



(43) International Publication Date
29 September 2016 (29.09.2016)

(51) International Patent Classification:

H04W 8/02 (2009.01) H04W 12/06 (2009.01)
H04W 60/00 (2009.01)

(21) International Application Number:

PCT/US2015/022805

(22) International Filing Date:

26 March 2015 (26.03.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(71) Applicant: HEWLETT PACKARD ENTERPRISE DEVELOPMENT LP [US/US]; 11445 Compaq Center Drive West, Houston, TX 77070 (US).

(72) Inventors; and

(71) Applicants (for US only): AYERS, John I. [US/US]; 10810 Farnam Drive, Omaha, Nebraska 68154 (US). ASKERUP, Anders [SE/US]; 10810 Farnam Drive, Omaha, Nebraska 68154 (US). KENYON, Brad [US/US]; 10810 Farnam Drive, Omaha, Nebraska 68154 (US).

(74) Agents: FEBBO, Michael et al.; Hewlett Packard Enterprise, 3404 E. Harmony Road, Mail Stop 79, Fort Collins, CO 80528 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

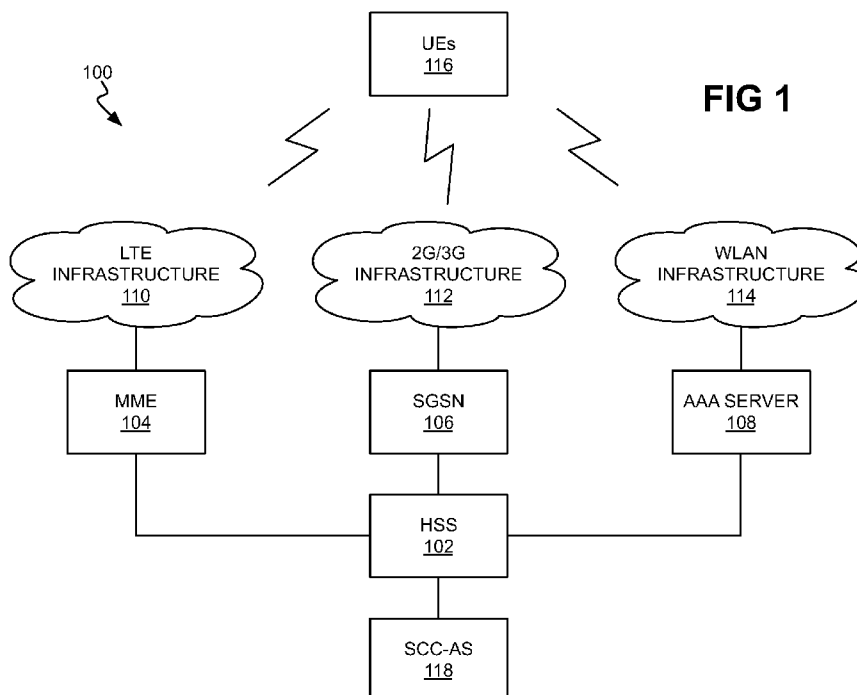
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: REGISTRATION INFORMATION



(57) Abstract: A home server, such as a home subscriber server (HSS) receives a request from an application server, such as a service centralization and continuity application server (SCC-AS) pertaining to a wireless device. The home server determines whether the device is registered with an authorization server, such as an authentication, authorization, and account (AAA) server. In response to determining that it is, the home server returns information to the application server.



Published:

— *with international search report (Art. 21(3))*

REGISTRATION INFORMATION

BACKGROUND

[0001] Wireless mobile communication networks by which wireless mobile devices such as smartphones can communicate wirelessly have greatly

5 increased in popularity. Such wireless mobile communication networks provide for both voice and data communication. Traditionally, these two types of communication were separate. More recently, with the advent of voice-over-Internet protocol (VoIP) technologies, voice communication has been merged with data communication, where voice is considered as just another type of data
10 communication.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 is a diagram of an example wireless mobile communication network and wireless local-area network (WLAN) architecture.

[0003] FIG. 2 is a flowchart of an example method for providing seamless
15 integration between a WLAN and a wireless mobile communication network when voice communication is terminated.

[0004] FIG. 3 is a diagram of an example server for providing seamless integration between a WLAN and a wireless mobile communication network when voice communication is terminated.

DETAILED DESCRIPTION

[0005] As noted in the background, although traditionally wireless mobile communication networks treated voice communication separately from data communication, more recently voice communication is being treated as just

5 another type of data communication. For example, wireless mobile communication networks employing second generation (2G) and third generation (3G) protocols typically treat voice communication in a circuit-switching manner akin to wired public switched telephone networks (PSTNs), and treat data communication in a packet-switching manner similar to Internet protocol (IP)-type
10 networks like the Internet. However, newer fourth generation (4G) data transmission protocols such as long-term evolution (LTE) permit voice communication to be treated as data, using voice-over-Internet protocol (VoIP) technologies, specifically voice-over-LTE (VoLTE) technologies.

