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Narasimhan et al.

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(54) **DYNAMIC CARRIER SWITCHING**

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(51) **Int. Cl.**

H04W 36/14	(2009.01)
H04M 15/00	(2006.01)
H04W 4/24	(2009.01)
H04L 29/06	(2006.01)

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CPC ***H04W 36/14*** (2013.01); ***H04L 63/102*** (2013.01); ***H04M 15/751*** (2013.01); ***H04M 15/8033*** (2013.01); ***H04M 15/8044*** (2013.01); ***H04M 15/8055*** (2013.01); ***H04W 4/24*** (2013.01); ***H04W 12/08*** (2013.01); *H04W 8/18* (2013.01)

(58) **Field of Classification Search**

CPC H04W 4/24; H04W 8/18; H04W 12/08; H04W 36/14; H04M 15/751; H04M 15/8033; H04M 15/8044; H04M 15/8055; H04L 63/102

USPC 455/418–420, 426.1, 423, 432.1–452.1, 455/456.1–457, 404.1–404.2; 370/331, 370/338, 252, 465

See application file for complete search history.

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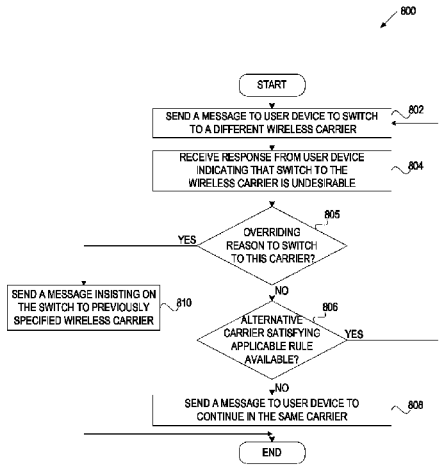
(57) **ABSTRACT**

A rule server detects a condition pertaining to a switch of a user device to a preferred wireless carrier, and sends a message to the user device indicating a switch to the preferred wireless carrier.

19 Claims, 11 Drawing Sheets



(51) **Int. Cl.**
H04W 12/08 (2009.01)
H04W 8/18 (2009.01)

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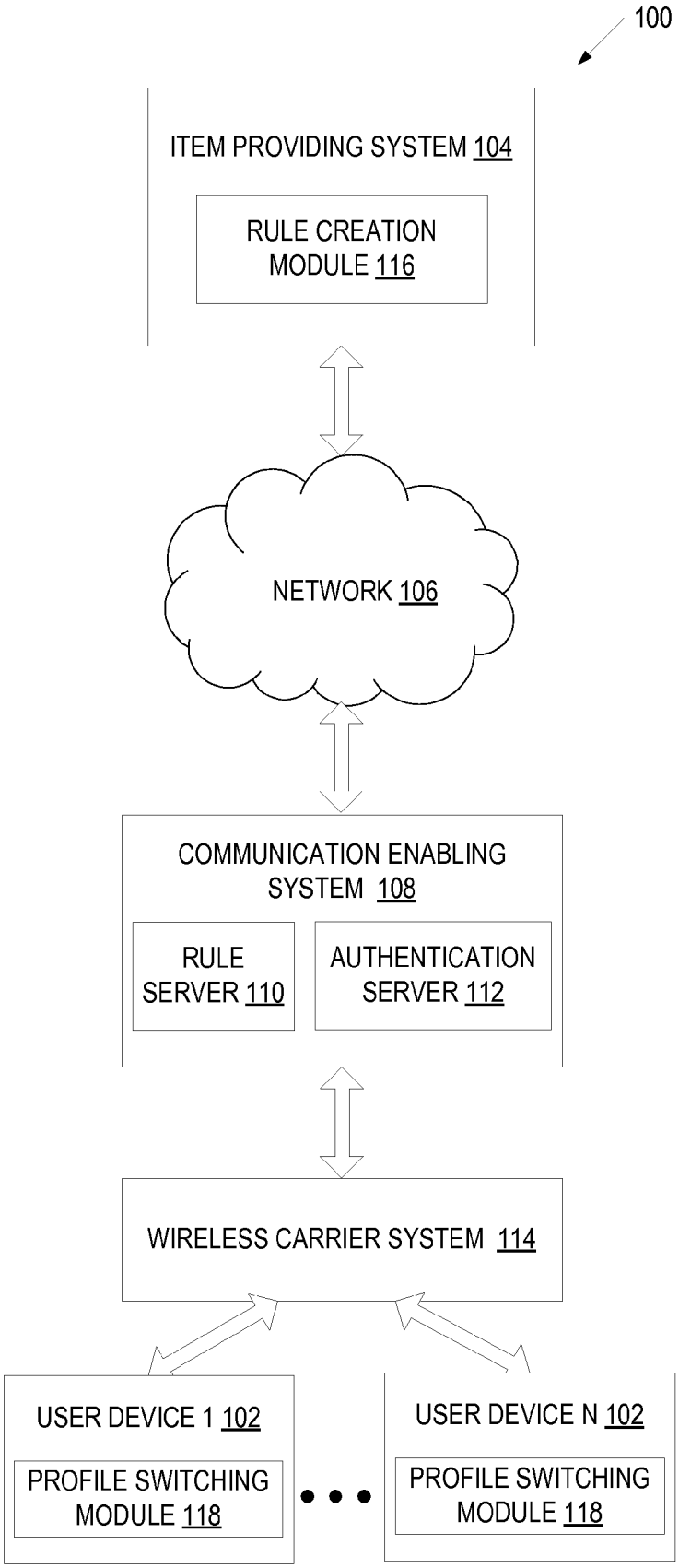
100
ITEM PROVIDING SYSTEM 104
RULE CREATION MODULE 116
NETWORK 106
COMMUNICATION ENABLING SYSTEM 108
RULE SERVER 110
AUTHENTICATION SERVER 112
WIRELESS CARRIER SYSTEM 114
USER DEVICE 1 102
PROFILE SWITCHING MODULE 118
USER DEVICE N 102
PROFILE SWITCHING MODULE 118

FIG. 1

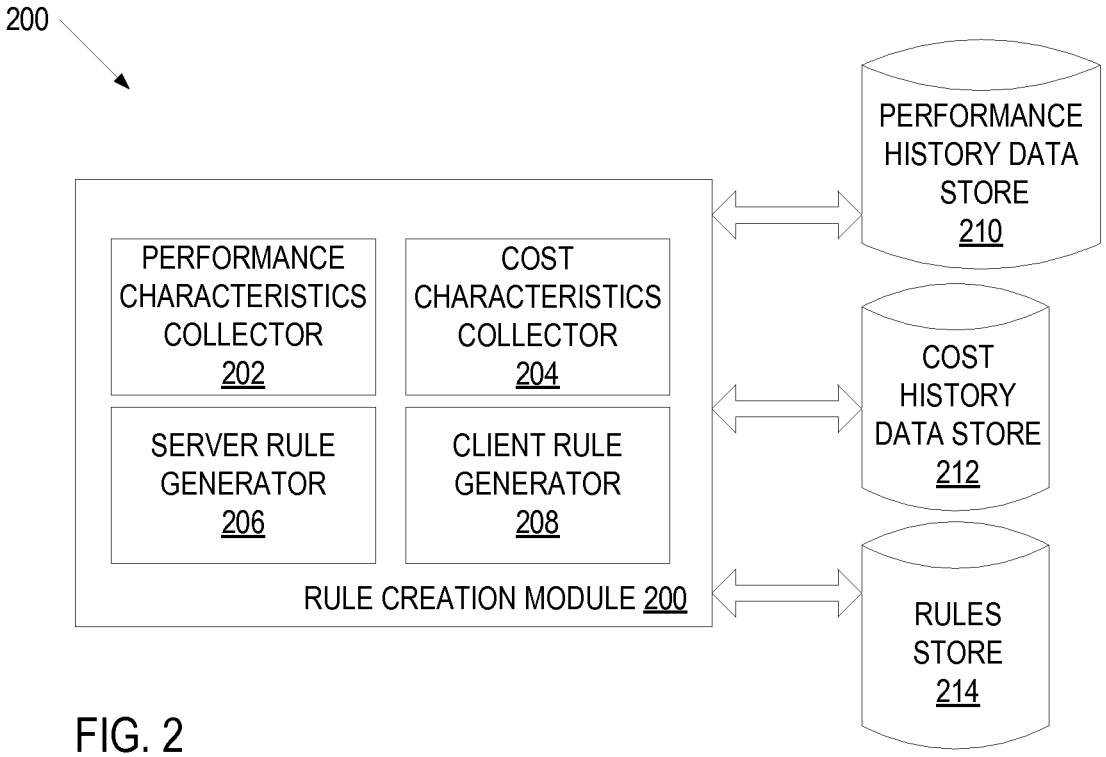
200
PERFORMANCE HISTORY DATA STORE 210
PERFORMANCE CHARACTERISTICS COLLECTOR 202
COST CHARACTERISTICS COLLECTOR 204
COST HISTORY DATA STORE 212
SERVER RULE GENERATOR 206
CLIENT RULE GENERATOR 208
RULE CREATION MODULE 200
RULES STORE 214

FIG. 2

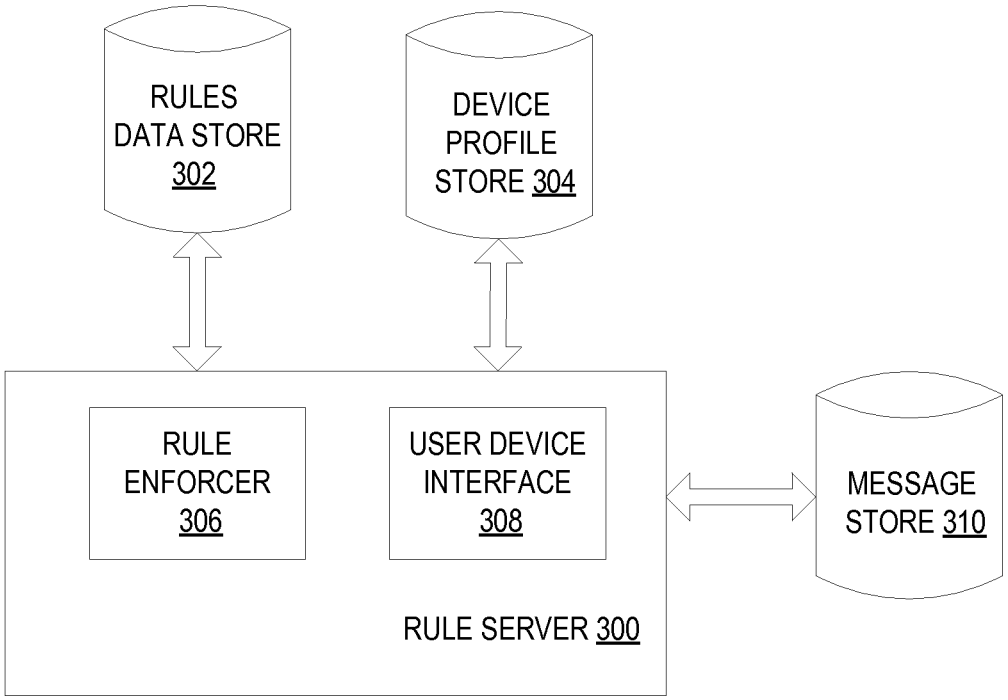
RULES DATA STORE 302
DEVICE PROFILE STORE 304
RULE ENFORCER 306
USER DEVICE INTERFACE 308
MESSAGE STORE 310
RULE SERVER 300

