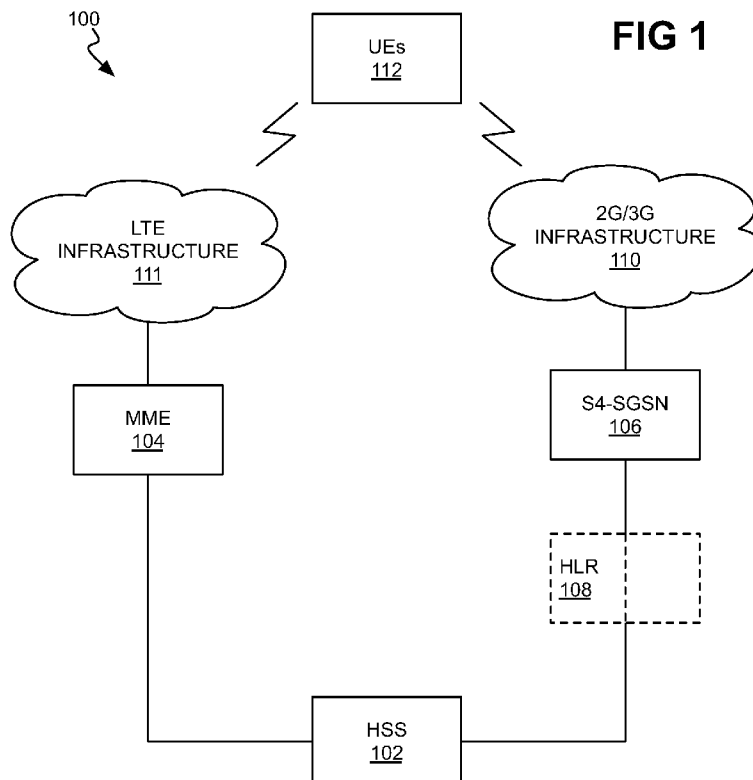




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(54) Title: REGISTRATION OVERRIDE



(57) Abstract: A server, such as a home subscriber server (HSS) receives a registration request from a first component, such as a mobile management entity (MME). The request pertains to a wireless device currently registered with a second component of a different type, such as a serving general packet radio service (GPRS) support node (SGSN). The first component has determined that the second component supports dual registration, such as idle mode signaling reduction (ISR). The request specifies enablement of dual registration. The server determines that the second component does not support dual registration, and overrides the first component's request by cancelling the device's registration with the second component.



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REGISTRATION OVERRIDE

BACKGROUND

[0001] Wireless mobile communication networks by which wireless mobile devices such as smartphones can communicate wirelessly have greatly
5 increased in popularity. Historically these networks were a way by which wireless voice communication was achieved. Today, however, wireless data communication has dislodged voice communication as the primary usage of such communication networks. As a result, new fourth generation (4G) data
10 transmission protocols such as long-term evolution (LTE) have been developed and deployed, which offer faster data transmission speeds than earlier second generation (2G) and third generation (3G) protocols.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 is a diagram of an example wireless mobile communication network architecture.

15 **[0003]** FIG. 2 is a flowchart of an example method for overriding idle mode signaling reduction (ISR)/dual registration within a wireless mobile communication network.

[0004] FIG. 3 is a diagram of an example server for overriding ISR/dual registration within a wireless mobile communication network.

DETAILED DESCRIPTION

[0005] As noted in the background, fourth generation (4G) long-term evolution (LTE) data transmission protocols have been developed and that offer faster data transmission speed than earlier second generation (2G) and third generation (3G) protocols. However, many wireless mobile devices currently in use are incompatible with the LTE protocol, and instead still rely on the 2G and/or 3G protocols for data communication. As wireless mobile communication networks are upgraded for compatibility with the LTE protocol, they commonly still retain 2G/3G protocol compatibility. The terminology “2G/3G protocol” as used herein encompasses just the 2G protocol, just the 3G protocol, or both the 2G and 3G protocols.

[0006] Furthermore, while national and global rollout of the LTE protocol is proceeding at a fast rate, there are still many areas that are serviced just by the 2G/3G protocol. As such, many if not most wireless mobile devices that are compatible with the LTE protocol are also compatible with the 2G/3G protocol. When such a wireless mobile device is in an area of a communication network that has been upgraded for compatibility with the LTE protocol, the device will communicate with the network using the LTE protocol, even if the area also is compatible with the 2G/3G protocol.