[0006] As such, wireless mobile communication networks have been
15 upgraded to support VoLTE technologies, permitting voice communication using both traditional packet-switching approaches provided by the 2G/3G protocol as well as packet-switching approaches that 4G protocols like LTE permit. (The terminology “2G/3G” protocol is used herein to specify just the 2G protocol, just the 3G protocol, or both the 2G and 3G protocols.) One advantage of providing
20 voice communication in a packet-switching manner is greater efficiency in network resource utilization as compared to providing such voice communication in a circuit-switching manner.

[0007] Packet-switching approaches for supporting voice communication

in wireless mobile communication networks, such as VoLTE, can be likened to VoIP technologies that have already proven popular as a lower cost and more flexible alternative to traditional landline PSTN technologies by moving voice

5 communications from a PSTN and onto the Internet. With the advent of wireless local-area network (WLAN) technologies such as Wi-Fi, VoIP in context of WLAN – i.e., voice-over-WLAN (VoWLAN) such as voice over Wi-Fi (VoWiFi) – has also been shown to be feasible. VoWLAN technologies have a decided cost advantage in expanding coverage areas over VoLTE technologies that rely upon
10 mobile communication networks: in general, it is usually cheaper and faster to add Wi-Fi “hot spots” than it is to add mobile communication network towers and antennas.

[0008] The desirable outcome is for seamless integration between WLANs and mobile communication networks. For example, a user of a smartphone

15 might connect to a Wi-Fi network, and when he or she travels out of range, be automatically switched over to a mobile communication network using a 4G protocol or the 2G/3G protocol. If a user is currently on a phone call using VoWLAN when he or she moves out of range, the user may be switched over to VoLTE automatically, for instance, without the phone call dropping out. In this
20 way, WLAN technologies can supplement existing mobile communication networks, or even supplant them, with existing networks using a 4G or the 2G/3G protocol serving as secondary networks where a WLAN hot spot is unavailable.

[0009] However, existing mobile communication network technologies do not currently support such seamless integration with WLANs. For example, when a user of a smartphone is called using his or her phone number, the access domain to which the smartphone is currently connected (i.e., attached) is
5 determined so that the phone call can terminate (i.e., connect to) to the user's smartphone. The terminology "access domain" refers to the protocol and/or the underlying infrastructure by which the smartphone communicates. Current technologies specify the access domain as being a type of third generation partnership project (3GPP) access domain: either a 4G-type domain that may be
10 supported by a network device known as a mobile management entity (MME), or a 2G/3G-type domain that may be supported by a serving general packet radio service (GPRS) support node (SGSN). When the user moves within a "cell" supported by an MME or an SGSN, the smartphone registers with the MME or the SGSN to become attached to the corresponding access domain.

[0010] VoWLAN, by comparison, involves the user's smartphone being attached to a non-3GPP access domain not supported by existing mobile communication network technologies, specifically a VoWLAN-type non-3GPP access domain. In general, attachment occurs when the smartphone registers with an authentication, authorization, and account (AAA) server. Such AAA
20 registration and non-3GPP domain attachment occur outside the auspices of existing MME/SGSN registration and 3GPP domain attachment topologies, which means that terminating a phone call to a smartphone attached to a non-3GPP domain is at best difficult to accomplish. As such, seamless integration between

mobile communication networks using a 4G protocol or the 2G/3G protocol and WLANs connected to the Internet is difficult to achieve in practice.

[0011] FIG. 1 shows an example wireless mobile communication network

and WLAN architecture 100 in which wireless devices can receive phone calls

5 when attached to a 3GPP domain, such as a 4G-type or a 2G/3G-type domain,

or when attached to a non-3GPP domain, such as a WLAN-type domain. The

architecture 100 includes a home subscriber server (HSS) 102, an MME 104, an

SGSN 106, and an AAA server 108. The architecture 100 further includes 4G

LTE wireless communication infrastructure 110, 2G/3G wireless communication

10 infrastructure 112, and WLAN infrastructure 114. The architecture 100 includes

user equipments (UEs) 116 and a service centralization and continuity

application server (SCC-AS) 118. The communication depicted in FIG. 1 among

the HSS 102, the MME 104, the SGSN 106, the AAA server 108, the

infrastructures 110, 112, and 114, and the SCC-AS 118 is specifically signaling

15 communication for maintaining and determining registration of the UEs 116

with the MME 104, the SGSN 106, and the AAA server 108 as managed by

the HSS 102.