FIG. 3

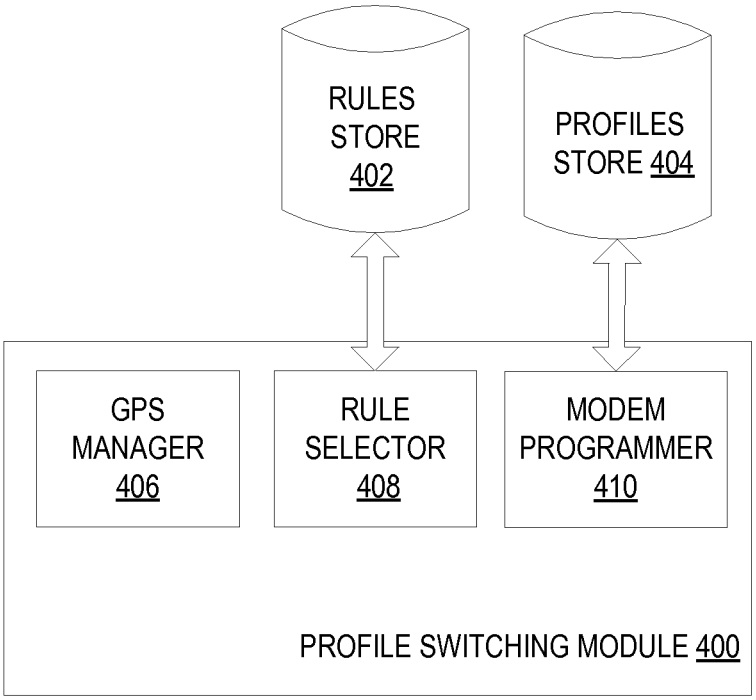
RULES STORE 402
PROFILES STORE 404
GPS MANAGER 406
RULE SELECTOR 408
MODEM PROGRAMMER 410
PROFILE SWITCHING MODULE 400

FIG. 4

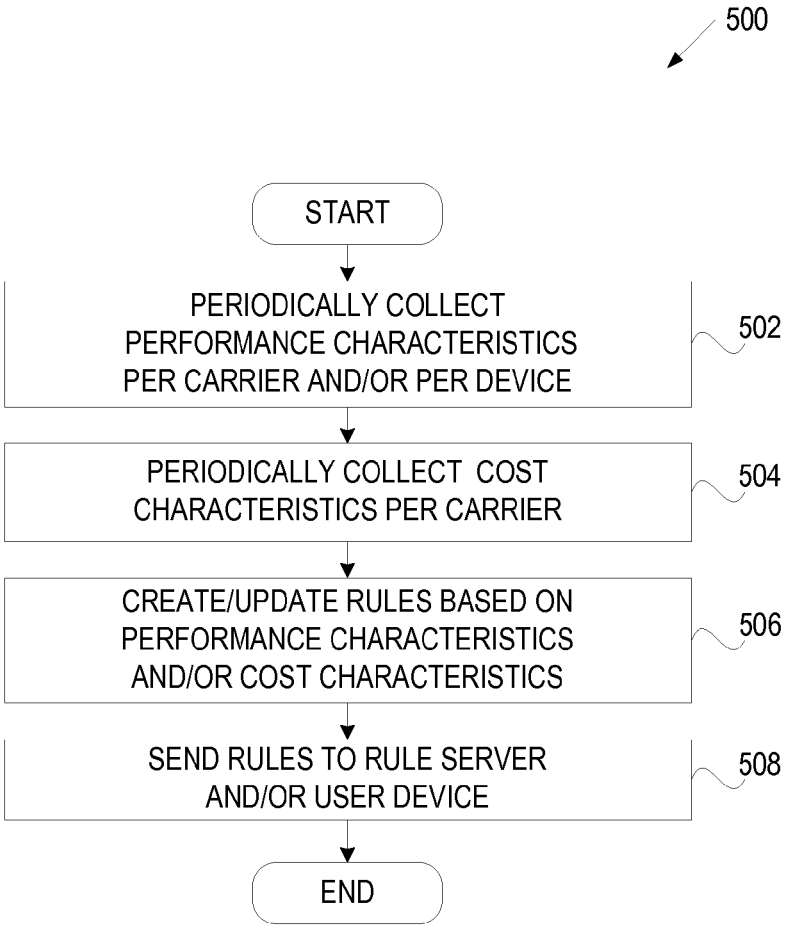
500
START
PERIODICALLY COLLECT PERFORMANCE CHARACTERISTICS PER CARRIER AND/OR PER DEVICE
502
PERIODICALLY COLLECT COST CHARACTERISTICS PER CARRIER
504
CREATE/UPDATE RULES BASED ON PERFORMANCE CHARACTERISTICS AND/OR COST CHARACTERISTICS
506
SEND RULES TO RULE SERVER AND/OR USER DEVICE
508
END

FIG. 5

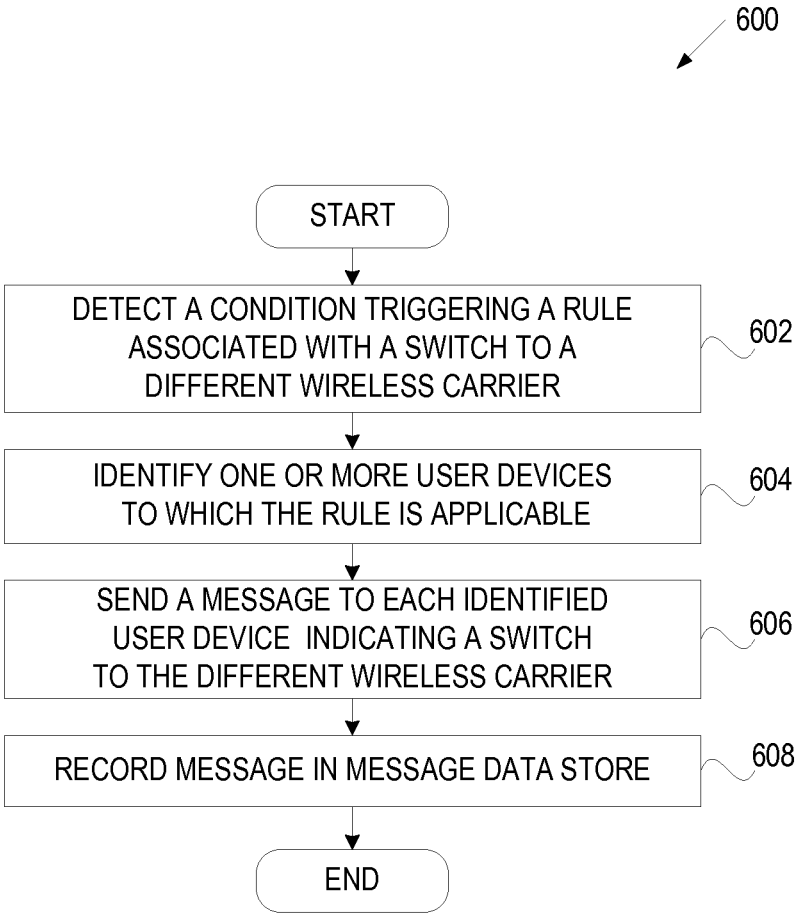
600
START
DETECT A CONDITION TRIGGERING A RULE ASSOCIATED WITH A SWITCH TO A DIFFERENT WIRELESS CARRIER
602
IDENTIFY ONE OR MORE USER DEVICES TO WHICH THE RULE IS APPLICABLE
604
SEND A MESSAGE TO EACH IDENTIFIED USER DEVICE INDICATING A SWITCH TO THE DIFFERENT WIRELESS CARRIER
606
RECORD MESSAGE IN MESSAGE DATA STORE
608
END

FIG. 6

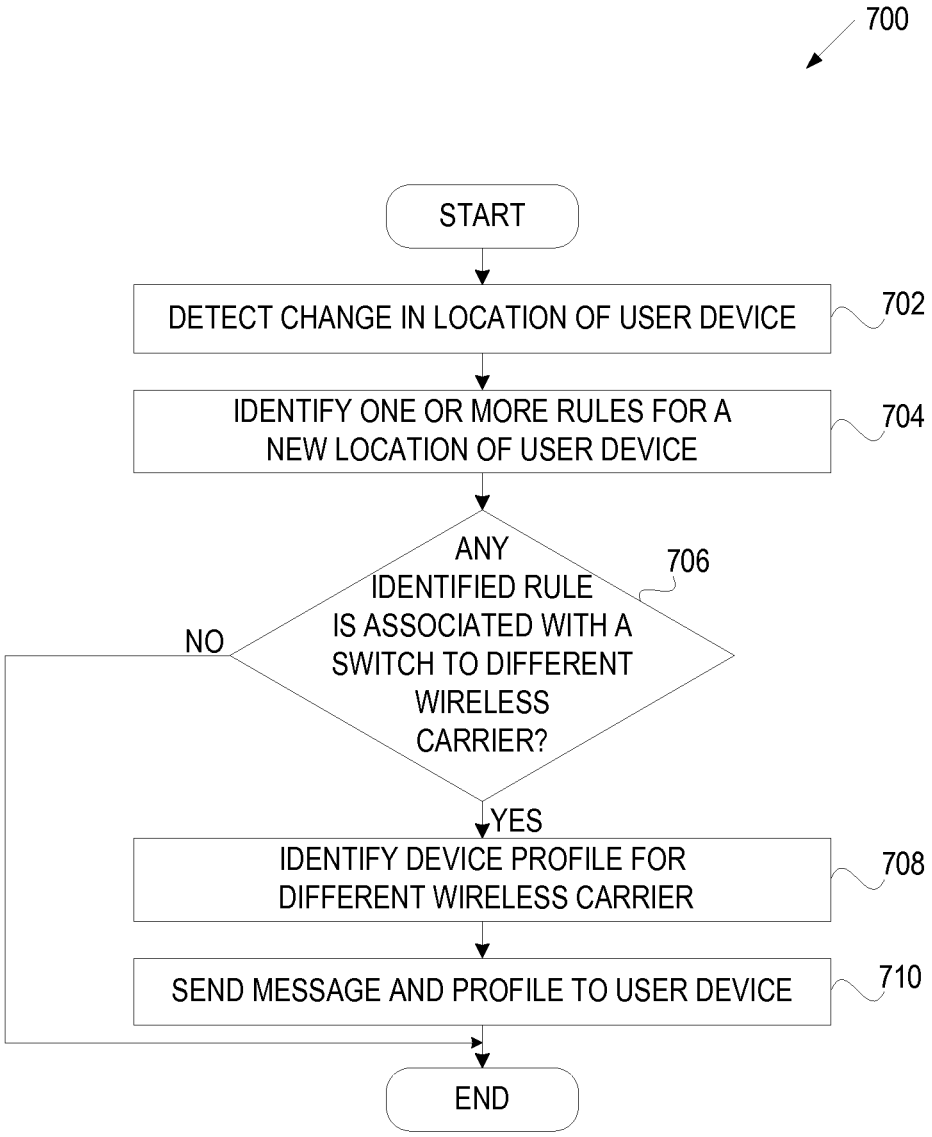
700
START
DETECT CHANGE IN LOCATION OF USER DEVICE
702
IDENTIFY ONE OR MORE RULES FOR A NEW LOCATION OF USER DEVICE
704
ANY IDENTIFIED RULE IS ASSOCIATED WITH A SWITCH TO DIFFERENT WIRELESS CARRIER?
706
NO
YES
IDENTIFY DEVICE PROFILE FOR DIFFERENT WIRELESS CARRIER
708
SEND MESSAGE AND PROFILE TO USER DEVICE
710
END

