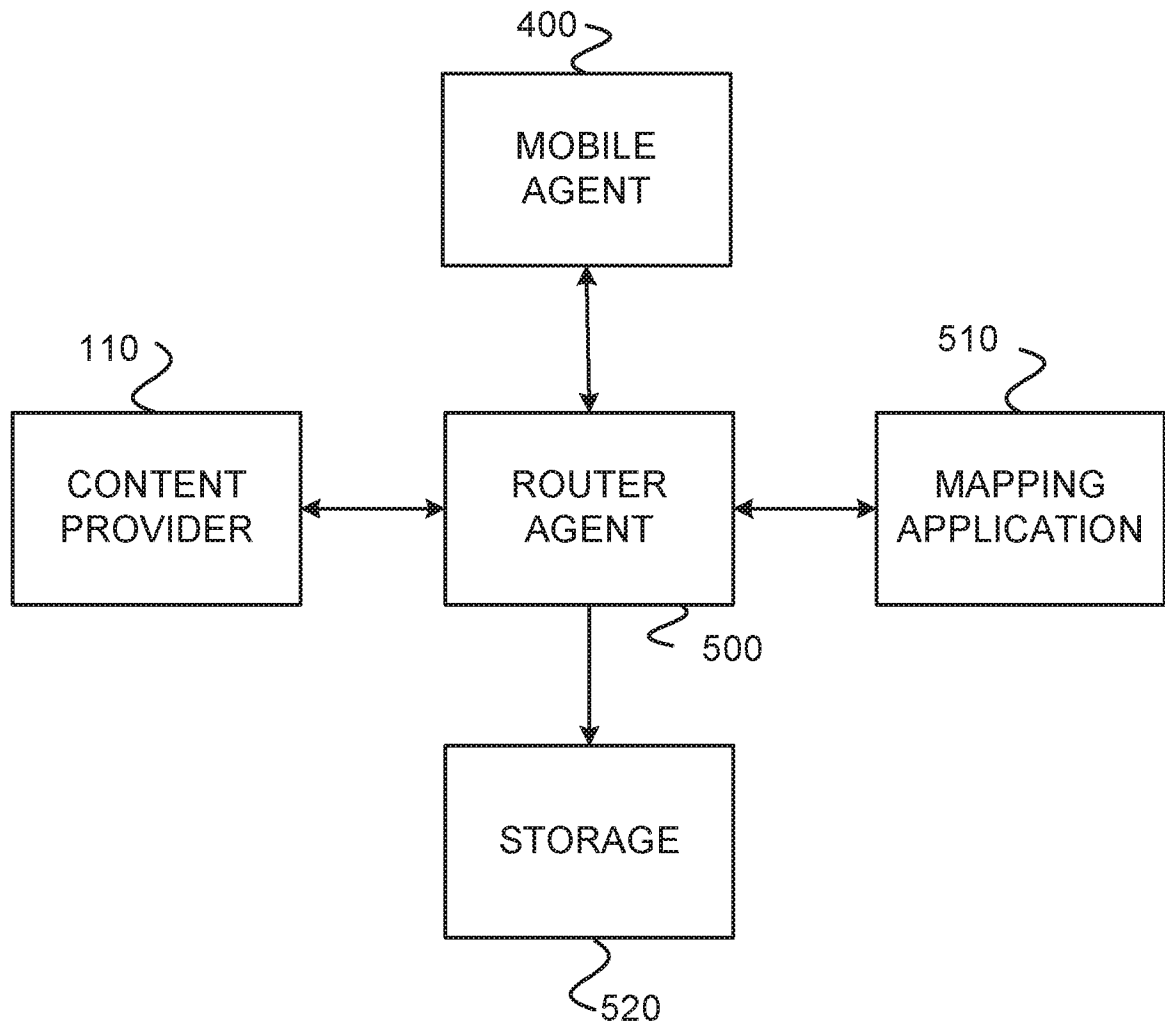


FIG. 3

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**FIG. 4**

