(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 January 2008 (31.01.2008)

PCT

(10) International Publication Number
WO 2008/013890 A1

(51) International Patent Classification:
H04Q 7/38 (2006.01)

(21) International Application Number: PCT/US2007/016800

(22) International Filing Date: 25 July 2007 (25.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/820,554 27 July 2006 (27.07.2006) US

(71) Applicant *(for all designated States except US)*: **INTERDIGITAL TECHNOLOGY CORPORATION** [US/US]; 3411 Silverside Road, Concord Plaza, Suite 105, Hagley Building, Wilmington, DE 19810 (US).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **OLIVERA-HERNANDEZ, Ulises** [MX/CA]; 2 Rolland Laniel, Kirkland, Québec H9J 4A5 (CA).

(74) Agent: BALLARINI, Robert, J.; Volpe And Koenig, P.C., United Plaza, Suite 1600, 30 S. 17th Street, Philadelphia, PA 19103 (US).

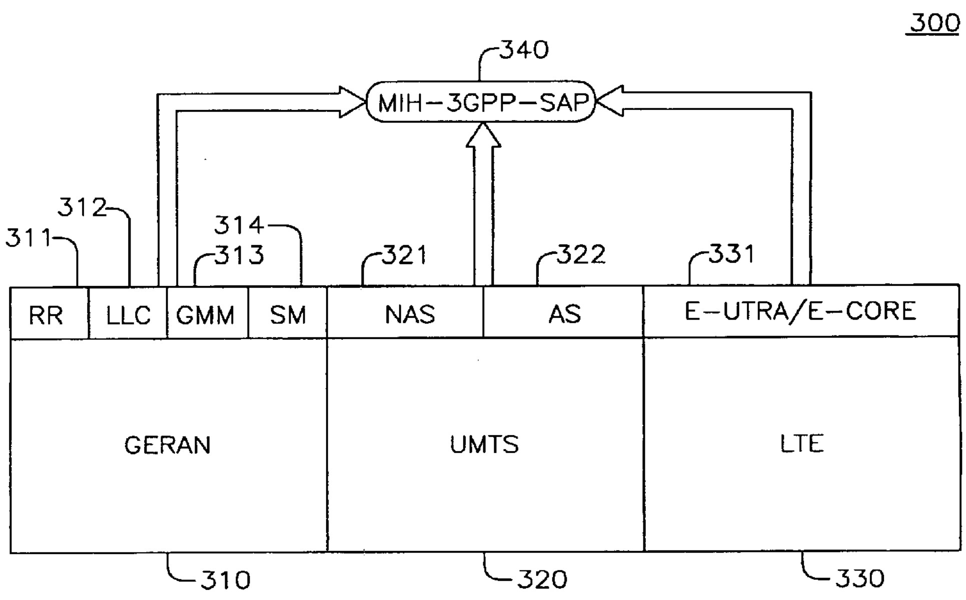
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND APPARATUS FOR FACILITATING INTER-NETWORK HANDOVER



(57) Abstract: A method and apparatus for facilitating inter-network handover comprises receiving a first network service primitive. The first network service primitive is then mapped to a second network service primitive.

WO 2008/013890 A1

[0001] METHOD AND APPARATUS FOR FACILITATING INTER-NETWORK HANDOVER

[0002] FIELD OF INVENTION

[0003] The present invention is related to wireless communication systems. More particularly, the present invention is related to a method and apparatus for facilitating inter-network handover.

[0004] BACKGROUND

[0005] The IEEE 802.21 group includes mechanisms and procedures that aid in the execution and management of inter-system handovers. In particular, IEEE 802.21 defines three main services that can be accessed by mobility management (MM) applications in order to aid in the management of handover operations and system discovery and system selection. Among these services are event service (ES), information service (IS) and command service (CS). All these services share an important characteristic in that they are delivered using a common uniform interface with respect to prospective users, regardless of the underlying access technologies that support the communication with respect to the core network.