FIG. 7

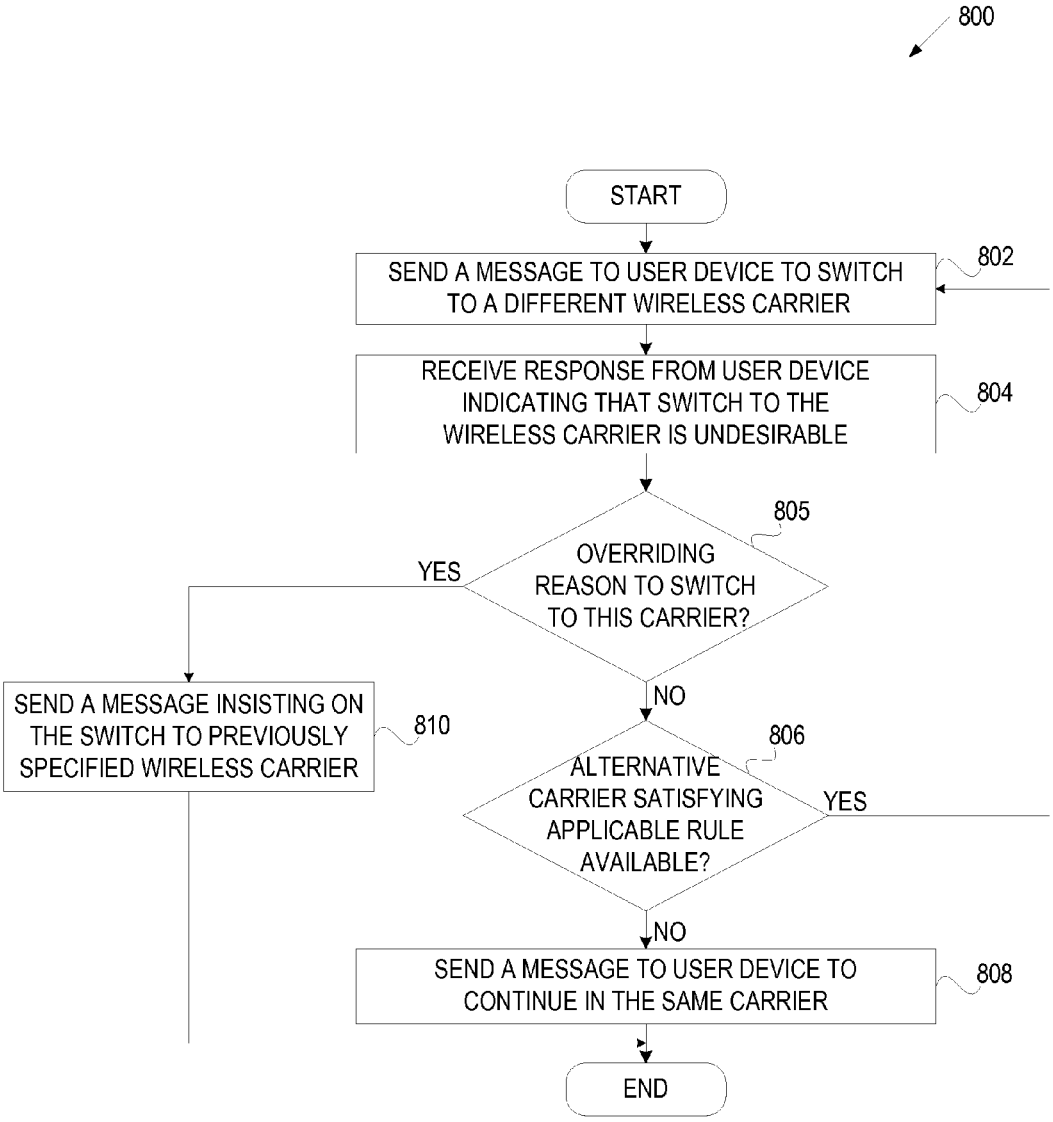
800
START
SEND A MESSAGE TO USER DEVICE TO SWITCH TO A DIFFERENT WIRELESS CARRIER
802
RECEIVE RESPONSE FROM USER DEVICE INDICATING THAT SWITCH TO THE WIRELESS CARRIER IS UNDESIRABLE
804
OVERRIDING REASON TO SWITCH TO THIS CARRIER?
805
YES
NO
SEND A MESSAGE INSISTING ON THE SWITCH TO PREVIOUSLY SPECIFIED WIRELESS CARRIER
810
ALTERNATIVE CARRIER SATISFYING APPLICABLE RULE AVAILABLE?
806
YES
NO
SEND A MESSAGE TO USER DEVICE TO CONTINUE IN THE SAME CARRIER
808
END

FIG. 8

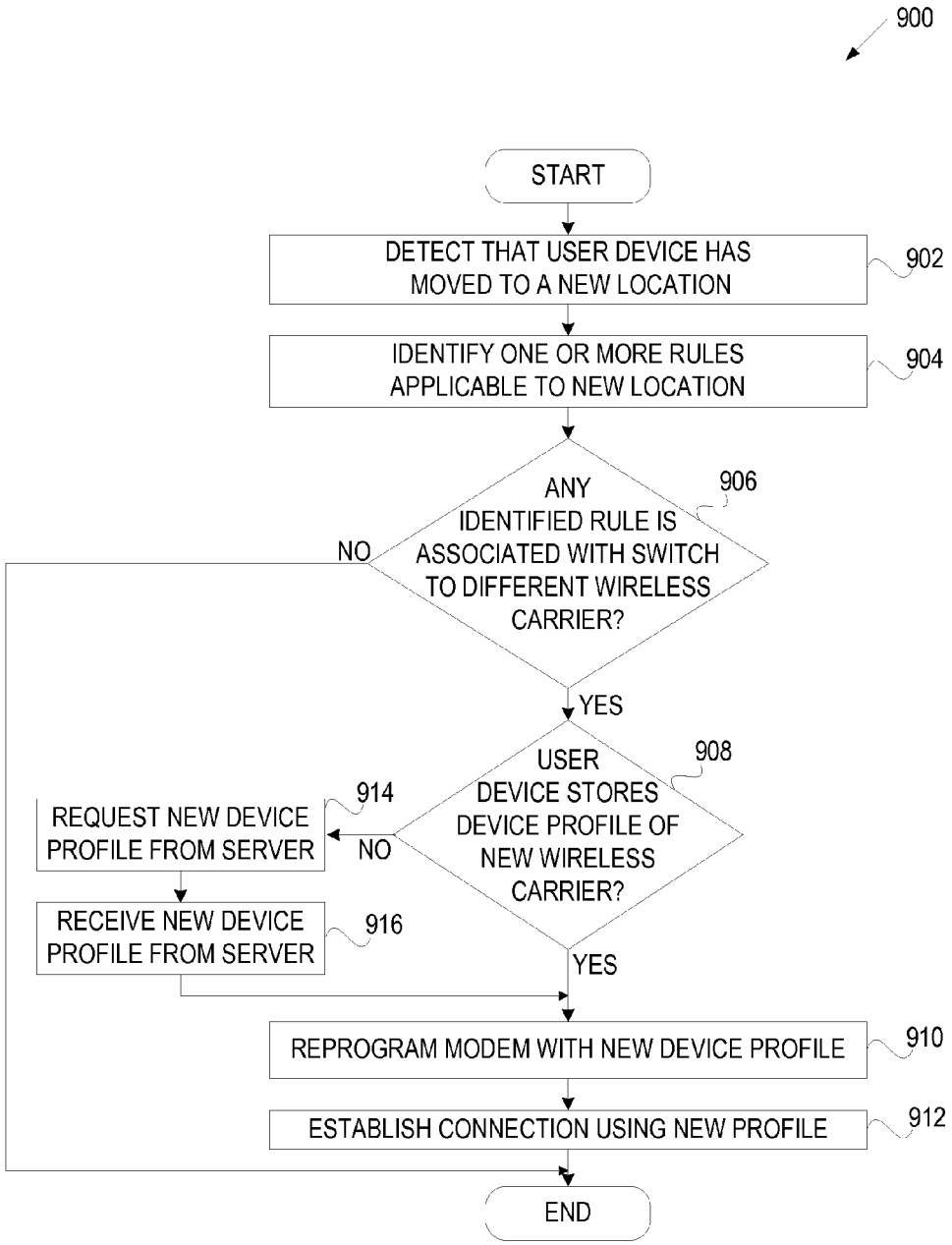
900
START
DETECT THAT USER DEVICE HAS MOVED TO A NEW LOCATION
902
IDENTIFY ONE OR MORE RULES APPLICABLE TO NEW LOCATION
904
ANY IDENTIFIED RULE IS ASSOCIATED WITH SWITCH TO DIFFERENT WIRELESS CARRIER?
906
NO
YES
USER DEVICE STORES DEVICE PROFILE OF NEW WIRELESS CARRIER?
908
NO
YES
REQUEST NEW DEVICE PROFILE FROM SERVER
914
RECEIVE NEW DEVICE PROFILE FROM SERVER
916
REPROGRAM MODEM WITH NEW DEVICE PROFILE
910
ESTABLISH CONNECTION USING NEW PROFILE
912
END