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**FIG. 5**

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600

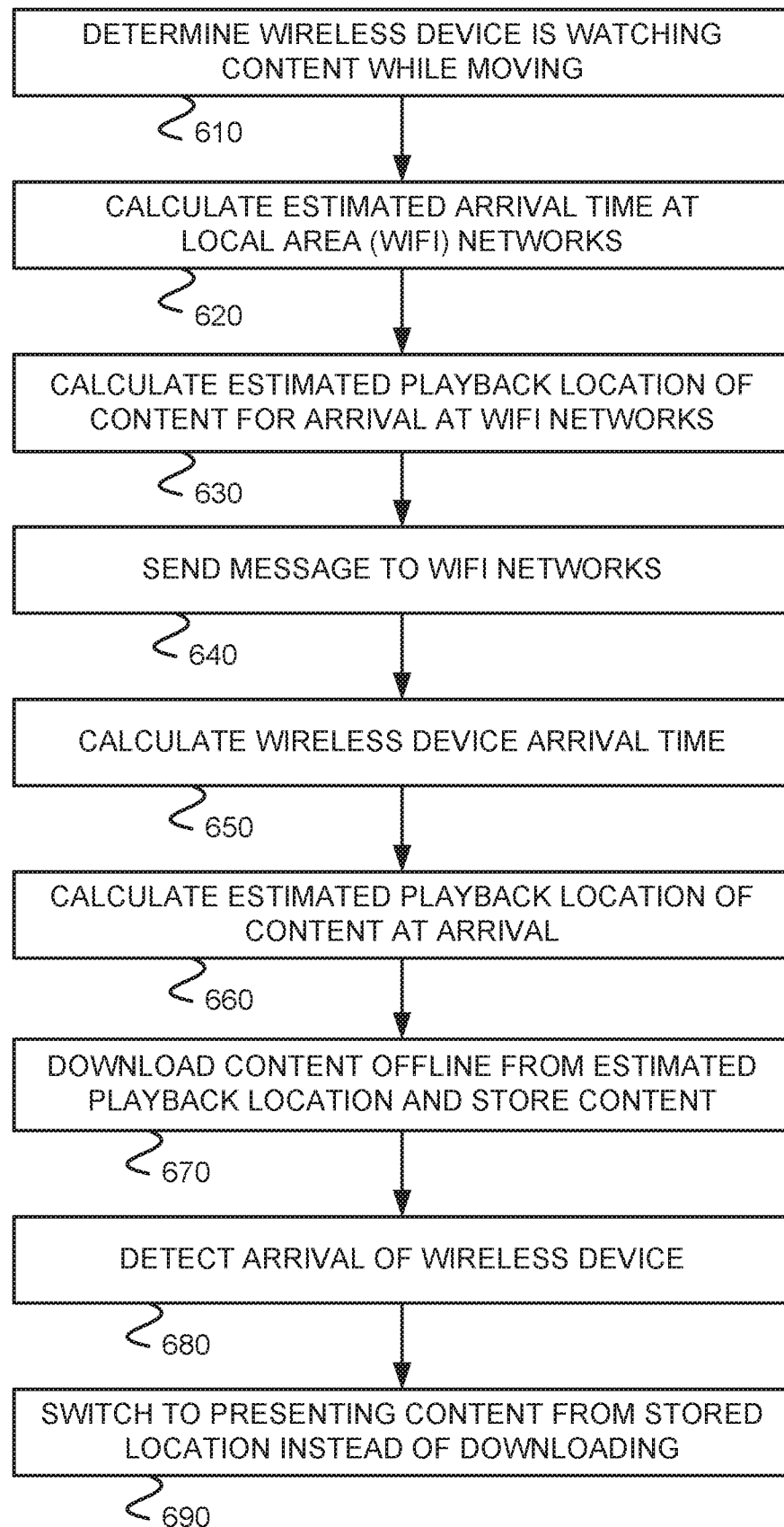