[0012] The HSS 102 communicates over wired communication lines with

the MME 104, the SGSN 106, the AAA server 108, and the SCC-AS 118. The

20 MME 104 communicates over a wired communication line with the LTE wireless

communication infrastructure 110 that supports a 4G-type 3GPP access domain,

and the SGSN 106 communicates over a wired communication line with the

2G/3G wireless communication infrastructure 112 that supports a 2G/3G-type

3GPP access domain. The AAA server 108 also communicates over a wired communication line with the WLAN infrastructure 114 that supports a WLAN-type non-3GPP access domain, such as a VoWLAN-type non-3GPP access domain in the case of voice communication like phone calls. The UEs 116 communicate
5 wireless with the infrastructures 110, 112, and 114.

[0013] The HSS 102 is a type of server, and maintains registrations of the UEs 116 with the MME 104, the SGSN 106, and the AAA server 108. The MME 104 is a type of network component or cellular communication network device that is compatible with just the LTE protocol, and the SGSN 106 is a type of
10 network component or cellular communication network device that is compatible with just the 2G/3G protocol. The AAA server 108 is another type of server, which performs authentication, authorization, and accounting functionality for WLAN communication, including VoWLAN communication) in relation to the UEs 116. That is, the AAA server 108 authenticates a UE 116 to verify that the UE
15 116 is that which it identifies itself as, authorizes the UE 116 so that it communicate over WLAN, such as participating in VoWLAN voice communication, and performs accounting as to the usage of the WLAN infrastructure 114 by the UE 116.

[0014] The wireless communication infrastructure 110 includes the radio
20 transmission towers and other components with which the UEs 116 directly communicate in a wireless manner using the LTE protocol, including VoLTE for voice communication. The wireless communication infrastructure 112 includes the radio transmission towers and other components with which the UEs 116

directly communicate in a wireless manner using the 2G/3G protocol, including voice communication in a circuit-switching manner. The WLAN infrastructure 114 includes the access points, routers, and other components with which the UEs 116 directly communicate in a wireless manner using an IP protocol,

5 including VoWLAN such as VoWiFi for voice communication. The WLAN infrastructure 114 may include the Internet, or connections thereto. The UEs 116 are wireless devices, such as wireless mobile devices like smartphones.

[0015] The HSS 102 maintains LTE registration of the UEs 116 with the MME 104, 2G/3G registration of the UEs 116 with the SGSN 106, and WLAN
10 registration of the UEs 116 with the AAA server 108. Registration of a UE with a component like the MME 104, the SGSN 106, or the AAA server 108 means that the UE 116 has moved into a physical location serviced by the component in question, and as such registers with the component to receive wireless communication services in that area. A UE 116 can be concurrently registered
15 with more than one of the MME 104, the SGSN 106, and the AAA server 108.

[0016] When a phone call (i.e., a voice communication) is initiated to a UE 116, the SCC-AS 118 has to determine the current registration of the UE 116 so that the SCC-AS 118 can terminate the phone call to the UE 116. Registration of the UE 116 with the AAA server 108 means that the UE 116 is attached to a non-
20 3GPP domain, and is able to receive voice communication over VoWLAN.

Registration of the UE 116 with the MME 104 means that the UE 116 is attached to a 4G-type 3GPP domain, and can receive voice communication over VoLTE if supported. Registration of the UE 116 with the SGSN 106 means that the UE

116 is attached to a 2G/3G-type 3GPP domain. Priority among VoWLAN, VoLTE, and circuit switching may be specified by the provider of the architecture 100 or by the user of the UE 116. For example, one prioritization may favor VoWLAN over VoLTE, and both VoWLAN and VoLTE over circuit switching.

5 **[0017]** FIG. 2 shows an example method 200 for providing seamless integration among the LTE infrastructure 110, the 2G/3G infrastructure 112, and the WLAN infrastructure 114 when terminating a voice communication to a UE 116. The HSS 102 performs the method 200. In one implementation, VoWLAN is prioritized over VoLTE, which is prioritized over circuit switching, when
10 terminating a phone call to the UE 116. Furthermore, in one implementation, it is assumed that registration of the UE 116 with the MME 104 means that the UE 116 can perform voice communication using VoLTE.

[0018] The HSS 102 receives a request from the SCC-AS 118 pertaining to the UE 116 (202). The SCC-AS 118 generates the request to determine what
15 access domain to which the UE 116 is currently attached, so that the SCC-AS 118 can appropriately route an incoming phone call to the UE 116. This request can be a terminating access domain selection (T-ADS)-related request.

[0019] In response to receiving the request, the HSS 102 determines whether the UE 116 is currently registered with the AAA server 108 (204). In
20 one implementation, the HSS 102 does not have this information stored, and therefore queries the AAA server 108 (206). In response, the HSS 102 receives from the AAA server 108 information regarding the registration of the UE 116

with the AAA server 108 if the UE 116 is registered with the AAA server 108, or an indication that the UE 116 is not registered with the AAA server 108 (208).