FIG. 9

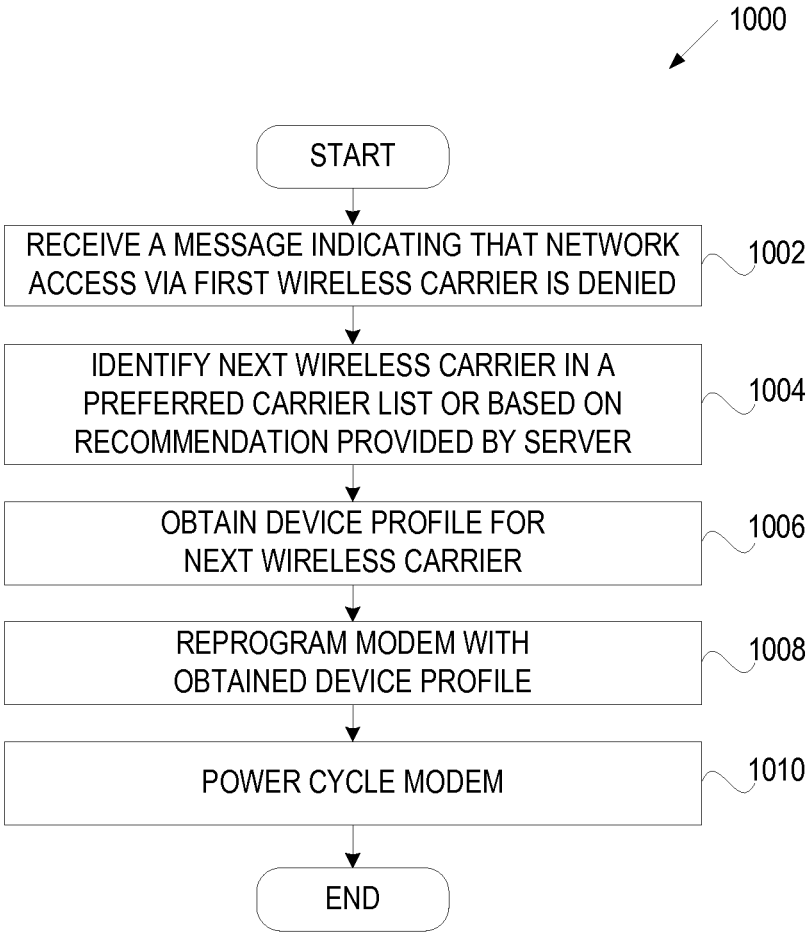
1000
START
RECEIVE A MESSAGE INDICATING THAT NETWORK ACCESS VIA FIRST WIRELESS CARRIER IS DENIED
1002
IDENTIFY NEXT WIRELESS CARRIER IN A PREFERRED CARRIER LIST OR BASED ON RECOMMENDATION PROVIDED BY SERVER
1004
OBTAIN DEVICE PROFILE FOR NEXT WIRELESS CARRIER
1006
REPROGRAM MODEM WITH OBTAINED DEVICE PROFILE
1008
POWER CYCLE MODEM
1010
END

FIG. 10

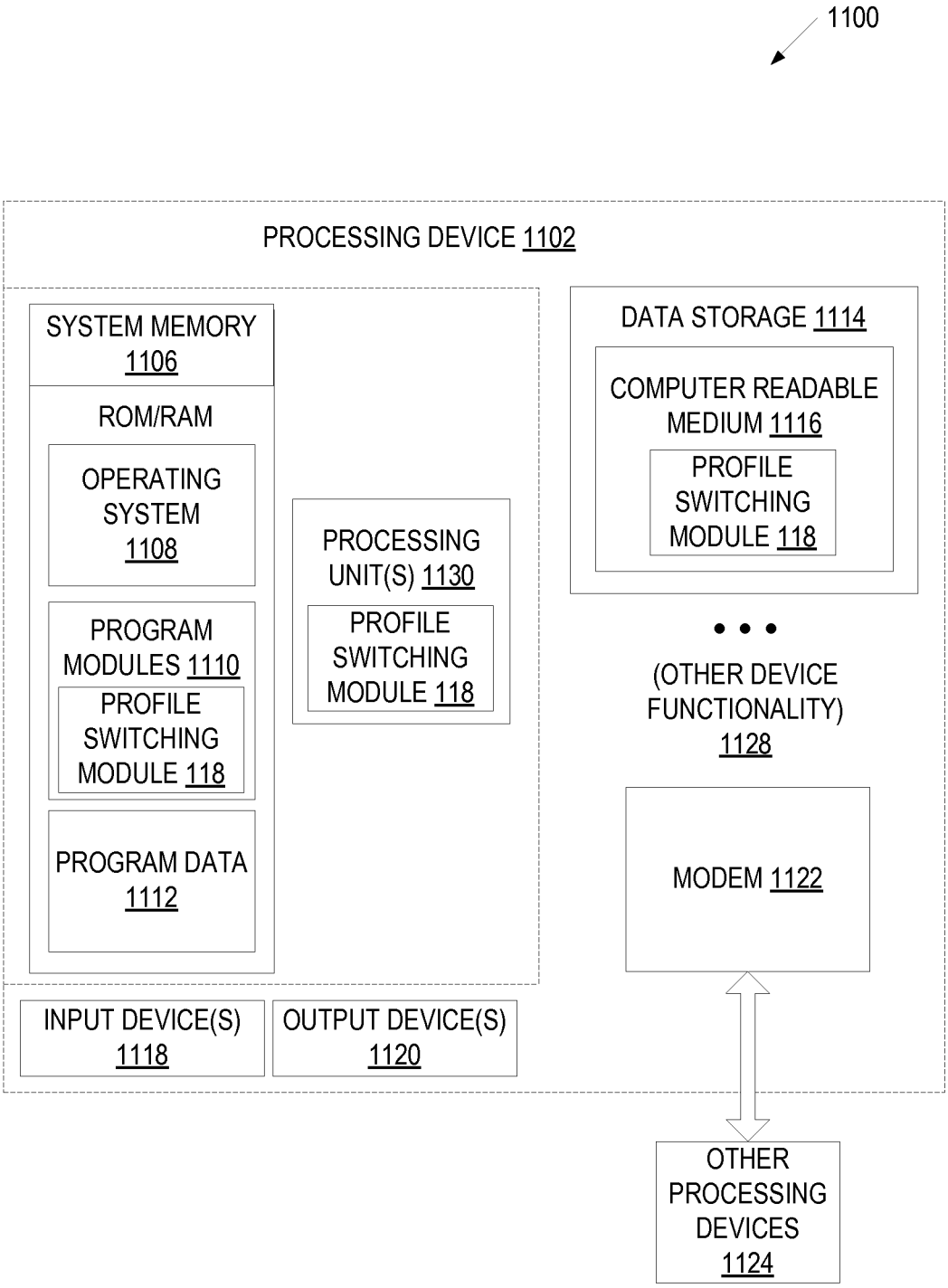
1100
PROCESSING DEVICE 1102
SYSTEM MEMORY 1106
ROM/RAM
OPERATING SYSTEM 1108
PROGRAM MODULES 1110
PROFILE SWITCHING MODULE 118
PROGRAM DATA 1112
PROCESSING UNIT(S) 1130
PROFILE SWITCHING MODULE 118
DATA STORAGE 1114
COMPUTER READABLE MEDIUM 1116
PROFILE SWITCHING MODULE 118
• • •
(OTHER DEVICE FUNCTIONALITY) 1128
MODEM 1122
INPUT DEVICE(S) 1118
OUTPUT DEVICE(S) 1120
OTHER PROCESSING DEVICES 1124

FIG. 11

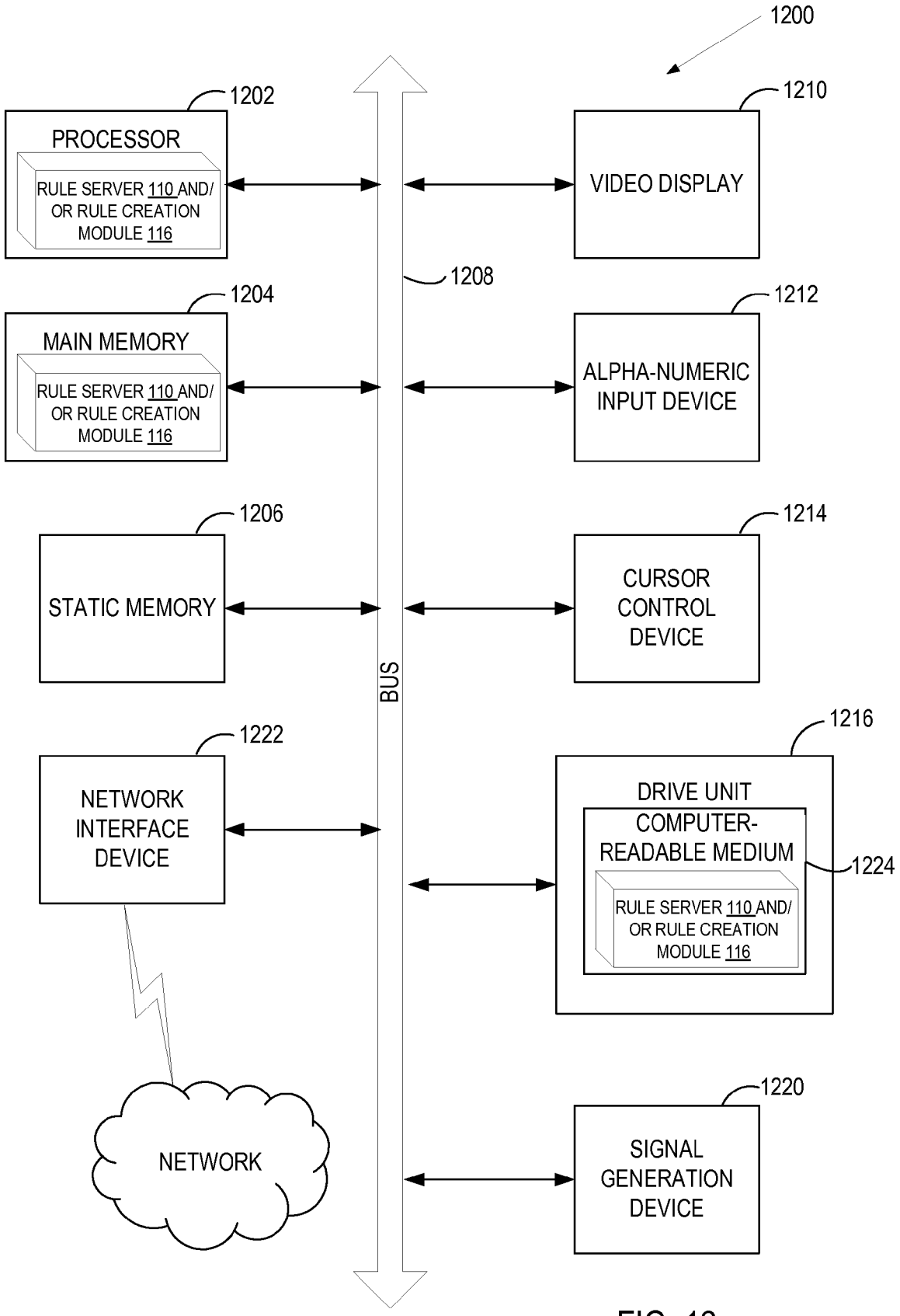
1200
1202
PROCESSOR
RULE SERVER 110 AND/ OR RULE CREATION MODULE 116
1210
VIDEO DISPLAY
1208
1204
MAIN MEMORY
RULE SERVER 110 AND/ OR RULE CREATION MODULE 116
1212
ALPHA-NUMERIC INPUT DEVICE
1206
STATIC MEMORY
1214
CURSOR CONTROL DEVICE
BUS
1222
NETWORK INTERFACE DEVICE
1216
DRIVE UNIT
COMPUTER-READABLE MEDIUM
1224
RULE SERVER 110 AND/ OR RULE CREATION MODULE 116
NETWORK
1220
SIGNAL GENERATION DEVICE

FIG. 12

DYNAMIC CARRIER SWITCHING

RELATED APPLICATIONS

This patent application is a continuation application of U.S. patent application Ser. No. 12/708,483, filed Feb. 18, 2010, which is herein incorporated by reference.