[0006] The delivery of event services and the generation of commands is typically determined by which event is be triggered based on the prevailing characteristics of the underlying technology. These underlying technologies may be 3GPP, 3GPP2 and IEEE-based wireless local area network (WLAN), (e.g., IEEE 802.11 or 802.16).

[0007] The IEEE 802.21 specification outlines various triggers and commands that are sent to and received from upper layers. However, the IEEE 802.21 specification does not describe how these events and commands are triggered and generated. There are no procedures or functionality to generate triggers toward upper layers, based on information provided by the 3GPP or 3GPP2 underlying layers. In particular, IEEE 802.21 does not describe how events and commands are triggered and generated when the underlying physical resources are based on 3GPP or 3GPP2 technology. Therefore, it is desirable to provide a method for generating these triggers.

[0008] SUMMARY

[0009] The present invention is related to a method and apparatus for facilitating inter-network handover. The method comprises receiving a first network service primitive. The first network service primitive is then mapped to a second network service primitive.

[0010] BRIEF DESCRIPTION OF THE DRAWINGS

[0011] A more detailed understanding of the invention may be had from the following description of a preferred embodiment, given by way of example and to be understood in conjunction with the accompanying drawings wherein:

[0012] Figure 1 shows an exemplary wireless communication system including a wireless transmit/receive unit (WTRU), access point (AP), and wireless local area network (WLAN) AP, configured in accordance with the present invention;

[0013] Figure 2 is a functional block diagram of the WTRU and AP/WLAN AP of the wireless communication system of Figure 1;

[0014] Figure 3 is a functional block diagram of a mapping model in accordance with the present invention;

[0015] Figure 4 is a flow diagram of a method for facilitating inter-network handover in accordance with the present invention;

[0016] Figure 5 is an exemplary graphical representation of an IEEE 802.21 command and event service mapping to 3GPP in accordance with the present invention; and

[0017] Figure 6 is an exemplary graphical representation of an 802.21 command and event service mapping to 3GPP2 in accordance with the present invention.

[0018] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of user device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

[0020] The present invention is applicable to any wireless communication system including, but not limited to, IEEE 802 technologies, (e.g., 802.11 baseline, 802.11a, 802.11b, 802.11g, 802.11j, 802.11n, 802.16, and 802.21), cellular standards, (e.g., 3GPP or 3GPP2), and other standardized or proprietary wireless technologies, (e.g., Bluetooth, HIPERLAN/2, and the like).

[0021] Figure 1 shows an exemplary wireless communication system 100 including a WTRU 110, an AP 120, and a WLAN AP 530 configured in accordance with the present invention. In a preferred embodiment, the WLAN AP 530 is connected to a WLAN 540. As shown in Figure 1, the WTRU 110 is in wireless communication with the AP 120, which is preferably a third generation partnership project (3GPP) access point, and transitioning during a handover to the WLAN AP 130. Although only one WTRU 110, one AP 120, and one WLAN AP 130 are shown in Figure 1, it should be noted that any number and combination of wireless and wired devices may be included in the wireless communication system 100.

[0022] Figure 2 is a functional block diagram 200 of the WTRU 110 and AP 120/WLAN AP 130 of the wireless communication system 100 of Figure 1. As shown in Figure 2, the WTRU 110 is in communication with the AP 120, the WLAN AP 130, or both, and all are configured to facilitate inter-network handover in accordance with the present invention. In a preferred embodiment of the present invention, the WTRU 110, AP 120, and WLAN AP 130 are configured to map events and commands from one network, (e.g., primitives in a 3GPP system), to events and commands in another network, (e.g., primitives in a WLAN network).

[0023] In addition to the components that may be found in a typical WTRU, the WTRU 110 includes a processor 115, a receiver 116, a transmitter 117, and an antenna 118. The processor 115 is configured to facilitate inter-network handover in accordance with the present invention. The receiver 116 and the transmitter 117 are in communication with the processor 115. The antenna 118 is in communication with both the receiver 116 and the transmitter 117 to facilitate the transmission and reception of wireless data.