[0020] In another implementation, the HSS 102 determines whether the AAA server 108 previously provided the information (210). In general, when the UE 116 registers with the AAA server 108 for attachment to the VoWLAN-type non-3GPP access domain, the AAA server 108 provides this registration information to the HSS 102, which the HSS 102 then stores. However, some implementations of the HSS 102 may perform parts 206 and 208 in lieu of part 210, just in case the information previously provided has changed.

[0021] If the UE 116 is registered with the AAA server 108, then the HSS 102 concludes that the UE 116 is currently attached to the VoWLAN-type non-3GPP access domain (214). In this respect, it is noted that the HSS 102 may not have any direct knowledge that the UE 116 is indeed attached to this access domain. Rather, the HSS 102 presumes that the UE 116 is currently attached to the VoWLAN-type non-3GPP access domain if the UE 116 is currently registered with the AAA server 108. This presumption is innovative, because it permits the HSS 102 to leverage existing information regarding registration of the UE 116 with the AAA server 108.

[0022] The HSS 102 returns a response to the SCC-AS 118 providing the information regarding the registration of the UE 116 with the AAA server 108 (216). This information thus permits the SCC-AS 118 to terminate an incoming voice communication to the currently attached VoWLAN-type non-3GPP access domain of the UE 116. The response can be a T-ADS-related response, and can

be considered as providing information regarding the VoWLAN-related access domain of the UE 116 as its current access domain. The information may include, for instance, the type of network to which the UE 116 is currently attached, on which basis the SCC-AS 118 can determine whether the UE 116 could receive a VoIP phone call with sufficient quality and then correspondingly terminate the incoming phone call at the UE 116.

[0023] If the UE 116 is not registered with the AAA server 108, however, then the HSS 102 determines whether the UE 116 is registered with the MME 104 or the SGSN 106 (218). In one implementation, the HSS 102 maintains registration of the UE 116 with the MME 104 and the SGSN 106, and can determine this information directly, whereas in another information the HSS 102 may query the MME 104 and the SGSN 106 in a similar manner by which it queried the AAA server 108 in part 206. If the UE 116 is registered with the MME 104 (220), regardless of whether the UE 116 is registered with the SGSN 106 (224), then in one implementation the HSS 102 responsively returns a response to the SCC-AS 118 providing the information regarding this registration. By comparison, if the UE 116 is not registered with the MME 104 (220) but is registered with the SGSN 106 in one implementation (224), then the HSS 102 responsively returns a response to the SCC-AS 118 providing the information regarding this registration.

[0024] The information regarding the registration with the MME 104 returned in part 222 can include the identification of the LTE cell within which the UE 116 is currently located. Similarly, the information regarding the registration

with the SGSN 106 returned in part 226 can include the identification of the 2G/3G cell within which the UE 116 is currently located. Both types of registration indicate that the UE 116 is currently attached to a 3GPP access domain. In the former case, the 3GPP access domain is a 4G-type (such as LTE-type) 3GPP access domain, whereas in the latter case, the 3GPP access domain is a 2G/3G-type access domain. The response that the HSS 102 returns in part 222 or 226 can be a T-ADS-related response.

[0025] If the UE 116 is not currently registered with the AAA server 108 (212), is not currently registered with the MME 104 (220), and is not currently registered with the SGSN 108 (224), then the HSS 102 responsively returns a response to the SCC-AS 118 indicating that the UE 116 is not currently registered (228). This may also be a T-ADS-related response. The UE 116 may not be currently registered because it is powered off, or has been placed in a mode in which its radios for communicating with the infrastructures 110, 112, and 114 have been turned off. The UE 116 further may not be currently registered because even though its radios are on, the UE 116 is located in a physical location that is out of range of the LTE infrastructure 110, the 2G/3G infrastructure 112, and the WLAN infrastructure 114.

[0026] The method 200 thus provides seamless integration between a mobile communication network – i.e., the LTE infrastructure 110 and the 2G/3G infrastructure 112 – and the WLAN infrastructure 114. Stated another way, the method 200 provides seamless integration with a VoWLAN-type non-3GPP access domain and 3GPP access domains like 4G-type (such as LTE-type) and

2G/3G-type 3GPP access domains. Regardless of whether a UE 116 is specifically registered with the MME 104, the SGSN 106, or the AAA server 108, and thus regardless of whether the UE 116 is specifically attached to a 3GPP access domain or a non-3GPP access domain, the UE 116 receives incoming
5 voice communication such as phone calls.

[0027] It is noted, too, that the method 200 advantageously reduces or eliminates needless network traffic between the HSS 102 and the MME 104 and the SGSN 106. Specifically, if the UE 116 is registered with the AAA server 106, then the HSS 102 can automatically conclude that the UE 116 is currently
10 attached to the VoWLAN-type non-3GPP access domain, and provide this information to the SCC-AS 118 for terminating the incoming phone call. That is, the HSS 102 in this implementation does not determine whether the UE 116 is registered with the MME 104 or the SGSN 106 (i.e., with a cellular communication network device). As such, network traffic between the HSS 102
15 and the MME 104 and the SGSN 106 is reduced.