FIELD OF INVENTION

Embodiments of the invention relate to user devices, and more particularly to dynamically switching user devices to preferred wireless carriers.

BACKGROUND OF THE INVENTION

A large and growing population of users is enjoying entertainment through the consumption of digital media items, such as music, movies, images, electronic books, and so on. The users employ various electronic devices to consume such media items. Among these electronic devices are electronic book readers, cellular telephones, personal digital assistants (PDAs), portable media players, tablet computers, netbooks, and the like. As the quantity of available electronic media content continues to grow, along with increasing proliferation of devices to consume that media content, providing network connectivity for such user devices in a cost efficient manner continues to be a priority.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood more fully from the detailed description given below and from the accompanying drawings of various embodiments of the invention, which, however, should not be taken to limit the invention to the specific embodiments, but are for explanation and understanding only.

FIG. **1** is a block diagram of exemplary network architecture in which embodiments of the invention may operate.

FIG. **2** is a block diagram of one embodiment of a rule creation module.

FIG. **3** is a block diagram of one embodiment of a rule server.

FIG. **4** is a block diagram of one embodiment of a profile switching module.

FIG. **5** is a flow diagram of one embodiment of a method for creating rules facilitating dynamic switching of user devices to preferred wireless carriers.

FIG. **6** is a flow diagram of one embodiment of a method for facilitating a dynamic switch of a user device to a preferred wireless carrier.

FIG. **7** is a flow diagram of one embodiment of a method for facilitating a switch of a user device to a different wireless carrier in response to a change in the location of the user device.

FIG. **8** is a flow diagram of one embodiment of a method for facilitating a switch of a user device to a different wireless carrier using preferences of a user.

FIG. **9** is a flow diagram of one embodiment of a method for dynamically switching a user device to a preferred local carrier at a new location of the user device.

FIG. **10** is a flow diagram of one embodiment of a method for dynamically switching a user device to a different wireless carrier using a priority list maintained by the user device.

FIG. **11** is a block diagram illustrating an exemplary user device.

FIG. **12** is a block diagram illustrating an exemplary server computing system such as an item providing system or a communication enabling system.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Methods and systems for dynamically switching user devices to preferred wireless carriers are described. User devices may be any content rendering devices including, for example, electronic book readers, cellular telephones, personal digital assistants (PDAs), portable media players, tablet computers, netbooks, and the like.

In one embodiment, a server computer system ("server") detects a condition triggering a rule that requires or recommends a switch to a specified wireless carrier. The rule may be based on one or more performance characteristics (throughput, signal strength, network load, etc.) of the specified wireless carrier and/or one or more cost characteristics (billing rate, surcharge, etc.) of the specified wireless carrier. In response to the detected condition, the server identifies one or more user devices to which the rule is applicable, and sends the message to each of these user devices, requesting or recommending a switch to the specified wireless carrier. In some embodiments, the server also sends a device profile of the specified wireless carrier to the user device. In other embodiments, the user devices store device profiles of various carriers including the device profile of the specified carrier and therefore do not need to receive the device profile from the server. In response to the message from the server, the user device reprograms its modem using the device profile of the specified wireless carrier, and establishes a network connection using the device profile of the specified wireless carrier. In another embodiment, in response to the message from the server, the user device determines whether to follow the recommendation of the server, and if this determination is positive, the user device reprograms the modem using the device profile of the specified wireless carrier, and establishes a network connection using the device profile of the specified wireless carrier.

In alternative embodiments, a switch to a different wireless carrier is initiated by a user device itself. In particular, a user device may contain a subset of rules that specify conditions for carrier switching. These conditions may include, for example, a change in the user device location, a denial of network access via a current wireless carrier, a change in a performance characteristic, etc.

Accordingly, embodiments of the invention facilitate dynamic switching of user devices to preferred wireless carriers. Dynamic switching consumes only a small amount of time and client resources and does not require any user interaction. As a result, the cost associated with network connectivity is significantly reduced, and network access performance characteristics are improved.

FIG. **1** is a block diagram of an exemplary network architecture **100** in which embodiments of the invention may operate. The network architecture **100** may include an item providing system **104** and multiple user devices **102** coupled to the item providing system **104** via a network **106**.

The user devices **102** are variously configured with different functionality to enable consumption of one or more types of media items. The media items may be any type or format of digital content, including, for example, electronic texts (eBooks, electronic magazines, digital newspapers, etc.), digital audio (music, audible books, etc.), digital video (movies, television, short clips, etc.), images (art, photographs, etc.), and multi-media content. The user devices **102** may

include any type of content rendering devices such as electronic book readers, portable digital assistants, mobile phones, laptop computers, portable media players, tablet computers, cameras, video cameras, netbooks, notebooks, desktop computers, gaming consoles, DVD players, media centers, and the like.

The item providing system **104** downloads items, upgrades, and/or other information to the user devices **102** via the network **106**. The item providing system **104** also receives various requests, instructions and other data from the user devices **102** via the network **106**. The item providing system **104** may include one or more machines (one or more server computer systems, routers, gateways, etc.) that have processing and storage capabilities to provide the above functionality.

In the illustrated implementation, communication between the item providing system **104** and the user device **102** is enabled via a communication infrastructure that includes a combination of a wide area network (WAN) **106** and wireless infrastructure, which allows a user to use the user device **102** to purchase items and consume items without being tethered to the item providing system **104** via hardwired links. The wireless infrastructure is provided by a wireless carrier system **114** that can be implemented using various data processing equipment, communication towers, etc. Alternatively, or in addition, the wireless carrier system **114** may rely on WiFi or satellite technology to exchange information with the user device **102**.

The communication infrastructure also includes a communication-enabling system **108** that serves as an intermediary in passing information between the item providing system **104** and the wireless carrier. The communication-enabling system **108** may communicate with the wireless carrier system **114** via a dedicated channel, and may communicate with the item providing system **104** via a non-dedicated communication mechanism, e.g., a public network such as the Internet. By virtue of this intermediary role, the communication enabling system **108** may be referred to as a Mobile Virtual Network Enabler (MVNE), while the item providing system **104** may be referred to as a Mobile Virtual Network Operator (MVNO).

The item providing system **104** may pay the wireless carrier a fee based on the aggregate use of the wireless carrier system **114** by all of the user devices **102**. The item providing system **104** may recoup these costs through fees charged to the end-users separately or as part of other purchases (e.g., purchase of digital content) made by the end-users. Alternatively, the wireless carrier may submit bills directly to individual users, or may submits bills to either the item providing system **104** (in aggregate) or to the individual users, at the option of the individual respective users.

A user device **102** may be associated with a specific wireless carrier by means of subscriber identity module (SIM) data that may be stored on a physical SIM card or included in a SIM profile. The SIM data includes information identifying the user device to the specific wireless carrier. This information may include a unique international mobile subscriber identity (IMSI) containing a mobile country code (MCC), a mobile network code (MNC) and a mobile station identification number (MSIN) within the wireless carrier's customer base. The SIM data may also include security authentication and ciphering information, temporary information related to the local network, a list of the services the user has access to, etc. In addition to the association via SIM data, a wireless modem of a user device may be pre-configured with a modem profile that defines network connection parameters for a relevant wireless carrier.

Depending on the location of the user device **102**, the wireless carrier that the user device **102** is associated with may not be a preferred carrier in terms of existing contracts with the item providing system **104** or the end-user, billing rates and/or provided performance characteristics (coverage, signal strength, speed network load, etc.). Hence, the device's network usage can result in increased costs (e.g., roaming charges or higher billing rates) and/or undesirable performance.

Embodiments of the invention overcome the above shortcomings by supporting dynamic switching of user devices to preferred wireless carriers. The modem of the user device is programmed with a SIM profile that includes settings of a currently-used wireless carrier such as the IMSI, security authentication and ciphering information, etc. When a switch to a preferred wireless carrier is triggered, the modem is automatically re-programmed with the SIM profile of the preferred wireless carrier. In addition, in some embodiments, the modem is also reconfigured with a modem profile that defines connection parameters for the preferred wireless carrier, such as a GSM frequency band parameter, the format for presenting the wireless carrier name on the user device, etc.

A switch to a preferred wireless carrier may be initiated upon detecting a condition that triggers a rule or detecting a parameter that exceeds a threshold. Various rules and/or thresholds may be maintained based on cost and performance characteristics pertaining to different wireless carriers. The cost characteristics may include, for example, billing rates, surcharges, initial fees and other charges of a wireless carrier. The performance characteristics may include, for example, availability of coverage, throughput, signal strength, network load, etc.

In some embodiments, the item providing system **104** hosts a rule creation module **116** that collects the above characteristics and creates rules and/or thresholds based on these characteristics. A rule may request a user device **102** to perform a switch, or a rule may provide a recommendation (suggestion or guideline) with respect to a switch and a user device **102** may further decide whether to follow the recommendation or not. For example, a rule may require/recommend a switch from carrier **1** to carrier **2** if the current billing rate of carrier **1** exceeds the current billing rate of carrier **2** by at least X amount. In another example, a rule may require/recommend a switch from carrier **1** to carrier **2** if the signal strength of carrier **2** exceeds the signal strength of carrier **1** by Y dBm. In yet another example, a rule may require/recommend a switch from carrier **1** to carrier **2** if the current billing rate of carrier **1** exceeds the current billing rate of carrier **2** by at least X amount, and the signal strength of carrier **1** does not exceed the signal strength of carrier **2** by more than Y dBm.

The rules and/or thresholds created by the rule creation module **116** can be enforced by a rule server **110** that is hosted by the communication enabling system **106**. In alternative embodiments, the rule server **110** can be hosted by the item providing system **104** or by any other system capable of communicating with the user devices **102**. The rule server **110** detects conditions that trigger the above rules and/or cause the above thresholds to be exceeded. The conditions may include, for example, a change in a fee charged by a wireless carrier, a change in a location of a user device, a change in a performance characteristic of a network of a wireless carrier, a change in a contractual agreement between the item providing system **104** and a wireless carrier, etc.