[0007] However, a wireless mobile device can move from one area that is compatible with just the 2G/3G protocol to another area that is also compatible with the LTE protocol. The radio of the device thus switches communication from a frequency over which 2G/3G protocol communication occurs to a frequency

over which LTE protocol communication occurs. The wireless mobile device may, though, be located in an area with relatively weak coverage with respect to the LTE protocol frequency, or located at an edge of one area that supports the LTE protocol and another area that does not. As such, the device may start switching
5 back and forth between the LTE protocol frequency and the 2G/3G protocol frequency, resulting in a “ping-pong” effect.

[0008] To minimize any disruption or other deleterious to ongoing communication sessions of the wireless mobile device, the device may be permitted to maintain registration with both the network component servicing the
10 LTE protocol and the network component servicing the 2G/3G protocol, which is referred to as dual registration. If the wireless mobile communication network supports such dual registration, a wireless mobile device that is registered with the network component servicing the 2G/3G protocol maintains this registration even when its radio stops communicating over the 2G/3G protocol frequency and
15 begins communicating over the LTE protocol frequency. That is, the device is registered with the network component servicing the LTE protocol without having its prior registration with the component servicing the 2G/3G protocol cancelled.

[0009] A feature of compatible wireless mobile communication networks that permits such dual registration is known as idle mode signaling reduction
20 (ISR). As used in, ISR and dual registration are referred to interchangeably, and also by the phrase ISR/dual registration. When a wireless mobile device begins communicating over the LTE protocol frequency, the network component servicing the LTE protocol is able to determine that the device is already

registered with a network component servicing the 2G/3G protocol that is compatible with ISR/dual registration. Therefore, when the component servicing the LTE protocol registers the device with a server managing both components, it requests that ISR be enabled. When receiving this request, the server thus does
5 not cancel the device's earlier registration with the component servicing the 2G/3G protocol. Therefore, the wireless mobile device ultimately has dual registration.

[0010] Older network components that service the 2G/3G protocol are incompatible with ISR/dual registration, and when the network component
10 servicing the LTE protocol determines that a wireless mobile device is already registered with such an older network component, it will not request that ISR be enabled. In this case, the server cancels the device's earlier registration with the component servicing the 2G/3G protocol. As such, the wireless mobile device has just single registration, with the component servicing the LTE protocol.

15 **[0011]** A problem, however, is that network components that service the 2G/3G protocol and that are compatible with ISR/dual registration may nevertheless be operating in a legacy mode in which they cannot support dual registration. The network component servicing the LTE protocol is unable to determine, however, if such a 2G/3G protocol-servicing network component is
20 operating in this legacy mode or not, and rather detects just that the component is inherently compatible with ISR/dual registration. Therefore, the component servicing the LTE protocol will request that ISR be enabled, and the server will not cancel a wireless mobile device's earlier registration with the component

servicing the 2G/3G protocol, even though the network component servicing the 2G/3G protocol is operating in a legacy mode in which dual registration is not supported.

[0012] Disclosed herein are techniques that overcome this problem. As an

5 example, a server may receive a request from a network component servicing the LTE protocol to register a wireless device that is currently registered with a network component servicing the 2G/3G protocol. The request specifies that ISR be enabled, because the network component servicing the LTE protocol has determined that the network component servicing the 2G/3G protocol supports
10 dual registration. However, the server then determines that the component servicing the 2G/3G protocol indeed does not support dual registration.

Therefore, the server overrides the request's specification that ISR be enabled, and still cancels the device's registration with the component servicing the 2G/3G protocol.

15 **[0013]** In this way, the techniques disclosed herein permit ISR/dual registration to be employed in a large variety of different wireless mobile communication network topologies. Even if a given network includes 2G/3G protocol-servicing network components that are compatible with ISR/dual registration, if such a network component is operating in a legacy mode that is
20 incompatible with ISR/dual registration, the techniques disclosed herein selectively permit ISR override for this component. Therefore, ISR/dual registration is permitted to occur where it can, even when the network includes

network components that are compatible with ISR/dual registration but operating in a legacy mode incompatible with ISR/dual registration.

[0014] The techniques are thus advantageous to other alternatives. One alternative is to completely shut off ISR/dual registration network-wide. This

5 alternative is undesirable, because it means that if within a wireless mobile communication network there is even one 2G/3G protocol-servicing network component that is inherently compatible with ISR/dual registration but that is operating in an incompatible legacy mode, no other network component can take advantage of ISR/dual registration. Another alternative is to ensure that no
10 2G/3G protocol-servicing network components are deployed in incompatible legacy modes. This alternative is also undesirable, as it limits the flexibility of network operators in deploying and configuring their networks.