[0024] In addition to the components that may be found in a typical AP, the AP 120 includes a processor 125, a receiver 126, a transmitter 127, and an antenna 128. The processor 115 is configured to facilitate inter-network handover in accordance with the present invention. The receiver 126 and the transmitter 127 are in communication with the processor 125. The antenna 128 is in communication with both the receiver 126 and the transmitter 127 to facilitate the transmission and reception of wireless data.

[0025] Similarly, in addition to the components that may be found in a typical WLAN AP, the WLAN AP 130 includes a processor 135, a receiver 136, a transmitter 137, and an antenna 138. The processor 135 is configured to facilitate inter-network handover in accordance with the present invention. The receiver 136 and the transmitter 137 are in communication with the processor 135. The antenna 138 is in communication with both the receiver 136 and the transmitter 137 to facilitate the transmission and reception of wireless data.

[0026] Figure 3 is a functional block diagram of a mapping model 300 in accordance with the present invention. The mapping model 300 shows schematically a global system for mobile communication enhanced data rate for global evolution radio access network (GERAN) 310, a universal mobile telecommunications system (UMTS) 320, and a long term evolution (LTE) system 330. The GERAN 310 includes a radio resource (RR) protocol layer 311, a logical link control (LLC) protocol layer 312, a general packet radio service mobility management (GMM) protocol layer 313, and a session management (SM) layer 314. The UMTS 320 includes a non access stratum (NAS) layer 321 and an access stratum (AS) layer 322. The LTE system 330 includes an evolved universal terrestrial radio access/evolved-CORE (E-UTRA/E-CORE) layer 331. As shown in Figure 3, events in the GERAN 310, UMTS 320, and LTE 330 may be mapped into a media independent handover (MIH) – 3GPP – service access point (SAP) layer 340. Any relevant primitives then supported by a layer within a specific technology may be mapped to a corresponding counterpart within the 802.21 technology without being first interpreted by other layers.

[0027] Still referring to Figure 3, the services within the different layers of the 3GPP technology may be accessed through the MIH-3GPP-SAP 340. Preferably, the service is delivered using a primitive defined within the 3GPP specifications and mapped to the corresponding 802.21 counterpart within the MIH function. Alternatively, the 3GPP primitive may be mapped through the use of AT commands or using an API.

[0028] Figure 4 is a flow diagram of a method 400 for facilitating inter-network handover in accordance with the present invention. In step 410, a 3G service primitive is received. The 3G service primitive is then mapped to an IEEE 802.21 primitive or event (step 420). Although the method 400 depicts the mapping of a 3G service primitive to an 802.21 primitive or event, it should be noted that the mapping may also occur in the reverse direction and that the primitives are not limited to 3G service primitives and 802.21 primitives. Table 1 below in an exemplary table depicting the mapping of 3GPP primitives to 802.21 events.

3GPP Layer	3GPP Service Primitive Descriptions	3GPP Primitive	802.21 Event
RR	Page received by RR layer	GMRR-PAGE	Link Parameter Change
	Successful reception of data supporting specific QoS	GRR-DATA	Link Parameter Change
LLC	Peer LLC layer is established	LL-ESTABLISH	Link Up/Link Parameter Change
	Peer LLC layer is	LL-RELEASE	Link Going