When a rule is triggered (or a threshold is exceeded), the rule server **110** identifies user devices **102** to which the rule or threshold is applicable, and sends a message to the identified user devices requesting them to switch to an alternative wire-

less carrier. In one embodiment, the rule server **110** also sends a device profile of the alternative wireless carrier to the user device. In another embodiment, the rule server **110** sends an identifier of the alternative wireless carrier to the user device, and the user device obtains the device profile from its local memory.

Upon receiving a request to switch from the rule server **110**, the user device **102** performs the requested switch. If the message of the rule server **110** indicates a recommendation to switch (as opposed to a request to switch), the user device **102** may or may not perform the recommended switch depending on further evaluation of local conditions, user preferences or other local data. In one embodiment, the user device **102** includes a profile switching module **118** that obtains a device profile of the alternative wireless carrier and reprograms the modem using the obtained device profile to enable the user device **102** to connect to the network via the alternative wireless carrier. In some embodiments, the profile switching module **118** maintains a subset of rules and initiates carrier switching of the user device **102** when any rule form the subset is triggered, without waiting for a request from the rule server **110**. The actual switch to the alternative wireless carrier may not occur during a current session but rather after the current session is completed, making it transparent to the user.

In one embodiment, the communication enabling system **108** includes an authentication server **112** that performs security-related functions. In particular, the authentication server **112** ensures that the user device **102** currently attempting to interact with the item providing system **104** is duly authorized to access the item providing system **104**. In some embodiments, the authentication server **112** is configured to deny access to the item providing system **104** for user devices that are connected via a non-preferred carrier. When a user device **102** receives a message indicating that it was denied access to the item providing system **104**, the user device **102** examines the local subset of rules to identify the next carrier in a preferred carrier list or asks the rule server to identify a preferred carrier, and reprograms the modem to enable the switch to the identified carrier.

FIG. **2** is a block diagram of one embodiment of a rule creation module **200**. The rule creation module **200** may be the same as the rule creation module **116** of FIG. **1** and may include a performance characteristics collector **202**, a cost characteristics collector **204**, a server rule generator **206**, and a client rule generator **208**. The components of the rule creation module **116** may represent modules that can be combined together or separated into further modules, according to some embodiments.

The performance characteristics collector **202** collects performance characteristics of different wireless carriers and stores them in a performance history data store **210**. Performance characteristics of a wireless carrier may include, for example, information about network coverage at different locations, throughput provided at different locations and on different days/times, signal strength provided at different locations and on different days/times, etc. In addition, the performance characteristics collector **202** may collect performance characteristics pertaining to individual user devices and store them in a performance history data store **210**. Performance characteristics pertaining to a user device may include, for example, information about network usage by the user device, throughput and signal strength during network usage at typical user locations (e.g., house, work, gym), user preferences of wireless carriers at typical user locations, etc.

The cost characteristics collector **204** collects cost characteristics of different wireless carriers and stores them in a cost history data store **210**. Cost characteristics of a wireless carrier may include, for example, billing rates charged at different locations and on different days/times, discount information, initial fees, surcharges, etc.

The server rule generator **206** creates rules and/or thresholds based on the collected performance and cost characteristics, and stores the created rules in a rules store **214**. A rule may, for example, require or recommend a switch if the billing rate of a current wireless carrier is at least 5 percent higher than the billing rate of another wireless carrier providing coverage in the present location. Another rule may require or recommend a switch if a user travels to a new geographical area. Yet another rule may require or recommend a switch if a signal strength or throughput provided by an alternative wireless carrier is at least 10 percent better than those provided by the current wireless carrier. A rule may include multiple conditions using any combination of performance characteristics and/or cost characteristics. In addition, a rule may be carrier specific and applicable to all user devices (e.g., "any user device should switch to carrier A when arriving to city X"). Alternatively, a rule may be user device specific (e.g., "user device should switch to carrier A when at home and then switch to carrier B when arriving to the office"). The server rule generator **206** stores the created rules and/or thresholds in a rules store **214**.

The client rule generator **208** creates rules and/or thresholds for individual user devices based on the collected performance and cost characteristics, and stores the created rules and/or thresholds in the rules store **214**. These rules and/or thresholds may be specific to a user device or a group of user devices (user devices of all users working in a certain office of a specific company, all user devices of a specific device type (e.g., certain type of electronic book reader), all user devices supporting a specific network protocol, etc.). For example, a rule may require or recommend that a device of any user working from a Chicago office of company X switch to carrier A at 12 pm and then switch to carrier B at 4 pm. In another example, a rule may require or recommend that user device Y switch to carrier A when arriving to the office, switch to carrier B when arriving home, and switch to carrier C when arriving to the gym.

The server rule generator **206** and the client rule generator **208** periodically update the rules and/or thresholds based on newly collected data and send them to the rule server. In addition, in some embodiments, a subset of rules and/or thresholds may be provided to the individual user devices.

The data stores **210**, **212** and **214** may represent a single or multiple data structures (databases, repositories, files, etc.) residing on one or more mass storage devices, such as magnetic or optical storage based disks, tapes or hard drives.

FIG. **3** is a block diagram of one embodiment of a rule server **300**. The rule server **300** may be the same as the rule server **11** of FIG. **1** and may include a rule enforcer **308**, a user device interface **308**, a rules store **302**, a device profile store **304**, and a message store **310**. The components of the rule server **300** may represent modules that can be combined together or separated into further modules, according to some embodiments.

The rule store **302** includes rules and/or thresholds created by the rule creation module **200** based on cost characteristics of different wireless carriers and/or based on performance characteristics of different wireless carriers and user devices. The rules may be carrier specific or user device specific.

The rule enforcer **306** enforces the rules and/or thresholds stored in the rules store **302**. In particular, the rule enforcer **306** tracks what carriers are currently being used by user devices. For each current carrier, the rule enforcer **306** uses the rules and/or thresholds associated with this carrier to

detect when the usage of this carrier by user devices becomes undesirable. The rule enforcer **306** then determines, based on relevant rule(s) and/or threshold(s), an alternative carrier that should be used instead of a current carrier, and identifies user devices to which these rules and/or thresholds are applicable.

The user device interface **308** is responsible for sending a message to the identified user devices, requesting or recommending that each of these user devices switch to the alternative carrier. In one embodiment, the user device interface **308** also retrieves a device profile associated with the alternative carrier from the device profile store **304** and sends this device profile to the user devices. The device profile store **304** may contain device profiles associated with different wireless carriers. Each device profile includes a SIM profile associated with a specific carrier, and optionally in some embodiments a modem profile that define network connection parameters for the specific wireless carrier. In another embodiment, the user device interface **308** does not send the device profile associated with the alternative carrier to the user device and the user device retrieves this device profile from a local device profile store.

In one embodiment, upon sending a switching message, the user device interface **308** stores the switching message in the message store **310** to keep track of all the switching messages. The user device interface **308** may check the contents of the message store **310** prior to sending a switching message to a user device to avoid frequent switching of the user device.

The rule enforcer **306** may also enforce user device specific rules and/or thresholds by monitoring activity associated with a specific user device and detecting conditions that trigger one or more rules pertaining to the specific user device or cause one or more thresholds pertaining to the specific user device to be exceeded. For example, if a rule requires or recommends that a user device switch from carrier A to carrier B when a user arrives to work, the rule enforcer **306** may monitor the location of the user device (e.g., using triangulation or other location detection techniques) to detect when the user arrives to work, and then invoke the user device interface **308** to send a message to the user device, requesting or recommending a switch.

The data stores **302**, **304** and **306** may represent a single data structure (a repository, a database, etc.) or different data structures residing on one or more mass storage devices, such as magnetic or optical storage based disks, tapes or hard drives.

FIG. **4** is a block diagram of one embodiment of a profile switching module **400**. The profile switching module **400** may be the same as the profile switching module **118** of FIG. **1** and may include a GPS manager **406**, a rule selector **408** and a modem reprogrammer **410**. The components of the profile switching module **400** may represent modules that can be combined together or separated into further modules, according to some embodiments.

The user device hosting the profile switching module **400** has a modem that is programmed with a SIM profile associated with a specific wireless carrier. The SIM profile may be stored in secure memory (e.g., one time programmable (OTP) memory) on the modem. In one embodiment, the modem is also configured with a modem profile that defines network connection parameters for the specific wireless network. The modem profile is stored in non-volatile memory on the modem.

When the profile switching module **400** receives a message from the rule server to switch to an alternative carrier, the modem reprogrammer **410** obtains a device profile of the alternative wireless carrier and reprograms the modem with the obtained device profile. This device profile includes a SIM profile and, in some embodiments, a modem profile of the alternative wireless carrier. The modem reprogrammer **410** can receive the device profile of the alternative wireless carrier from the rule server or retrieve it from a local profile store **404**. The profile store **404** may include SIM profiles and modem profiles of various wireless carriers and can reside in a secure memory (e.g., secure OTP memory) on the modem. Optionally, the profiles in the data store **404** can be encrypted for additional security. If the profile store **404** does not include the device profile of the alternative wireless carrier, the modem reprogrammer **410** can request it from the rule server. The actual switch to the alternative wireless carrier may not occur during a current session but rather after the current session is completed, making it transparent to the user.

In some embodiments, when the profile switching module **400** receives a message from the rule server indicating a switch to an alternative carrier, the profile switching module **400** may or may not reprogram the modem with a different device profile depending on whether it decides to follow a recommendation of the rule server or not. This decision may be based on local conditions (e.g., network coverage at the current location, throughput provided at the current location, signal strength at the current location), user preferences and other local data.

In some embodiments, the profile switching module **400** initiates carrier switching itself, without waiting for a switching message from the rule server. In these embodiments, the profile switching module **400** may include the rule selector **408** that uses the rules and/or thresholds from a rules store **402** to initiate carrier switching. The rules store **402** may include, for example, location specific rules that require a switch to a certain carrier when the user arrives to a specific location. Changes in the user device location can be detected by the GPS manager **406** using a GPS technique. Alternatively, changes in the user device location can be detected using a triangulation technique, MCC and MNC data, etc.

In another example, the rule store **402** may include a rule specifying a preferred carrier list ordered by priority. When the authentication server **112** denies access to the item providing system **104** via a current wireless carrier, the rule selector **408** may select the next carrier in the preferred carrier list and invoke the modem reprogrammer **410** to perform the carrier switch.

Rules and/or thresholds **402** may be stored in memory on the modem or some other memory of the user device. Rules and/or thresholds **402** can be periodically updated by receiving data from the item providing system **104**. For example, the preferred carrier list can be updated on a daily basis to re-prioritize based on daily rates.