[0015] FIG. 1 shows an example wireless mobile communication network architecture 100. The architecture 100 includes a home subscriber server (HSS)

15 102, a mobile management entity (MME) 104, an S4-serving general packet radio service (GPRS) support node (SGSN) 106, 2G/3G wireless communication infrastructure 110, 4G LTE wireless communication infrastructure 111, and user equipments (UEs) 112. The architecture 100 can also include an external home location register (HLR) 108. The communication depicted in FIG. 1 via lines
20 among the HSS 102, MME 104, S4-SGSN 106, HLR 108, UEs 112, and the wireless communication infrastructures 110 and 111 is specifically signaling communication for maintaining registration of the UEs 112 with the MME 104 and the S4-SGSN 106 as managed by the HSS 102 and the HLR 108.

[0016] The HSS 102 communicates over wired communication lines with the MME 104. The HSS 102 directly communicates over a wired communication line with the S4-SGSN 106 if the HLR 108 is not present. If the HLR 108 is present, the HSS 102 directly communicates over a wired communication line with the HLR 108, which in turn directly communicates over a wired communication line 106 with the S4-SGSN 106. The HLR 108 thus is effectively an intermediary between the HSS 102 and the S4-SGSN 106. In an implementation in which the HLR 108 is present, therefore, it can be said that the HSS 102 indirectly communicates with the S4-SGSN 106 via the HLR 108, whereas in an implementation in which the HLR 108 is absent, it can be said that the HSS 102 directly communicates with the S4-SGSN 106. The MME 104 communicates over a wired communication line with the LTE wireless communication infrastructure 111. Similarly the S4-SGSN 106 communicates over a wired communication line with the 2G/3G wireless communication infrastructure 110. The UEs 112 communicate wirelessly with the wireless communication infrastructure 110 and 111.

[0017] The HSS 102 is a type of server, and maintains registrations of the UEs 112 with the MME 104 and the S4-SGSN 106. The HLR 108 is similarly a type of server, but can maintain registration of the UE 112 just with the SGSN 106, and not with the MME 104. The MME 104 is one type of network component, and the S4-SGSN is another type of network component. The MME 104 is compatible with just the LTE protocol. The S4-SGSN 106 is compatible with just the 2G/3G protocol. The wireless communication infrastructure 110

includes the radio transmission towers and other components with which the UEs 112 directly communicate in a wireless manner using the 2G/3G protocol. The wireless communication infrastructure 111 includes the radio transmission towers and other components with which the UEs 112 directly communicate in a wireless manner using the LTE protocol. The UEs 112 are wireless devices, such as wireless mobile devices like smartphones.

[0018] The HSS 102 maintains both LTE registration of the UEs 112 with the MME 104 and 2G/3G registration of the UEs 112 with the S4-SGSN 106 regardless of whether the HLR 108 is present. However, if the HLR 108 is present, the HLR 108 primarily maintains 2G/3G registration of the UEs 112 with the S4-SGSN 106, and the HSS 102 secondarily maintains this 2G/3G registration by maintaining or storing the registration information from the HLR 108. That is, the HSS 102 is able to maintain both 2G/3G registration and LTE registration, whereas the HLR 108 is able to maintain just 2G/3G registration.

Registration of a UE 112 with a network component such as the MME 104 or the S4-SGSN 106 means that the UE 112 has moved into a physical location serviced by the network component, and as such registers with the network component to receive wireless communication services.

[0019] One reason why the HLR 108 may be present is if a wireless communication provider had an existing 2G/3G-only wireless mobile communication network, and added the HSS 102, the MME 104, and the LTE wireless communication infrastructure 111 to add LTE capability to the network. One reason why the HLR 108 may not be present is if a wireless communication

provider did not have an existing 2G/3G-only wireless mobile communication network, and added the HSS 102, the MME 104, the S4-SGSN 106 and the wireless communication infrastructure 110 and 111 to provide both 2G/3G- and LTE-compatible network. Another reason why the HLR 108 may not be present is if a wireless communication provider had an existing 2G/3G-only wireless mobile communication network, but removed the HLR 108 prior to adding the HSS 102, the MME 104, and the LTE wireless communication infrastructure 111 to add LTE capability to the network.

[0020] When a UE 112 first communicates with the 2G/3G wireless communication infrastructure 110, it is registered with the S4-SGSN 106 at the HSS 102 and/or the HLR 108. When the UE 112 subsequently communicates with the LTE wireless communication infrastructure 111, it is registered with the MME 104 at the HSS 102. The S4-SGSN 106 inherently has dual registration capability. This means that the UE 112 can stay registered with the S4-SGSN 106 even when the UE 112 becomes registered with the MME 104.