[0028] FIG. 3 shows an example server 300, which may implement the HSS 102. The server 300 includes networking hardware 302, an access domain determiner 304, and a memory 306. The server 300 can and typically does include other components, in addition to those depicted in FIG. 3. The
20 networking hardware 302 permits the server 300 to communicate with networking components, such as the MME 104 and the SGSN 106, and servers, such as the AAA server 108 and the SCC-AS 118, in a wired manner.

[0029] The access domain determiner 304 performs the method 200 that has been described. The determiner 304 may be implemented in hardware or in a combination of hardware and software. In the former implementation, the determiner 340 may be an application-specific integrated circuit (ASIC) or a field-
5 programmable gate array (FPGA), for instance, appropriately programmed to perform the method 200. In the latter implementation, the determine 340 may include a non-transitory computer-readable data storage medium storing computer-executable code that when executed by a hardware processor performs the method 200.

10 **[0030]** The memory 306 is a hardware memory, and may be volatile memory or non-volatile. The memory 306 stores a flag 308. The flag 308 is set to indicate that on the mobile communication network on which wireless devices like the UEs 116 communicate, VoWLAN is enabled. As such, the access domain determiner 304 performs the method 200 when the flag 308 is set. That
15 is, the determiner 340 determines whether wireless devices are registered with an authorization server when the flag is set. The flag is a network-wide flag.

[0031] The memory 306 can also stores VoWLAN information 310. The information 310 is with respect to the current attachment of wireless devices, such as the UEs 116, that the authorization server provided when the wireless
20 devices were attached to a VoWLAN-related access domain. As has been described above, the AAA server 108, for instance, sends this information to the HSS 102 when a UE 116 registers with the server 108. This information may

include radio access technology (RAT)-type information, which specifies that the radio access in question is WLAN, for example, as opposed to 4G or 2G/3G.

We claim:

1. A non-transitory computer-readable medium storing computer-executable code executable by a home subscriber server (HSS) to:

5 in response to receiving a terminating access domain selection (T-ADS)-related request from a service centralization and continuity application server (SCC-AS) pertaining to a user equipment (UE),

determine whether the UE is registered with an authentication, authorization, and account (AAA) server; and

10 in response to determining that the UE is registered with the AAA server,

return a T-ADS-related response to the SCC-AS providing information regarding registration of the UE with the AAA server.

2. The non-transitory computer-readable medium of claim 1, wherein in
15 response to determining that the UE is registered with the AAA server, the HSS is to return the T-ADS-related response to the SCC-AS without determining whether the UE is registered with any mobile management entity (MME) or with any serving general packet radio service (GPRS) support node (SGSN).

3. The non-transitory computer-readable medium of claim 1, wherein in
20 response to determining that the UE is registered with the AAA server, the HSS

is to conclude that the UE is currently attached to a non-third generation partnership project (3GPP) access domain.

4. The non-transitory computer-readable medium of claim 1, wherein the HSS is to determine whether the UE is registered with the AAA server by

5 querying the AAA server,

wherein in response to querying the AAA server, the HSS receives from the AAA server the information regarding the registration of the UE with the AAA server if the UE is registered with the AAA server.

5. The non-transitory computer-readable medium of claim 1, wherein the

10 HSS is to determine whether the UE is registered with the AAA server by determining whether the AAA server previously provided the HSS server the information regarding the registration of the UE with the AAA server.

6. The non-transitory computer-readable medium of claim 1, wherein in response to determining that the UE is not registered with the AAA server, the

15 HSS is to:

determine whether the UE is registered with one or more of a mobile management entity (MME) and a serving general packet radio service (GPRS) support node (SGSN);

in response to determining that the UE is registered with the MME,

20 returning the T-ADS-related response to the SCC-AS providing information regarding registration of the UE with the MME; and

in response to determining that the UE is not registered with the MME and is registered with the SGSN,

returning the T-ADS-related response to the SCC-AS providing information regarding registration of the UE with the SGSN.

5 7. A method comprising:

in response to receiving, by a home server, a request from an application server asking for a current access domain of a wireless device,

determining, by the home server, whether the wireless device is registered with an authorization server; and

10 in response to determining that the wireless device is registered with the authorization server,

returning, by the home server, a response to the application server providing information regarding a voice-over-wireless local-area network (VoWLAN)-related access domain of the wireless device as the current access
15 domain of the wireless device.

8. The method of claim 7, wherein in response to determining that the wireless device is registered with the authorization server, the home server returns the response to the application server without determining whether the wireless device is registered with a cellular communication network device.