FIG. **5** is a flow diagram of one embodiment of a method **500** for creating rules facilitating dynamic switching of user devices to alternative wireless carriers. The method is performed by processing logic that may comprise hardware (circuitry, dedicated logic, etc.), software (such as is run on a general purpose computer system or a dedicated machine), or a combination of both. In one embodiment, embodiments of the method are performed by an item providing system **104** (e.g., a rule creation module **116** hosted by the item providing system **104** of FIG. **1**).

Referring to FIG. **5**, the rule creation module periodically collects performance characteristics per carrier and/or per device (blocks **502**). As discussed above, performance characteristics of a wireless carrier may include, for example, information about network coverage at different locations, throughput provided at different locations and on different

days/times, signal strength provided at different locations and on different days/times, etc. Performance characteristics pertaining to a user device may include, for example, information about network usage by the user device, throughput and signal strength during network usage at typical user locations (house, work, gym, etc.), user preferences of wireless carriers at typical user locations, etc.

At block **504**, the rule creation module periodically collects cost characteristics per carrier. Cost characteristics of a wireless carrier may include, for example, billing rates charged at different locations and on different days/times, discount information, initial fees, surcharges, etc.

At block **506**, the rule creation module creates rules and/or thresholds based on performance characteristics and/or cost characteristics. A rule may include one or more conditions using any combination of performance characteristics and/or cost characteristics. A rule or threshold may be carrier specific and applicable to all user devices, or a rule or threshold may be user device specific. The rule creation module periodically updates the rules and/or thresholds based on newly collected data.

In some embodiments, the rule creation module also creates rules and/or thresholds for switching between different delivery mechanisms or different communication channels within the same wireless network. For example, if a wireless carrier has higher billing rates for use of the multimedia messaging service (MMS) than the short message service (SMS) in a certain geographical area, a rule may require or recommend a switch from the SMS to the MMS when the user travels to this area.

At block **508**, the rule creation module sends rules and/or thresholds to the rule server. In some embodiments, the rules creation module also sends to a user device a subset of the rules and/or thresholds that is relevant to the user device.

FIGS. **6**, **7** and **8** are flow diagrams of some embodiments of a method for facilitating a dynamic switch of a user device to a different wireless carrier. The method is performed by processing logic that may comprise hardware (circuitry, dedicated logic, etc.), software (such as is run on a general purpose computer system or a dedicated machine), or a combination of both. In one embodiment, embodiments of the method are performed by a computer system hosting a rule server (e.g., a rule server **110** of FIG. **1**).

Referring to FIG. **6**, the rule sever receives various carrier switching rules and/or thresholds from the item providing system and stores them in a rules store. At block **602**, the rule server detects a condition triggering one of the rules from the rule store or causing one or more threshold from the rule store to be exceeded. At block **604**, the rule server identifies one or more user devices to which the rule or threshold is applicable. For example, if the rule requests or recommends a switch to carrier A for all devices located in area X, the rule server identifies all user devices in area X that are presently using a wireless carrier other than carrier A.

At block **606**, the rule server sends a message to each identified user device to request or recommend a switch to the preferred wireless carrier. In one embodiment, the rule server also retrieves a device profile associated with the preferred wireless carrier from a device profile store and sends this device profile to the user devices. The device profile includes a SIM profile associated with the preferred wireless carrier, and optionally in one embodiment a modem profile that define network connection parameters for the preferred wireless carrier. In another embodiment, the rule server sends the identifier of the device profile associated with the preferred carrier to the user device but not the device profile itself.

At block **608**, the rule server stores the switching message in a message store. In one embodiment, prior to sending a message to the user device, the rule server determines how many times the user device was requested or recommended to switch over the last N hours or when the last switch of the user device took place. If the number of switches or requests/recommendations exceeds a predefined threshold or the last switch has occurred (or a request/recommendation was sent) less than a predefined number of hours ago, the rule server does not send a switching message to the user device.

In one embodiment, several device profiles may be maintained for a single wireless carrier, each of these device profiles corresponding to a different delivery mechanism or a different communication channel within the same wireless network. For example, one device profile may correspond to the use of MMS while connecting to a specific wireless network and another device profile may correspond to the use of SMS while connecting to the same wireless network. The rule server can maintain rules and/or thresholds to initiate or recommend a switch to a preferred delivery mechanism or communication channel when a specific condition occurs. When the rule server detects a condition triggering one of the above rules or causing one of the above thresholds to be exceeded, the rule server identifies user devices to which this rule or threshold applies, and sends these user devices a message, requesting or recommending that the user devices switch to a preferred delivery mechanism or communication channel. The user devices can then reprogram their modems with the device profile associated with the preferred delivery mechanism or communication channel.

FIG. **7** is a flow diagram of one embodiment of a method **700** for facilitating a switch of a user device to a different wireless carrier in response to a change in the location of the user device. Method **700** begins with the rule server detecting a change in location of a user device (block **702**). The change in location can be detected using triangulation or other location detection techniques.

At block **704**, the rule server identifies one or more rules and/or thresholds relevant to the new location of the user device. At block **706**, the rule server determines whether any identified rule or threshold necessitates or recommends a switch to a different wireless carrier. If so, the rule server identifies the device profile for the different wireless carrier (block **708**) and sends a switching message and the device profile to the user device (block **710**). Otherwise, if there are no rules thresholds necessitating or recommending a switch to a different wireless carrier, method **700** ends.

FIG. **8** is a flow diagram of one embodiment of a method **800** for facilitating a switch of a user device to a different wireless carrier using user device preferences. Method **800** begins with the rule server sending a message to a user device indicating a switch to a different wireless carrier. At block **804**, the rule server receives a response from the user device indicating that the switch to the specified wireless carrier is undesirable. The reason for such a response may be user preferences with respect to wireless carriers or performance characteristics collected by the user device.

At block **805**, the rule server determines whether there are any overriding reasons necessitating a switch to the specified wireless carrier (e.g., requirements of a service contract between the specified wireless carrier and the item providing system, a significant billing rate difference between the current wireless carrier and the new wireless carrier, etc.). If there is an overriding reason to switch to the new wireless carrier, the rule server sends a message insisting on the switch to the previously specified wireless carrier (block **810**). Otherwise, the rule server further determines whether an alternative wire-

less carrier is available that satisfies the applicable rule (block **806**). If so, the method returns to block **802**. If not, the rule server sends a message to the user device to continue using the existing wireless carrier (block **808**).

FIGS. **9** and **10** are flow diagrams of some embodiments of a client-side method for switching to a different wireless carrier. The method is performed by processing logic that may comprise hardware (circuitry, dedicated logic, etc.), software (such as is run on a general purpose computer system or a dedicated machine), or a combination of both. In one embodiment, embodiments of the method are performed by a user device (e.g., a profile switching module **118** hosted by the user device **102** of FIG. **1**).

Referring to FIG. **9**, method **900** begins with detecting that the user device has moved to a new location. The change in location can be detected using GPS hosted by the user device, a triangulation technique, MCC/MNC data, etc.

At block **904**, the user device identifies one or more rules applicable to the new location using a subset of rules stored in local memory. At block **906**, the user device determines whether any identified rule indicates a switch to a preferred wireless carrier. If not, method **900** ends. If so, the user device determines whether the user device contains a device profile of the preferred wireless carrier (block **908**).

If the user device contains the device profile of the preferred wireless carrier, the user device reprograms the modem with this device profile (block **910**) and establishes a network connection using the device profile of the preferred wireless carrier. In one embodiment, the user device power cycles the modem to implement profile changes prior to establishing the network connection.

If the user device does not contain the device profile of the preferred carrier, the user device requests this device profile from the rule server (block **914**), receives this device profile from the rules server (block **916**), reprograms the modem with this device profile (block **910**), and establishes a network connection using the device profile of the preferred wireless carrier.

Referring to FIG. **10**, method **1000** begins with user device receiving a message from an authentication server, indicating that the network access via a first wireless carrier is denied. At block **1004**, in one embodiment, the user device identifies the next wireless carrier in a preferred carrier list stored in memory of the user device. In another embodiment, the user device sends a request to the rule server to identify a preferred wireless carrier.

At block **1006**, the user device obtains the device profile for the identified wireless carrier (from local memory or from the rule server). At block **1008**, the user device reprograms the modem with the obtained device profile. At block **1010**, the user device power cycles the modem to implement the obtained device profile and connects to the network using the obtained device profile.

FIG. **11** is a block diagram illustrating an exemplary user device **1100**. The user device **1100** may be the same as user device **102** of FIG. **1** and may be any type of computing device such as an electronic book reader, a PDA, a mobile phone, a laptop computer, a portable media player, a tablet computer, a camera, a video camera, a netbook, a desktop computer, a gaming console, a DVD player, a media center, and the like.

The user device **1100** includes one or more processing units **1104**, such as one or more CPUs. The user device **1100** also includes system memory **1106**, which may correspond to any combination of volatile and/or non-volatile storage mechanisms. The system memory **1106** may store information which provides an operating system component **1108**, various program modules **1110** including the profile switching module **118**, program data **1112**, and/or other components. The user device **1100** performs functions by using the processing unit(s) **1104** to execute the profile switching module **118** and other instructions provided by the system memory **1106**.

The user device **1100** may also include a data storage device **1114** that may consist of one or more types of removable storage and/or one or more types of non-removal storage. The data storage device **1114** may include a computer-readable medium **1116** on which is stored one or more sets of instructions (e.g., instructions of the profile switching module **118**) embodying any one or more of the methodologies or functions described herein. As shown, instructions of the profile switching module **118** may also reside, completely or at least partially, within the system memory **1106** and/or within the processing unit(s) **1130** during execution thereof by the user device **1100**, the system memory **1106** and the processing unit(s) **1130** also constituting computer-readable media. The instructions of the profile switching module **118** may further be transmitted or received over a network.

The user device **1100** may also include one or more input devices **1118** (keyboard, mouse device, specialized selection keys, etc.) and one or more output devices **1120** (displays, printers, audio output mechanisms, etc.). The user device **1100** may further include a wireless modem **1122** to allow the user device **1100** to communicate via a wireless network with other computing devices **1124**, such as remote computers, the item providing system, and so forth. The wireless modem **1122** may allow the user device **1100** to receive a telephone ring and also communicate with the item providing system in a data mode. The wireless modem **1122** may provide network connectivity using any type of mobile network technology including, for example, cellular digital packet data (CDPD), general packet radio service (GPRS), enhanced data rates for GSM evolution (EDGE), universal mobile telecommunications system (UMTS), 1 times radio transmission technology (1xRTT), evaluation data optimized (EVDO), high-speed downlink packet access (HSDPA), WiFi, etc.

The above-enumerated list of modules is representative and is not exhaustive of the types of functions performed by the user device **1100**. As indicated by the label "Other Device Functionality" **1128**, the user device **1100** may include additional functions.