[0021] However, the S4-SGSN 106 may be operating in a legacy mode that is incompatible with ISR/dual registration. For example, an older type of SGSN is the Gn/Gp SGSN that does not support ISR/dual registration, and a wireless communication provider may configure the S4-SGSN 106 to operate as if it were a Gn/Gp SGSN, or to operate similar to a Gn/Gp SGSN at least in the respect that it cannot support ISR/dual registration. The wireless communication provider may choose to do this, for instance, for maximum compatibility with its existing wireless networking infrastructure.

[0022] Even though the S4-SGSN 106 in the legacy mode is operating without dual registration capability, the MME 104 nevertheless detects the SGSN 106 as being an S4-SGSN 106, and therefore determines, incorrectly, that the S4-SGSN 106 has dual registration capability. When the MME 104 sends a request to register the UE 112 to the HSS 102, the MME 104 thus requests ISR. The HSS 102, however, determines that the S4-SGSN 106 is operating in a legacy mode that cannot support ISR/dual registration, and overrides the ISR request. The HSS 102 thus cancels the registration of the UE 112 with the S4-SGSN 106, such as via the HLR 108 if present, so that the UE 112 has just a single registration, with the MME 104.

[0023] FIG. 2 shows an example method 200. Parts of the method 200 in the left column are performed by a first network component; parts of the method 200 in the middle column are performed by a server; and parts of the method 200 in the right column are performed by a second network component of a different type than the first network component. For example, the MME 104 may be the first network component, the HSS 102 may be the server, and the S4-SGSN 106 may be the second network component. In the method 200, the HSS 102 communicates directly with the S4-SGSN 106 if the HLR 108 is not present. If the HLR 108 is present and the S4-SGSN 106 is connected to it, the HSS 102 communicates indirectly with the S4-SGSN 106 through the HLR 108.

[0024] The second network component sends a registration request to the server (208), which receives the registration request (210). The server registers the wireless device with the second network component (212), and sends a

registration response to the second network component confirming the registration (214). The second network component receives the registration response (216).

[0025] At some point in time thereafter, while the wireless device is still

5 registered with the second network component, the first network component sends a registration request to the server pertaining to the same device (218). The server receives the registration request (220). The registration request may or may not specify enablement of ISR. That is, the registration request may or may not specify enablement of dual registration of the wireless device with both
10 the first network component and the second network component. ISR/dual registration enablement may be specified within the registration request by the setting of a corresponding flag or bit.

[0026] Generally, the first network component specifies enablement of dual registration if it detects or determines that the second network component
15 supports dual registration, and does not specify enablement of dual registration if it detects or determines that the second network component does not support dual registration. For example, if the second network component is not the S4-SGSN 106, but is instead a Gn/Gp SGSN, the first network component does not request ISR, because it will have determined that the Gn/Gp SGSN does not
20 support dual registration. By comparison, if the second network component is the S4-SGSN 106, the first network component does request ISR, because it will have determined that the S4-SGSN 106 can support dual registration – even if

the S4-SGSN 106 is operating in a legacy mode in which the S4-SGSN 106 does not.

[0027] If the registration request specifies enablement of ISR/dual registration (222), then the server determines whether the second network

5 component in actuality supports ISR/dual registration (224). For example, the server may determine whether a network-wide flag has been previously set. This network-wide flag may be set to override dual registration for any second network component that does not support dual registration but in relation to which registration requests are received from any first network component that
10 nevertheless specify dual registration enablement.

[0028] As another example, the server may determine whether a flag for just the particular second network component itself has been previously set. This flag may be set to override dual registration just for the second network component with respect to registration requests received from any first network

15 component that nevertheless specify dual registration enablement. The difference between these two implementations is that the former controls ISR override for every second network component within the wireless mobile communication network, whereas the latter controls ISR override for just one second network component. In the former implementation, there can be just one
20 flag for the entire network, whereas in the latter implementation, there can be a flag for each individual second network component.

[0029] If the server determines that the second network component does not actually support ISR/dual registration (226) – due to, for instance, the

component operating in an incompatible legacy mode – the server overrides the ISR/dual registration enablement of the registration request (228). The server cancels the wireless device's registration with the second network component, sending a cancel registration request to the second network component (230).