	released		Down/Link Parameter Change
	LLC Layer unrecoverable error	LL-STATUS	Link Down
GMM	Station is attached	GMMREG-ATACH	Link Parameter Change
	Station is detached	GMMREG-DETACH	Link Parameter Change
SM	Data session active	SMSM-ACTIVE	Link Up/Link Parameter Change
	Data session is deactivated	SMSM-DEACTIVEATE	Link Down/Link Parameter Change
	Data session modified	SMSM-MODIFY	Link Parameter Change
	Data session terminated due to unrecoverable error	SMSM-STATUS	Link Down
	PDP Context is active	SMREG-PDP-ACTIVATE	Link Up/Handover Complete/Parameter Change/ Handover Complete
	PDP Context is modified	SMREG-PDP-MODIFY	Link Up/Parameter Change/ Handover Complete
	PDP Context is deactivated	SMREG-PDP-DEACTIVATE	Link Going Down/Link Down
NAS	Station is attached	GMMREG-ATACH	Parameter Change
	Station is detached	GMMREG-DETACH	Parameter Change
	PDP Context is active	SMREG-PDP-ACTIVATE	Link Up/Handover Complete/Parameter Change
	PDP Context is modified	SMREG-PDP-MODIFY	Parameter Change/ Link Up
	PDP Context is deactivated	SMREG-PDP-DEACTIVATE	Link Down/Link Parameter Change
	Radio Access Bearer is activated for data transfer	RABMSM-ACTIVATE	Link Up/Parameter Change/ Handover Complete
	Radio Access Bearer is deactivated for data transfer	RABMSM-DEACTIVATE	Link Down/Link Parameter Change
	Radio Access Bearer is modified for data transfer	RABMSM-MODIFY	Parameter Change/ Link Up/ Handover Complete
	Radio Access Bearer data transfer error	RABMSM-STATUS	Link Down

AS	Radio Access Bearer has been activated	RABMAS-RAB-ESTABLISH	Link Up/ Handover Complete
	Radio Access Bearer has been released	RABMAS-RAB-RELEASE	Link Down
	AS failure Indication	RABMAS-STATUS	Link Down
	Information regarding geographical area.	Information Broadcast	Parameter Change
	Notification of paging for particular user or terminal	Paging Request	Parameter Change
	Notification for all users	Notification Broadcast	Parameter Change
	Notification information for a specific or for many user	Notification Indication	Parameter Change
	UE initiated connection establishment	Connection Establishment	Link Up
	Network initiated connection release	IF Initiated Connection Release	Link Down
	Network initiated Radio Access Bearer Establishment	IF Side Initiated Radio Access Bearer Establishment	Link Up/Link Detected
	Network initiated Radio Access Bearer Release	IF Side Initiated Radio Access Bearer Release	Link Down
	Indication that the connection might be aborted unless streamlining is done	Streamlining Require Indication	Link Going Down
	Location information provided by the network for a specific UE	UE location information	Parameter Change
	Connection loss indications	Connection loss indication	Link Down
E-UTRAN/E-CORE*	The location of the UE is now know by the network	LTE-detached	Parameter Change
	The UE is known to the network but not transport channel is established	LTE-idle	Parameter Change/Link Down
	Radio resources have	LTE-Active	Link Up/Link

	been established and the UE is able to perform uplink and downlink transport of PDU		Handover Complete

Table 1

[0029] Figure 5 is an exemplary graphical representation of an IEEE 802.21 command and event service mapping to 3GPP 500 in accordance with the present invention. Figure 5 shows an MIH user 510, an MIH functional layer 520, a mobile network signaling (MNS) layer 530, and a 3GPP access network 540. An MIH-SAP layer exists between the MIH user 510 and the MIH functional layer 520, and the MIH-3GPP-SAP layer exists between the MIH functional layer 520 and the MNS layer 530.

[0030] The MNS layer 530 includes an MIH-3GLINK-SAP layer, an 802.21-AT inter-working (IW) function layer, an AT-command interface, and an AT-command-3GPP IWF layer. As shown in Figure 5, a 3GPP primitive is received at the AT-command-3GPP IWF layer which is in communication with the AT-command interface layer and generates an AT command. The AT command may be received by the 802.21-AT IWF layer where it is translated into a 3GPP primitive as expected by the MIH function. Alternatively, the 3GPP primitive could be received directly from the 3GPP access network 540. Upon receipt of the 3GPP primitive through the MIH-3GLINK-SAP layer, the MIH function 520 maps, or converts, the 3GPP primitive into an 802.21 primitive. Additionally, the MIH function may generate a corresponding media independent primitive toward the MIH user 510. Conversely, an 802.21 primitive is converted into a 3GPP primitive by a similar reverse process. Accordingly, the 3GPP primitive may be translated into an AT command or directly sent to the 3GPP access network, such as through the use of a function call that implements the 3GPP API.