FIG. **12** illustrates an exemplary server system **1200**, such as an item providing system or a communication enabling system, in the form of a computer system within which a set of instructions, for causing the machine to perform any one or more of the methodologies discussed herein, may be executed. In alternative embodiments, the machine may be connected (e.g., networked) to other machines in a LAN, an intranet, an extranet, or the Internet. The machine may operate in the capacity of a server machine in client-server network environment. The machine may be a personal computer (PC), a set-top box (STB), a server, a network router, switch or bridge, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein.

The exemplary computer system **1200** includes a processing system (processor) **1202**, a main memory **1204** (e.g., read-only memory (ROM), flash memory, dynamic random access memory (DRAM) such as synchronous DRAM (SDRAM)), a static memory **1206** (e.g., flash memory, static

random access memory (SRAM)), and a data storage device **1216**, which communicate with each other via a bus **1206**.

Processor **1202** represents one or more general-purpose processing devices such as a microprocessor, central processing unit, or the like. More particularly, the processor **1202** may be a complex instruction set computing (CISC) microprocessor, reduced instruction set computing (RISC) microprocessor, very long instruction word (VLIW) microprocessor, or a processor implementing other instruction sets or processors implementing a combination of instruction sets. The processor **1202** may also be one or more special-purpose processing devices such as an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), a digital signal processor (DSP), network processor, or the like. The processor **1202** is configured to execute the rule server **110** and/or rule creation module **116** for performing the operations and steps discussed herein.

The computer system **1200** may further include a network interface device **1222**. The computer system **1200** also may include a video display unit **1210** (e.g., a liquid crystal display (LCD) or a cathode ray tube (CRT)), an alphanumeric input device **1212** (e.g., a keyboard), a cursor control device **1214** (e.g., a mouse), and a signal generation device **1220** (e.g., a speaker).

The data storage device **1216** may include a computer-readable medium **1224** on which is stored one or more sets of instructions (instructions of rule server **110** and/or rule creation module **116**) embodying any one or more of the methodologies or functions described herein. The rule server **110** and/or rule creation module **116** may also reside, completely or at least partially, within the main memory **1204** and/or within the processor **1202** during execution thereof by the computer system **1200**, the main memory **1204** and the processor **1202** also constituting computer-readable media. The rule server **110** and/or rule creation module **116** may further be transmitted or received over a network **1220** via the network interface device **1222**.

While the computer-readable storage medium **1224** is shown in an exemplary embodiment to be a single medium, the term "computer-readable storage medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more sets of instructions. The term "computer-readable storage medium" shall also be taken to include any medium that is capable of storing, encoding or carrying a set of instructions for execution by the machine and that cause the machine to perform any one or more of the methodologies of the present invention. The term "computer-readable storage medium" shall accordingly be taken to include, but not be limited to, solid-state memories, optical media, and magnetic media.

In the above description, numerous details are set forth. It will be apparent, however, to one of ordinary skill in the art having the benefit of this disclosure, that embodiments of the invention may be practiced without these specific details. In some instances, well-known structures and devices are shown in block diagram form, rather than in detail, in order to avoid obscuring the description.

Some portions of the detailed description are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the above discussion, it is appreciated that throughout the description, discussions utilizing terms such as "detecting", "identifying", "sending", "recording" or the like, refer to the actions and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (e.g., electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Embodiments of the invention also relate to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions.

The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct a more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description below. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein.

It is to be understood that the above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reading and understanding the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

What is claimed is:

1. A non-transitory computer readable storage medium having instructions that, when executed by a processing system, cause the processing system to perform operations comprising:

detecting, by the processing system, a condition associated with a switch from a current wireless carrier to a specified wireless carrier;

identifying, by the processing system, a user device to which the condition applies; and

responsive to identifying the user device to which the condition applies, performing the following comprising:

sending, by the processing system, a message to the user device, while the user device is connected to the cur-

rent wireless carrier, the message indicating the switch to the specified wireless carrier; and

sending, by the processing system, at least one of a device profile for the specified wireless carrier or an identifier for the device profile, the device profile comprising data defining a new unique international mobile subscriber identity (IMSI) associated with the specified wireless carrier that will replace a current IMSI associated with the current wireless carrier;

receiving a response of the user device to the message, the response indicating that the switch to the specified wireless carrier is undesirable;

determining whether any rule provides an alternative wireless carrier for switching;

when any rule provides the alternative wireless carrier for switching, sending a second message to the user device, the second message indicating a switch to the alternative wireless carrier; and

when no rules provide the alternative wireless carrier for switching, sending a third message to the user device, the third message insisting that the switch to the specified wireless carrier be performed.

2. The non-transitory computer readable storage of claim **1**, wherein:

the device profile comprises subscriber identity module (SIM) data that defines the new unique IMSI, the new unique IMSI comprising a mobile country code (MCC), a mobile network code (MNC) and a mobile station identification number (MSIN) associated with the specified wireless carrier; and

the SIM data further defines settings for the specified wireless carrier, the settings comprising at least one of security authentication information, ciphering information or a list of services.

3. The non-transitory computer readable storage medium of claim **2**, wherein the device profile further comprises a modem profile that defines connection parameters for the specified wireless carrier, the connection parameters comprising at least one of a frequency band or a format for presenting a name of the specified wireless carrier on the user device.

4. The non-transitory computer readable storage medium of claim **1**, wherein the condition is defined by a rule that is based on at least one of a performance characteristic of the specified wireless carrier or a cost characteristic of the specified wireless carrier.

5. The non-transitory computer readable storage medium of claim **1**, wherein detecting the condition associated with a switch to the specified wireless carrier comprises:

detecting a change in a location of the user device;

identifying one or more rules applicable to a new location of the user device; and

determining that one of the identified rules indicates the switch to the specified wireless carrier.

6. A non-transitory computer readable storage medium including instructions that, when executed by a processing unit of a user device, cause the processing unit to perform operations comprising:

receiving, by the processing unit, while the user device is connected to a first wireless carrier, a message comprising an indication that a switch of the user device from the first wireless carrier to a second wireless carrier is to be performed;

sending, by the processing unit, a response to the message, the response indicating that the switch to the second wireless carrier is undesirable;

in response to the sending the response to the message,

receiving, by the processing unit, a second message indicating a switch to an alternative wireless carrier when a rule provides the alternative wireless carrier for switching; and

receiving, by the processing unit, a third message insisting that the switch to the second wireless carrier be performed when no rules provide the alternative wireless carrier for switching;

when no rules provide the alternative wireless carrier for switching, obtaining, by the processing unit, a device profile associated with the second wireless carrier, the device profile comprising data defining a new unique international mobile subscriber identity (IMSI) associated with the second wireless carrier that will replace a current IMSI associated with the first wireless carrier;

reprogramming a modem of the user device using the device profile associated with the second wireless carrier, wherein the reprogramming causes the user device to switch from the first wireless carrier to the second wireless carrier; and

establishing a network connection for the user device using the device profile associated with the second wireless carrier.

7. The non-transitory computer readable storage medium of claim **6**, wherein:

the device profile comprises subscriber identity module (SIM) data that defines the new unique IMSI, the new unique IMSI comprising a mobile country code (MCC), a mobile network code (MNC) and a mobile station identification number (MSIN) associated with the second wireless carrier; and

the SIM data further defines settings for the second wireless carrier, the settings comprising at least one of security authentication information, ciphering information or a list of services.

8. The non-transitory computer readable storage medium of claim **7**, wherein the device profile further comprises a modem profile that defines connection parameters for the second wireless carrier, the connection parameters comprising at least one of a frequency band or a format for presenting a name of the second wireless carrier on the user device.

9. The non-transitory computer readable storage medium of claim **6**, wherein obtaining the device profile associated with the second wireless carrier comprises at least one of a) receiving the device profile associated with the second wireless carrier from a server or b) retrieving the device profile associated with the second wireless carrier from secure memory.

10. The non-transitory computer readable storage medium of claim **6**, wherein the receiving comprises receiving the indication in response to a condition associated with the switch from the first wireless carrier to the second wireless carrier, wherein the condition is any one of a change in a location of the user device, a message indicating that the user device is denied network access via the first wireless carrier or a change in a network access performance characteristic.

11. The non-transitory computer readable storage medium of claim **6**, wherein receiving the indication that the switch of the user device from the first wireless carrier to the second wireless carrier is to be performed comprises at least one of a) detecting that a condition pertaining to the switch of the user device from the first wireless carrier to the second wireless carrier has been satisfied or b) receiving a command to perform the switch from the first wireless carrier to the second wireless carrier.

12. A user device comprising:

a wireless modem; and

a processing unit coupled to the wireless modem, the processing unit to:

receive, while the user device is connected to a first wireless carrier, a message comprising an indication that a switch of the user device from the first wireless carrier to a second wireless carrier is to be performed;

send a response to the message, the response indicating that the switch to the second wireless carrier is undesirable;

in response to the sending the response to the message,

receive a second message indicating a switch to an alternative wireless carrier when a rule provides the alternative wireless carrier for switching; and

receive a third message insisting that the switch to the second wireless carrier be performed when no rules provide the alternative wireless carrier for switching;

when no rules provide the alternative wireless carrier for switching, obtain a device profile associated with the second wireless carrier, the device profile comprising data defining a new unique international mobile subscriber identity (IMSI) associated with the second wireless carrier that will replace a current IMSI associated with the first wireless carrier;

reprogram the wireless modem using the device profile associated with the second wireless carrier, wherein the reprogramming causes the user device to switch from the first wireless carrier to the second wireless carrier;

and establish a network connection for the user device using the device profile associated with the second wireless carrier.

13. The user device of claim **12**, wherein the user device is an electronic book reader.

14. The user device of claim **12**, wherein the device profile comprises subscriber identity module (SIM) data that defines the new unique IMSI, the new unique IMSI comprising a mobile country code (MCC), a mobile network code (MNC) and a mobile station identification number (MSIN) associated with the second wireless carrier.

15. The user device of claim **14**, wherein the SIM data further defines settings for the second wireless carrier, the settings comprising at least one of security authentication information, ciphering information or a list of services.

16. The user device of claim **14**, wherein the device profile further comprises a modem profile that defines connection parameters for the second wireless carrier, the connection parameters comprising at least one of a frequency band or a format for presenting a name of the second wireless carrier on the user device.

17. The user device of claim **12**, wherein obtaining the device profile associated with the second wireless carrier comprises at least one of a) receiving the device profile associated with the second wireless carrier from a server or b) retrieving the device profile associated with the second wireless carrier from secure memory on the modem.

18. The user device of claim **12**, wherein the indication is received in response to a condition associated with the switch from the first wireless carrier to the second wireless carrier, wherein the condition is any one of a change in a location of the user device, a message indicating that the user device is denied network access via the first wireless carrier, and a change in a network access performance characteristic.

19. The user device of claim **12**, wherein receiving the indication that the switch of the user device from the first wireless carrier to the second wireless carrier is to be performed comprises at least one of a) detecting that a condition pertaining to the switch of the user device from the first wireless carrier to the second wireless carrier has been satisfied or b) receiving a command to perform the switch from the first wireless carrier to the second wireless carrier.

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