- 5 Note that the server also proceeds to part 230 from part 222 in the case where the registration request does not specify ISR/dual registration enablement. The second network component receives the cancel registration request (232). The second network component sends a cancel registration response to the server (234), which receives the response (236). The cancel registration response
- 10 confirms cancellation of the registration.

[0030] The server registers the wireless device with the first network component (238). Note that the server also proceeds to part 238 from part 226 in the case where the registration request specifies ISR/dual registration enablement and the second network component in actuality supports ISR/dual

15 registration. The server sends a registration response to the first network component confirming the registration (240). The first network component receives the registration response (242), which may also be in the form of a ULA.

[0031] In relation to FIG. 1, the method 200 may proceed from part 222 to part 230 where the second network component is a Gn/Gp SGSN. This case

20 corresponds to the MME 104 being able to correctly determine that the Gn/Gp SGSN does not support ISR/dual registration. The method 200 may proceed from part 226 to part 238 where the second network component is the S4-SGSN 106 operating in a non-legacy mode compatible with ISR/dual registration. This

case corresponds to the MME 104 effectively correctly determining that the S4-SGSN 106 supports ISR/dual registration.

[0032] The method 200 may proceed from part 226 to part 228 where the second network component is again the S4-SGSN 106, but operating in a legacy mode incompatible with ISR/dual registration. That is, the MME 104 correctly determines that the S4-SGSN 106 inherently supports ISR/dual registration, but cannot determine that the S4-SGSN 106 is operating in a legacy mode that does not support ISR/dual registration.

[0033] FIG. 3 shows an example server 300, which may implement the HSS 102. The server 300 includes networking hardware 302, an override mechanism 304, and a memory 306 storing a flag 308. The server 300 can and typically does include other components, in addition to those depicted in FIG. 3. The networking hardware 302 permits the server 300 to communicate with first and second network components in a wired manner.

[0034] The override mechanism 304 performs the parts of the method 200 in the middle column. The mechanism 304 may be implemented in hardware, or in a combination of hardware and software. In the former implementation, the mechanism 304 may be an application-specific integrated circuit (ASIC) or a field-programmable gate array (FPGA), for instance, appropriately programmed to perform the middle column of FIG. 2. In the latter implementation, the mechanism 304 may include a non-transitory computer-readable data storage medium storing computer-executable code that when executed by a hardware processor performs the middle column of FIG. 2.

[0035] The memory 306 is a hardware memory, and may be volatile memory or non-volatile. The flag 308 that the memory 306 stores may be a single flag specifying ISR/dual registration override for the entire wireless mobile communication network of which the server 300 is a part, as described above. In
5 another implementation, there may be a flag 308 for each second network component, specifying ISR/dual registration override just for a corresponding second network component, as also described above. In this latter implementation, then, there are multiple such flags 308.

We claim:

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

receive a registration request from a mobile management entity (MME),

5 the registration request pertaining to a user equipment (UE) currently registered with a serving general packet radio service (GPRS) support node (SGSN) and specifying enablement of idle mode signaling reduction (ISR) for the MME and the SGSN with respect to the UE;

determine that the SGSN does not support the ISR, wherein the MME has

10 previously determined that the SGSN does support the ISR; and

in response to determining that the SGSN does not support the ISR,

override the ISR and send a cancel registration request to the SGSN pertaining to the UE.

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

15 HSS is to determine that the SGSN does not support the ISR by determining that a network-wide flag has been previously set to override the ISR for any SGSN that does not support the ISR but in relation to which ULRs are received that specify the enablement of the ISR.

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

20 HSS is to determine that the SGSN does not support the ISR by determining that a flag for the SGSN has been previously set to override the ISR for the SGSN.

4. The non-transitory computer-readable medium of claim 1, wherein the SGSN is an S4-SGSN but is operating in a legacy mode incompatible with the ISR.

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

5 computer-executable code is executable by the HSS further to:

prior to receiving the registration request from the MME, receive a registration request from the SGSN and pertaining to the UE;

send a registration response to the SGSN responsive to the registration request from the SGSN;

10 send a registration response to the MME responsive to the registration request; and

receive a cancel registration response from the SGSN responsive to cancel registration request sent to the SGSN.

6. The non-transitory computer-readable medium of claim 1, wherein HSS is

15 to send communicate with the SGSN via an intermediary home location register (HLR), including sending the cancel registration request to the SGSN via the intermediary HLR.