[0031] Figure 6 is an exemplary graphical representation of an IEEE 802.21 command and event service mapping to 3GPP2 600 in accordance with the present invention. Figure 6 shows an MIH user 610, an MIH functional layer 620, upper layer signaling/point to point protocol (PPP) layer 630, and a 3GPP2 access network

640. An MIH-SAP layer exists between the MIH user 610 and the MIH functional layer 620, and the MIH-3GLINK-SAP layer exists between the MIH functional layer 620 and the upper layer/PPP layer 630.

[0032] The upper layer/PPP layer 630 includes an MIH-3GLINK-SAP layer, an 802.21-AT inter-working (IW) function layer, an AT-command interface, and an AT-command-3GPP2 IWF layer. As shown in Figure 6, a 3GPP2 primitive is received at the AT-command-3GPP2 IWF layer which is in communication with the AT-command interface layer and generates an AT command. The AT command may be received by the 802.21-AT IWF layer where it is translated into a 3GPP2 primitive as expected by the MIH function. Alternatively, the 3GPP2 primitive could be received directly from the 3GPP2 access network 640. Upon receipt of the 3GPP2 primitive through the MIH-3GLINK-SAP layer, the MIH function 620 maps, or converts, the 3GPP2 primitive into an 802.21 primitive. Additionally, the MIH function may generate a corresponding media independent primitive toward the MIH user 610. Conversely, an 802.21 primitive is converted into a 3GPP2 primitive by a similar reverse process. Accordingly, the 3GPP2 primitive may be translated into an AT command or directly sent to the 3GPP2 access network, such as through the use of a function call that implements the 3GPP API.

[0033] Although the features and elements of the present invention are described in the preferred embodiments in particular combinations, each feature or element can be used alone without the other features and elements of the preferred embodiments or in various combinations with or without other features and elements of the present invention. The methods or flow charts provided in the present invention may be implemented in a computer program, software, or firmware tangibly embodied in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

[0034] Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

[0035] A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) module.

[0036] Embodiments

1. A method for facilitating inter-network handover.

2. The method of embodiment 1, further comprising receiving a first network service primitive.

3. A method as in any preceding embodiment, further comprising mapping a first network service primitive to a second network service primitive.

4. A method as in any preceding embodiment wherein a first network service primitive is a third generation partnership project (3GPP) service primitive

and a second network service primitive is an institute of electrical and electronics engineers (IEEE) 802.21 primitive.

5. A method as in any preceding embodiment wherein a media independent handover (MIH) function maps a 3GPP service primitive to an IEEE 802.21 primitive.

6. A method as in any preceding embodiment wherein a 3GPP service primitive includes any one of the following: a radio resource (RR) service primitive, a mobility management (MM) service primitive, a session management (SM) service primitive, a long term evolution (LTE) service primitive, a system architecture (SAE) service primitive, a logical link control (LLC) service primitive, an access stratum (AS) service primitive, and/or a non access stratum (NAS) service primitive.

7. A method as in any preceding embodiment, further comprising triggering a media independent handover (MIH) event upon mapping an IEEE 802.21 primitive.

8. A method as in any of embodiments 1-3 and 5-7 wherein a first network service primitive is a 3GPP2 service primitive and a second network service primitive is an IEEE 802.21 primitive.

9. A method as in any preceding embodiment wherein an MIH function maps a 3GPP2 service primitive to an IEEE 802.21 primitive.

10. A method as in any preceding embodiment wherein AT commands are used to perform the step of mapping.

11. A method as in any preceding embodiment wherein an MIH function maps a first service primitive to a second network service primitive.

12. A wireless transmit/receive unit (WTRU) configured to perform a method as in any preceding embodiment.

13. The WTRU of embodiment 12, further comprising a receiver.

14. A WTRU as in any of embodiments 12-13, further comprising a transmitter.

15. A WTRU as in any of embodiments 12-14, further comprising a processor in communication with the receiver and the transmitter.