FIG. 6

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700

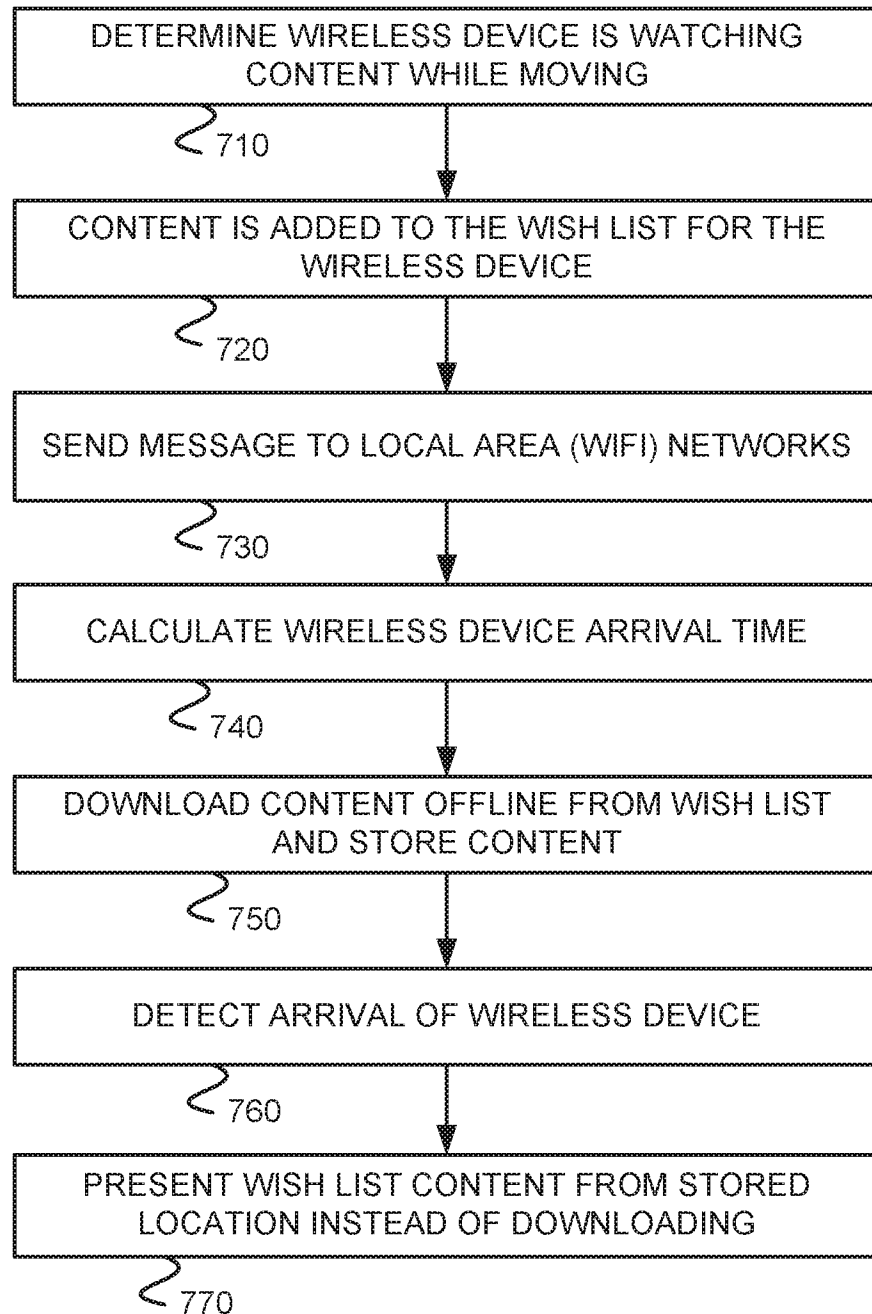


FIG. 7