7. A method comprising:

receiving, by a server, a registration request from a first component of a

20 first type, the registration request pertaining to a wireless device currently

registered with a second component of a second type different than the first type,

the registration request specifying enablement of dual registration for the first component and the second component with respect to the wireless device;

determining, by the server, that the second component does not support the dual registration, wherein the first component had previously determined that
5 the second component does support the dual registration; and

in response to determining that the second component does not support the dual registration, overriding, by the server, specification of the enablement of the dual registration within the registration request and sending, by the server, a cancel registration request to the second component, the cancel registration
10 request pertaining to the wireless device.

8. The method of claim 7, wherein determining that the second component does not support the dual registration comprises determining that a network-wide flag has been previously set to override the dual registration for any component of the second type that does not support the dual registration but in relation to
15 which registration requests are received that specify the enablement of the dual registration.

9. The method of claim 7, wherein determining that the second component does not support the dual registration comprises determining that a flag for the second component has been previously set to override the dual registration for
20 the second component.

10. The method of claim 7, further comprising:

 sending a registration response to the first component, by the server,

confirming registration of the wireless device with the first component; and

 receiving a cancel registration response from the second component, by

5 the server, confirming cancellation of registration of the wireless device with the second component.

11. The method of claim 7, further comprising:

 prior to receiving the registration request from the first component,

receiving a registration request from the second component, by the server,

10 pertaining to the wireless device; and

 sending a registration response to the second component, by the server,

confirming registration of the wireless device with the second component.

12. The method of claim 7, wherein:

 the server is a home subscriber server (HSS),

15 the first component is a mobile management entity (MME),

 and the second component is an S4-serving general packet radio service (GPRS) support node (S4-SGSN) but is operating in a legacy mode incompatible with dual registration.

13. A server comprising:

20 networking hardware to communicate with a first component of a first type and a second component of a second type different than the first type, a wireless

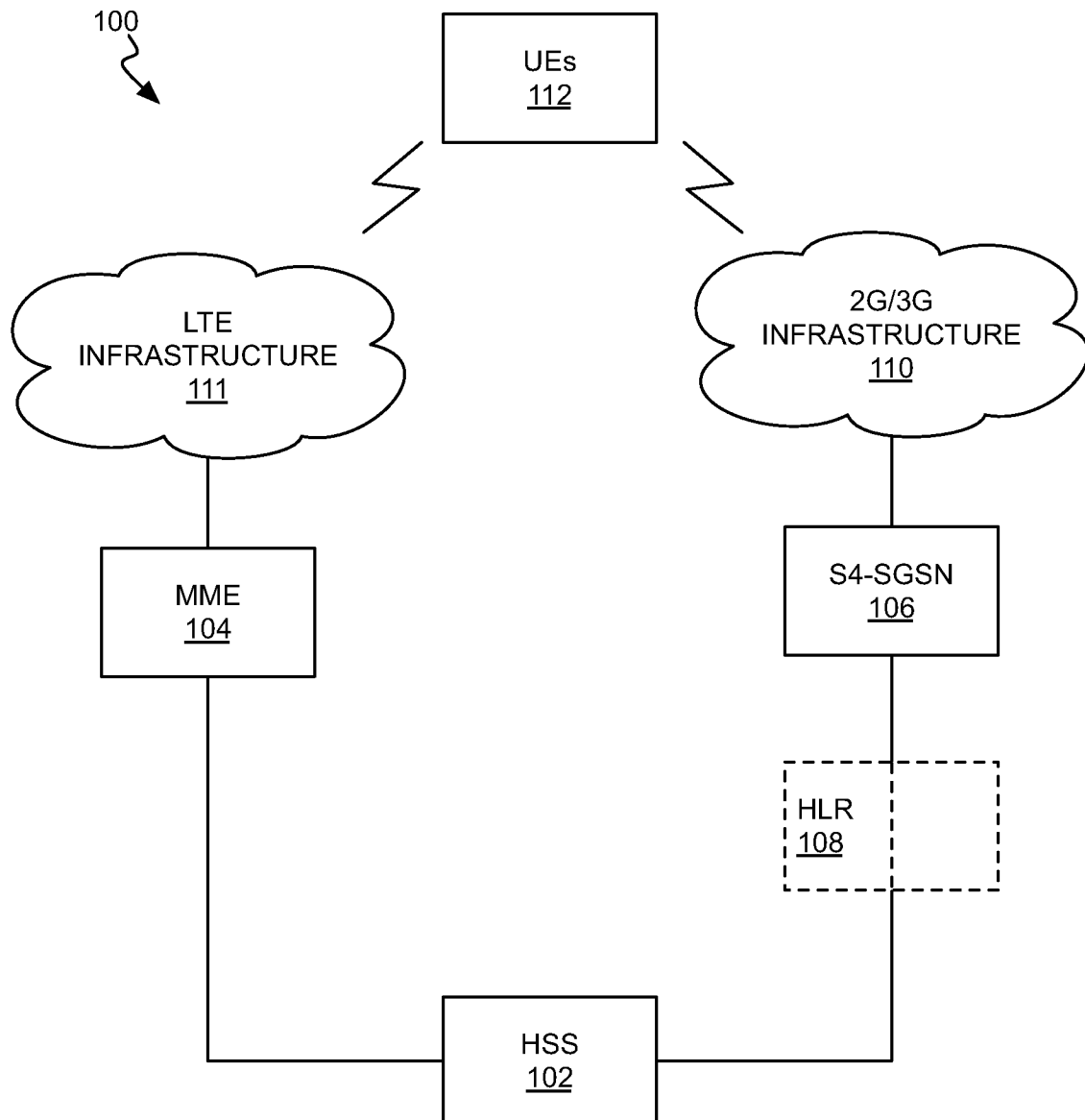
device currently registered with the second component, a registration request received from the first component to register the wireless device with the first component, the registration request specifying enablement of dual registration; and