16. A WTRU as in any of embodiments 12-15 wherein a processor configured to receive a first network service primitive and map the first network service primitive to a second network service primitive.

17. A WTRU as in any of embodiments 12-16 wherein a processor is further configured to trigger an MIH event.

18. A WTRU as in any of embodiments 12-17, further comprising a mobile network signaling (MNS) layer resident in a processor.

19. A WTRU as in any of embodiments 12-18, wherein an MNS layer includes an AT-Command-3GPP interworking function (IWF), an AT-Command interface in communication with the AT-Command-3GPP IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

20. A WTRU as in any of embodiments 12-19 wherein an AT-Command-3GPP IWF is configured to receive a 3GPP service primitive and communicate with an AT-Command interface.

21. A WTRU as in any of embodiments 12-20 wherein an AT-Command interface is configured to generate an AT command and communicate it to an 802.21-AT IWF.

22. A WTRU as in any of embodiments 12-21 wherein an 802.21-AT IWF is configured to receive an AT Command and generate an 802.21 primitive through an MIH-3GLINK-SAP layer.

23. A WTRU as in any of embodiments 12-22 wherein an AT-Command interface is configured to receive an AT command from an 802.21-AT IWF.

24. A WTRU as in any of embodiments 12-23, further comprising an upper layer signaling/point to point protocol (PPP) layer.

25. A WTRU as in any of embodiments 12-24 wherein an upper layer signaling/PPP layer includes an AT-Command-3GPP2 IWF, an AT-Command interface in communication with the AT-Command-3GPP2 IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

26. A WTRU as in any of embodiments 12-25 wherein the AT-Command-3GPP2 IWF is configured to receive a 3GPP2 service primitive and communicate with the AT-Command interface.

27. A WTRU as in any of embodiments 12-26 wherein an AT-Command interface is configured to generate an AT command and communicate it to an 802.21-AT IWF.

28. A WTRU as in any of embodiments 12-27 wherein an 802.21-AT IWF is configured to receive an AT Command and generate an 802.21 primitive through an MIH-3GLINK-SAP layer.

29. A WTRU as in any of embodiments 12-28 wherein an AT-Command interface is configured to receive an AT command from an 802.21-AT IWF.

30. A WTRU as in any of embodiments 12-29 wherein a processor includes an MIH function.

31. A WTRU as in any of embodiments 12-30 wherein an MIH function is configured to receive a 3GPP or 3GPP2 service primitive and map the 3GPP or 3GPP2 service primitive into an IEEE 802.21 primitive.

32. An integrated circuit (IC) configured to perform a method as in any of embodiments 1-11.

33. The IC of embodiment 32, further comprising a receiver.

34. An IC as in any of embodiments 32-33, further comprising a transmitter.

35. An IC as in any of embodiments 32-34, further comprising a processor in communication with the receiver and the transmitter.

36. An IC as in any of embodiments 32-35 wherein a processor configured to receive a first network service primitive and map the first network service primitive to a second network service primitive.

37. An IC as in any of embodiments 32-36 wherein a processor is further configured to trigger an MIH event.

38. An IC as in any of embodiments 32-37, further comprising a mobile network signaling (MNS) layer resident in a processor.

39. An IC as in any of embodiments 32-38, wherein an MNS layer includes an AT-Command-3GPP interworking function (IWF), an AT-Command interface in communication with the AT-Command-3GPP IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

40. An IC as in any of embodiments 32-39 wherein an AT-Command-3GPP IWF is configured to receive a 3GPP service primitive and communicate with an AT-Command interface.

41. An IC as in any of embodiments 32-40 wherein an AT-Command interface is configured to generate an AT command and communicate it to an 802.21-AT IWF.

42. An IC as in any of embodiments 32-41 wherein an 802.21-AT IWF is configured to receive an AT Command and generate an 802.21 primitive through an MIH-3GLINK-SAP layer.