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800

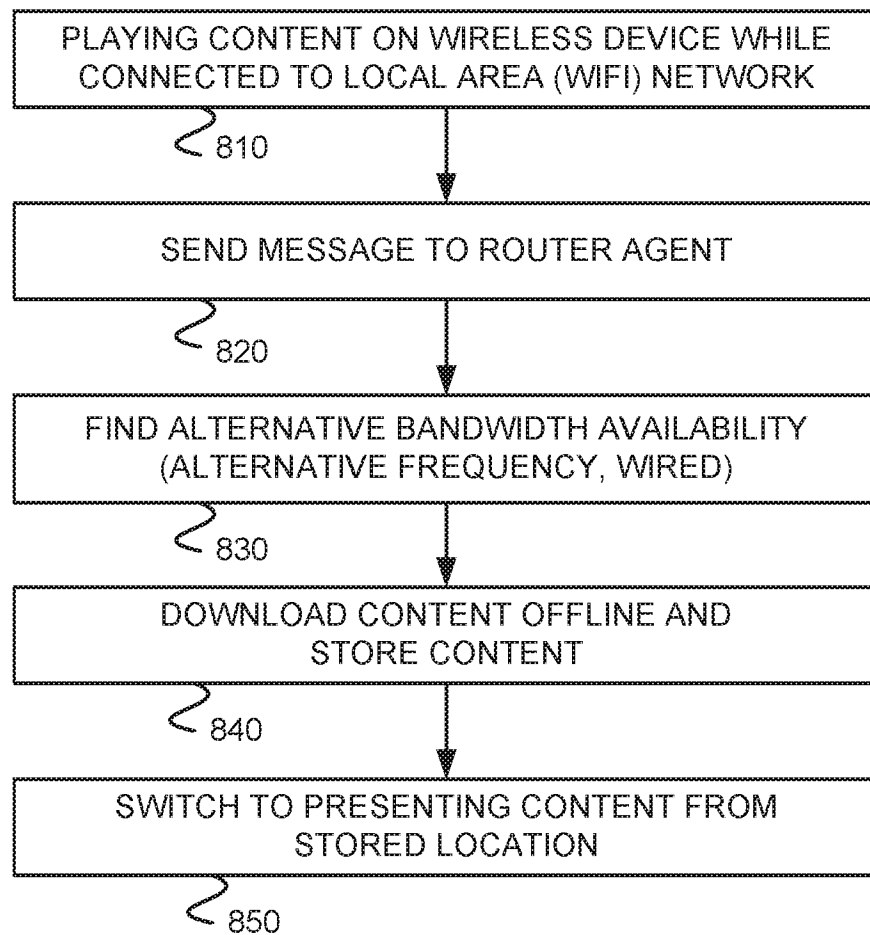
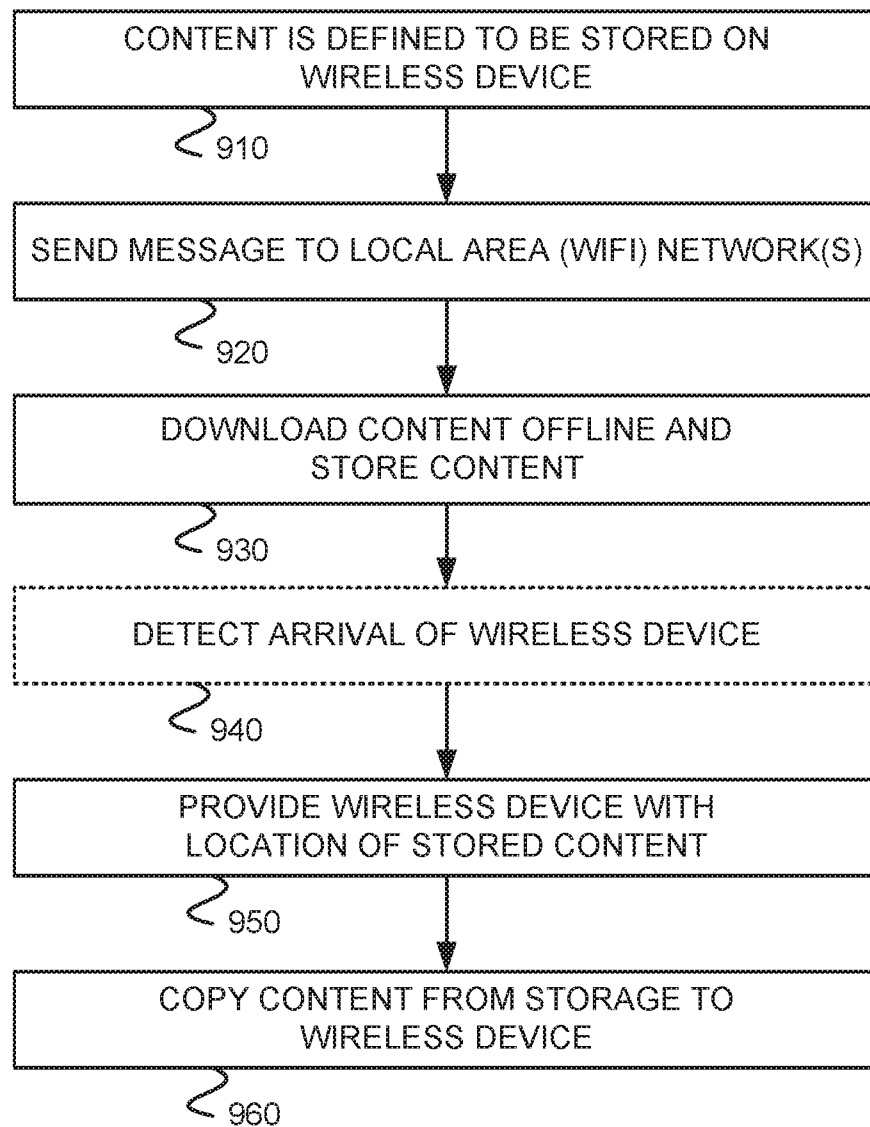