5 an overrider to determine that the second component does not support the dual registration and to responsively override specification of the enablement of the dual registration within the registration request and send a cancel registration request to the second component to deregister the wireless device.

14. The server of claim 13, further comprising a memory storing a network-
10 wide flag that is set to override the dual registration for any component of the second type that does not support the dual registration but in relation to which registration requests are received that specify the enablement of the dual registration.

15. The server of claim 13, further comprising a memory storing a flag specific
15 to the second component and that is set to override the dual registration for the second component.

1/3

FIG 1

2/3

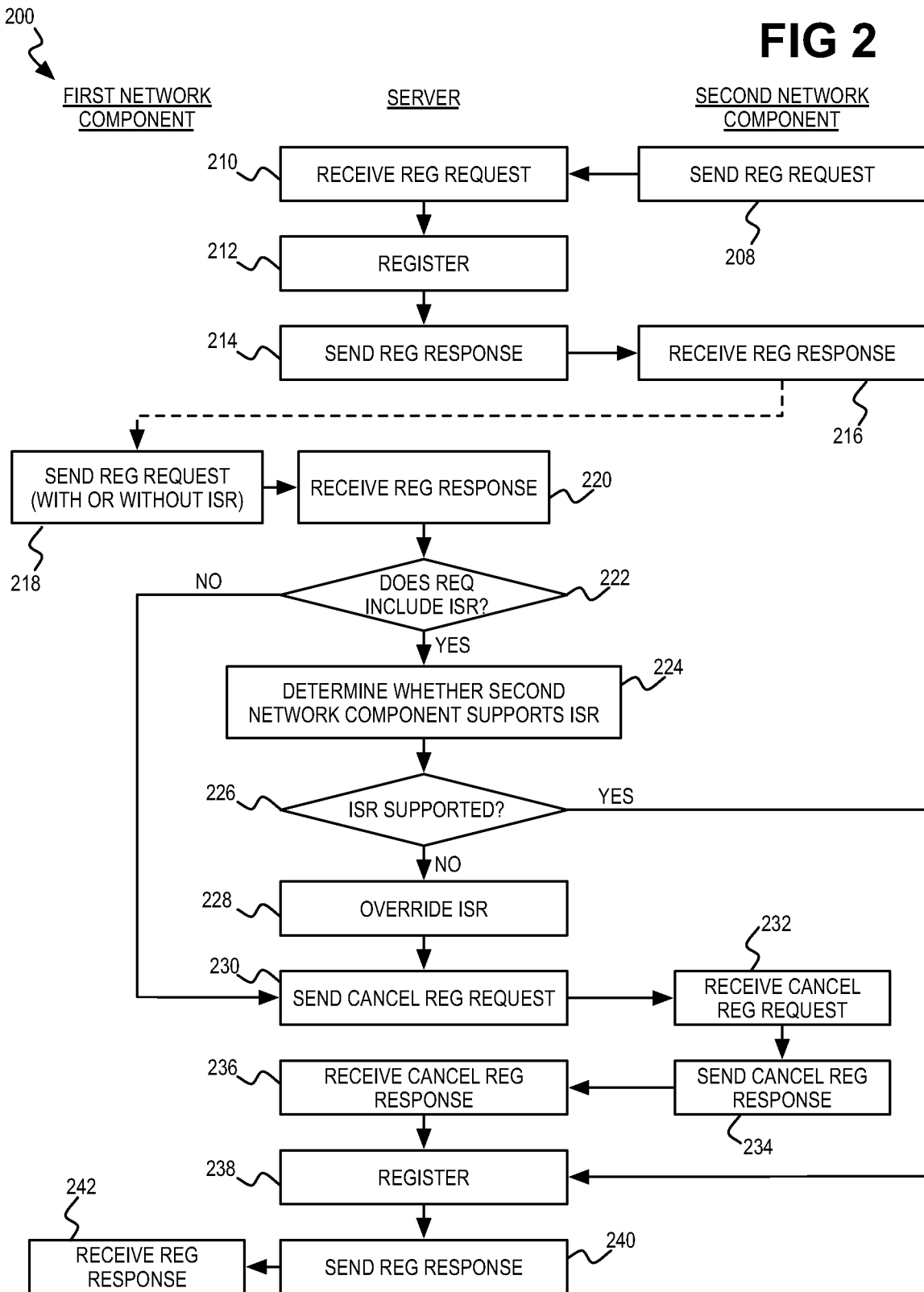
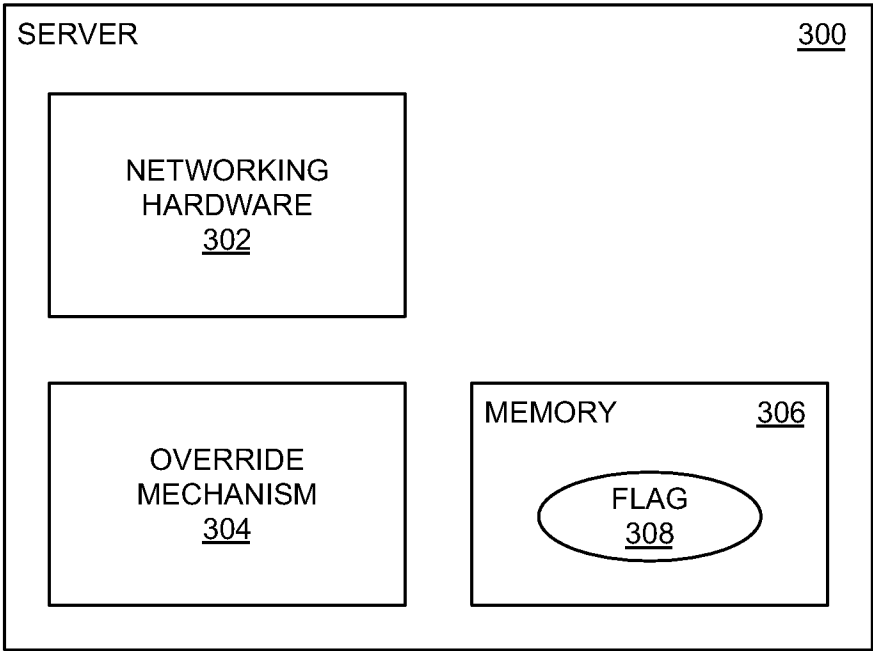
FIG 2

FIG 3



A. CLASSIFICATION OF SUBJECT MATTER**H04W 8/04(2009.01)i, H04W 60/00(2009.01)i**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 8/04; H04W 4/00; H04W 8/12; H04W 60/00

Documentation 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 models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: registration request, support ISR, MME, SGSN, override, cancel, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010-115461 A1 (TELEFONAKTIEBOLAGET LM ERICSSON) 14 October 2010 See page 3, lines 14-20; page 8, lines 12-16; page 9, lines 15-32; and figures 4 and 8-11.	1-15
A	NOKIA SIEMENS NETWORKS et al., `Idle State Signalling Reduction`, S2-074401, 3GPP TSG-SA WG2 #60, Kobe, Japan, 02 October 2007 See pages 1-2.	1-15
A	US 2011-0090848 A1 (LAEYOUNG KIM et al.) 21 April 2011 See paragraphs [0126]-[0152]; and figures 1 and 5.	1-15
A	ALCATEL-LUCENT et al., `Enabling seamless handover to WLAN`, S2-150216, 3GPP TSG-SA WG2 #107, Sorrento, Italy, 20 January 2015 See pages 28-29 and figure 36c.	1-15
A	ZTE et al., `P-CSCF restoration failure when UE is temporarily out of coverage`, C4-150155, 3GPP TSG-CT WG4 #68, Sorrento, Italy, 23 January 2015 See pages 2-3 and figure 5.4.2.1-1.	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

17 September 2015 (17.09.2015)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/013467

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