43. An IC as in any of embodiments 32-42 wherein an AT-Command interface is configured to receive an AT command from an 802.21-AT IWF.

44. An IC as in any of embodiments 32-43, further comprising an upper layer signaling/point to point protocol (PPP) layer.

45. An IC as in any of embodiments 32-44 wherein an upper layer signaling/PPP layer includes an AT-Command-3GPP2 IWF, an AT-Command interface in communication with the AT-Command-3GPP2 IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

46. An IC as in any of embodiments 32-45 wherein the AT-Command-3GPP2 IWF is configured to receive a 3GPP2 service primitive and communicate with the AT-Command interface.

47. An IC as in any of embodiments 32-46 wherein an AT-Command interface is configured to generate an AT command and communicate it to an 802.21-AT IWF.

48. An IC as in any of embodiments 32-47 wherein an 802.21-AT IWF is configured to receive an AT Command and generate an 802.21 primitive through an MIH-3GLINK-SAP layer.

49. An IC as in any of embodiments 32-48 wherein an AT-Command interface is configured to receive an AT command from an 802.21-AT IWF.

50. An IC as in any of embodiments 32-49 wherein a processor includes an MIH function.

51. An IC as in any of embodiments 32-50 wherein an MIH function is configured to receive a 3GPP or 3GPP2 service primitive and map the 3GPP or 3GPP2 service primitive into an IEEE 802.21 primitive.

* * *

CLAIMS

What is claimed is:

1. A method for facilitating inter-network handover, the method comprising:

receiving a first network service primitive; and

mapping the first network service primitive to a second network service primitive.

2. The method of claim 1 wherein the first network service primitive is a third generation partnership project (3GPP) service primitive and the second network service primitive is an institute of electrical and electronics engineers (IEEE) 802.21 primitive.

3. The method of claim 2 wherein a media independent handover (MIH) function maps the 3GPP service primitive to the IEEE 802.21 primitive.

4. The method of claim 2 wherein the 3GPP service primitive includes at least one of: a radio resource (RR) service primitive, a mobility management (MM) service primitive, a session management (SM) service primitive, a long term evolution (LTE) service primitive, a system architecture (SAE) service primitive, a logical link control (LLC) service primitive, an access stratum (AS) service primitive, and a non access stratum (NAS) service primitive.

5. The method of claim 2, further comprising triggering a media independent handover (MIH) event upon mapping the IEEE 802.21 primitive.

6. The method of claim 1 wherein the first network service primitive is a 3GPP2 service primitive and the second network service primitive is an IEEE 802.21 primitive.

7. The method of claim 6 wherein an MIH function maps the 3GPP2 service primitive to the IEEE 802.21 primitive.

8. The method of claim 1 wherein the first network service primitive is an IEEE 802.21 primitive and the second network service primitive is a 3GPP service primitive.

9. The method of claim 1 wherein the first network service primitive is an IEEE 802.21 primitive and the second network service primitive is a 3GPP2 service primitive.

10. The method of claim 1 wherein AT commands are used to perform the step of mapping.

11. The method of claim 1 wherein an MIH function maps the first service primitive to the second network service primitive.

12. A wireless transmit/receive unit (WTRU) configured to facilitate inter-network handover, the WTRU comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor configured to receive a first network service primitive and map the first network service primitive to a second network service primitive.

13. The WTRU of claim 12 wherein an MIH function maps the first network service primitive to the second network service primitive.

14. The WTRU of claim 12 wherein the processor is further configured to trigger an MIH event.

15. The WTRU of claim 12, further comprising a mobile network signaling (MNS) layer resident in the processor.

16. The WTRU of claim 14 wherein the MNS layer includes an AT-Command-3GPP interworking function (IWF), an AT-Command interface in communication with the AT-Command-3GPP IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

17. The WTRU of claim 16 wherein the AT-Command-3GPP IWF is configured to receive a 3GPP service primitive and communicate with the AT-Command interface.