20 9. The method of claim 7, further comprising:

in response to determining that the wireless device is registered with the

authorization server,

concluding, by the home server, that the wireless device is currently attached to the VoWLAN-related access domain.

10. The method of claim 7, wherein determining whether the wireless device

5 is registered with the authorization server comprises:

sending a query to the authorization server; and

receiving a response from the authorization server including the information regarding the regarding the VoWLAN-related access domain of the wireless device if the wireless device is registered with the authorization server.

10 11. The method of claim 7, wherein determining whether the wireless device is registered with the authorization server comprises:

determining whether the authorization server previously provided the home server the information regarding the regarding the VoWLAN-related access domain of the wireless device.

15 12. A server comprising:

networking hardware to communicate with an application server that is to terminate a voice call to a wireless device to receive from the application server a request for a current access domain of the wireless device that is currently attached to a voice-over-wireless local-area network (VoWLAN)-related access

20 domain; and

an access domain determiner to determine that the wireless device is

registered with an authorization server, and to responsively return a response to the application server providing information regarding current attachment of the wireless device to the VoWLAN.

13. The server of claim 12, further comprising:

5 a memory to store a network-wide flag that is set to indicate that on a network within which the wireless device communicates, VoWLAN is enabled, wherein the access domain determiner is to determine whether the wireless device is registered with the authorization server if the network-wide flag is set.

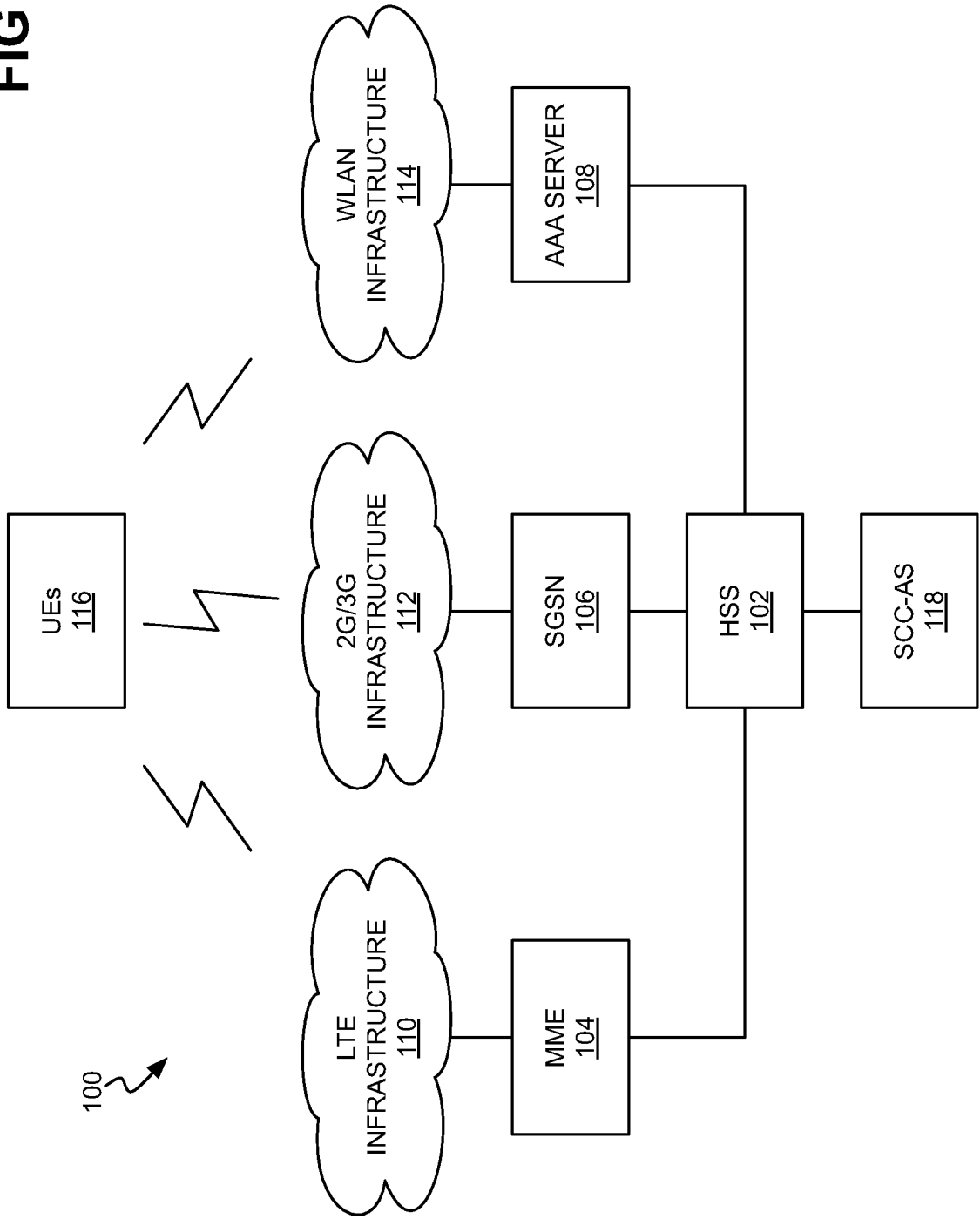
10 14. The server of claim 12, wherein the networking hardware is further to communicate with the authorization server,

and wherein the access domain determiner is to determine whether the wireless device is registered with the authorization server by querying the authorization server for the information regarding the current attachment of the
15 wireless device to the VoWLAN.