FIG. 8

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900

**FIG. 9**

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/067340

A. CLASSIFICATION OF SUBJECT MATTER INV. H04N21/433 H04N21/432 H04N21/4363 H04N21/61 H04N21/258 H04W36/22 H04N21/658 H04N21/231 H04N21/2747 H04N21/414 H04W72/04 H04W88/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H04N H04W		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/163330 A1 (SPARRELL CARLTON [US]) 3 July 2008 (2008-07-03)	1,2,10, 16
Y	figures 1-3, 12, 13 paragraph [0018] - paragraph [0025] paragraph [0028] - paragraph [0031] paragraph [0034] - paragraph [0035] paragraph [0051] - paragraph [0057]	3,4,7-9, 11,12, 14,15, 17,19,20
Y	US 2018/097905 A1 (TODASCO MICHAEL CHARLES [US] ET AL) 5 April 2018 (2018-04-05) figures 1-4 paragraph [0020] - paragraph [0025] paragraph [0036] - paragraph [0054] paragraph [0058] - paragraph [0060]	3,4,7-9, 11,12, 14,15, 17,19,20
----- -/-		
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 15 May 2020		Date of mailing of the international search report 27/05/2020
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Berthel�, P

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2019/067340

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2017/331914 A1 (LOACH SCOT G [CA]) 16 November 2017 (2017-11-16) figures 2-4 paragraph [0061] - paragraph [0064] paragraph [0072] - paragraph [0080] paragraph [0098] - paragraph [0131] paragraph [0144] - paragraph [0153] -----	1,10,16
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X	US 2018/248948 A1 (REMENTILLA RICHARD P [US] ET AL) 30 August 2018 (2018-08-30) figures 1-4 paragraph [0030] - paragraph [0034] paragraph [0049] - paragraph [0054] -----	1,10,16
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A	US 2018/027468 A1 (PASULKA MATTHEW P [US] ET AL) 25 January 2018 (2018-01-25) figures 1-4 paragraph [0012] paragraph [0022] paragraph [0028] - paragraph [0041] -----	5,6,13, 18
A	US 2015/351096 A1 (SIDHU GURSHARAN [US] ET AL) 3 December 2015 (2015-12-03) figures 1, 5, 6 paragraph [0009] - paragraph [0010] paragraph [0040] - paragraph [0047] paragraph [0051] - paragraph [0059] paragraph [0067] - paragraph [0068] -----	5,6,13, 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/067340

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4, 7-12, 14-17, 19, 20

A wireless device requests download and storage of content in a local area network (LAN). The content is played currently by the wireless device, retrieved via a mobile network and the request helps to anticipate when the mobile device will connect to the LAN and the part of the content to store (see claims 2 and 3). When the wireless device is connected to the LAN, it may then access the stored content.

2. claims: 5, 6, 13, 18

A wireless device requests download and storage of content in a local area network (LAN). The wireless device is connected to the LAN and the content is played currently by the wireless device, retrieved via a first wireless frequency band of the LAN with low quality. The request indicates that an alternative download path is needed. Then it is determined if bandwidth is available in the LAN via another frequency or wired connection (see claims 2 and 5).

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/067340

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