15. The server of claim 12, wherein the networking hardware is further to communicate with the authorization server, the server further comprising:

a memory to store the information regarding the current attachment of the wireless device to the VoWLAN that the authorization server provided when the
20 wireless device was attached to the VoWLAN-related access domain.

FIG 1



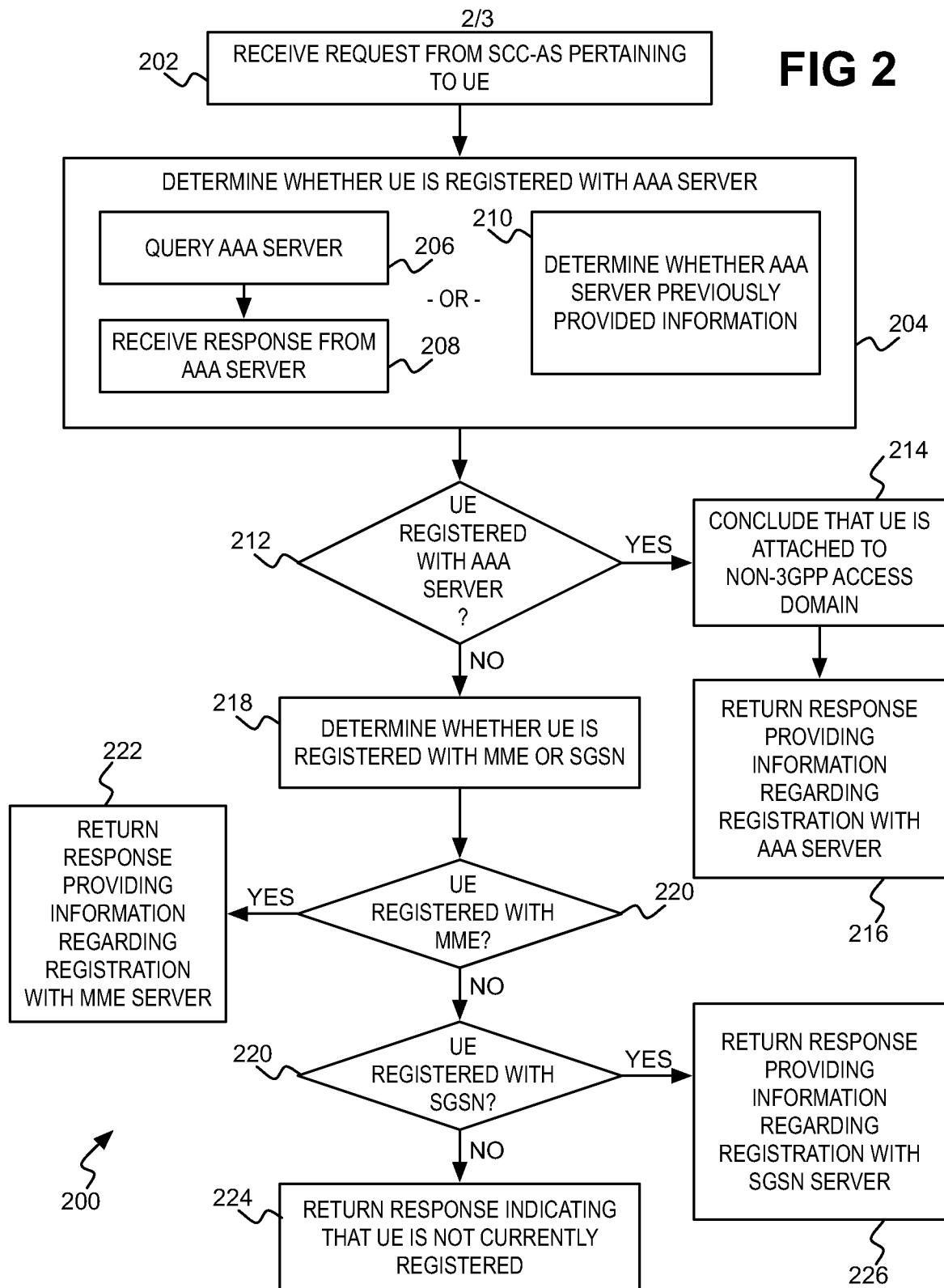
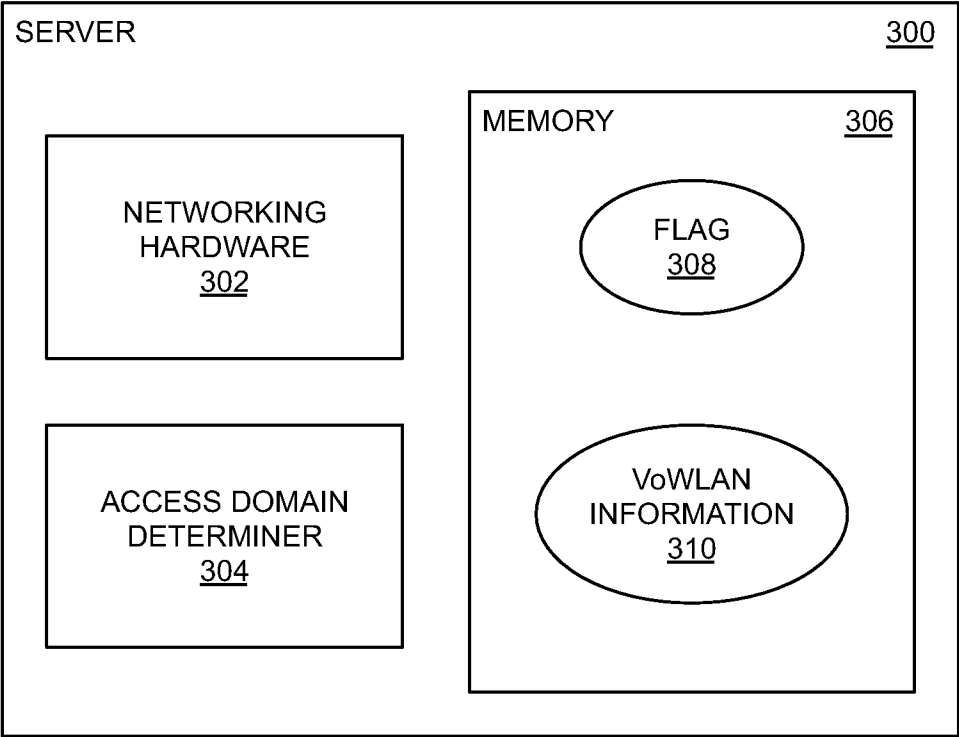


FIG 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/022805**A. CLASSIFICATION OF SUBJECT MATTER****H04W 8/02(2009.01)i, H04W 60/00(2009.01)i, H04W 12/06(2009.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
H04W 8/02; H04W 76/02; H04W 36/16; H04W 8/04; H04W 8/08; H04W 60/00; H04W 12/06Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility modelsElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: HSS, T-ADS, SCC-AS, AAA, registration**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014-202117 A1 (TELEFONAKTIEBOLAGET L M ERICSSON) 24 December 2014 See page 12, lines 12-37; and figures 2-3.	1-5, 7-15
Y		6
Y	NOKIA NETWORKS, `T-ADS clarification`, C4-150202, 3GPP TSG-CT WG4 #68, Sorrento, Italy, 28 January 2015 See pages 5-9.	6
A	`3GPP; TSG-CT; Organization of subscriber data (Release 13)`, 3GPP TS 23.008 V13.0.0, 19 March 2015 See section 2.13.75.	1-15
A	KR 10-2012-0123337 A (SAMSUNG ELECTRONICS CO., LTD.) 08 November 2012 See paragraphs [0040]-[0049]; and figure 1.	1-15
A	US 2012-0307794 A1 (KAMEL M. SHAHEEN et al.) 06 December 2012 See paragraphs [0003], [0067]-[0086]; and figures 4-5.	1-15



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

22 December 2015 (22.12.2015)

Date of mailing of the international search report

23 December 2015 (23.12.2015)

Name and mailing address of the ISA/KR

International Application Division
Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan City, 302-701,
Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

YANG, Jeong Rok

Telephone No. +82-42-481-5709



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/022805

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014-202117 A1	24/12/2014	None	
KR 10-2012-0123337 A	08/11/2012	CN 102714539 A	03/10/2012
		EP 2526637 A2	28/11/2012
		GB 2476977 A	20/07/2011
		GB 2476977 B	11/06/2014
		GB 2477014 A	20/07/2011
		GB 2477014 B	11/06/2014
		GB 2504635 A	05/02/2014
		GB 2504635 B	11/06/2014
		JP 2013-517732 A	16/05/2013
		JP 5795334 B2	14/10/2015
		US 2012-0327852 A1	27/12/2012
		WO 2011-087331 A2	21/07/2011
		WO 2011-087331 A3	01/12/2011
US 2012-0307794 A1	06/12/2012	WO 2011-057127 A2	12/05/2011
		WO 2011-057127 A3	14/07/2011