18. The WTRU of claim 17 wherein the AT-Command interface is configured to generate an AT command and communicate it to the 802.21-AT IWF.

19. The WTRU of claim 18 wherein the 802.21-AT IWF is configured to receive the AT Command and generate an 802.21 primitive through the MIH-3GLINK-SAP layer.

20. The WTRU of claim 17 wherein the AT-Command interface is configured to receive an AT command from the 802.21-AT IWF.

21. The WTRU of claim 12, further comprising an upper layer signaling/point to point protocol (PPP) layer.

22. The WTRU of claim 21 wherein the upper layer signaling/PPP layer includes an AT-Command-3GPP2 IWF, an AT-Command interface in communication with the AT-Command-3GPP2 IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

23. The WTRU of claim 22 wherein the AT-Command-3GPP2 IWF is configured to receive a 3GPP2 service primitive and communicate with the AT-Command interface.

24. The WTRU of claim 23 wherein the AT-Command interface is configured to generate an AT command and communicate it to the 802.21-AT IWF.

25. The WTRU of claim 24 wherein the 802.21-AT IWF is configured to receive the AT Command and generate an 802.21 primitive through the MIH-3GLINK-SAP layer.

26. The WTRU of claim 23 wherein the AT-Command interface is configured to receive an AT command from the 802.21-AT IWF.

27. An integrated circuit (IC) configured to facilitate inter-network handover, the WTRU comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor configured to receive a first network service primitive and map the first network service primitive to a second network service primitive.

28. The IC of claim 27 wherein an MIH function maps the first network service primitive to the second network service primitive.

29. The IC of claim 27 wherein the processor is further configured to trigger an MIH event.

30. The IC of claim 27, further comprising a mobile network signaling (MNS) layer resident in the processor.

31. The IC of claim 30 wherein the MNS layer includes an AT-Command-3GPP interworking function (IWF), an AT-Command interface in communication with the AT-Command-3GPP IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

32. The IC of claim 31 wherein the AT-Command-3GPP IWF is configured to receive a 3GPP service primitive and communicate with the AT-Command interface.

33. The IC of claim 32 wherein the AT-Command interface is configured to generate an AT command and communicate it to the 802.21-AT IWF.

34. The IC of claim 33 wherein the 802.21-AT IWF is configured to receive the AT Command and generate an 802.21 primitive through the MIH-3GLINK-SAP layer.

35. The IC of claim 32 wherein the AT-Command interface is configured to receive an AT command from the 802.21-AT IWF.

36. The IC of claim 27, further comprising an upper layer signaling/point to point protocol (PPP) layer.

37. The IC of claim 36 wherein the upper layer signaling/PPP layer includes an AT-Command-3GPP2 IWF, an AT-Command interface in communication with the AT-Command-3GPP2 IWF, and an IEEE 802.21-AT IWF in communication with the AT-Command interface and an MIH-3GLINK-SAP layer.

38. The IC of claim 37 wherein the AT-Command-3GPP2 IWF is configured to receive a 3GPP2 service primitive and communicate with the AT-Command interface.

39. The IC of claim 38 wherein the AT-Command interface is configured to generate an AT command and communicate it to the 802.21-AT IWF.

40. The IC of claim 39 wherein the 802.21-AT IWF is configured to receive the AT Command and generate an 802.21 primitive through the MIH-3GLINK-SAP layer.

41. The IC of claim 38 wherein the AT-Command interface is configured to receive an AT command from the 802.21-AT IWF.

42. A WTRU configured to facilitate inter-network handover, the WTRU comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor including an MIH function, wherein the MIH function is configured to receive a 3GPP service primitive and map the 3GPP service primitive into an IEEE 802.21 primitive.

43. A WTRU configured to facilitate inter-network handover, the WTRU comprising:

a receiver;

a transmitter; and

a processor in communication with the receiver and the transmitter, the processor including an MIH function, wherein the MIH function is configured to receive a 3GPP2 service primitive and map the 3GPP2 service primitive into an IEEE 802.21 primitive.

1/5

100

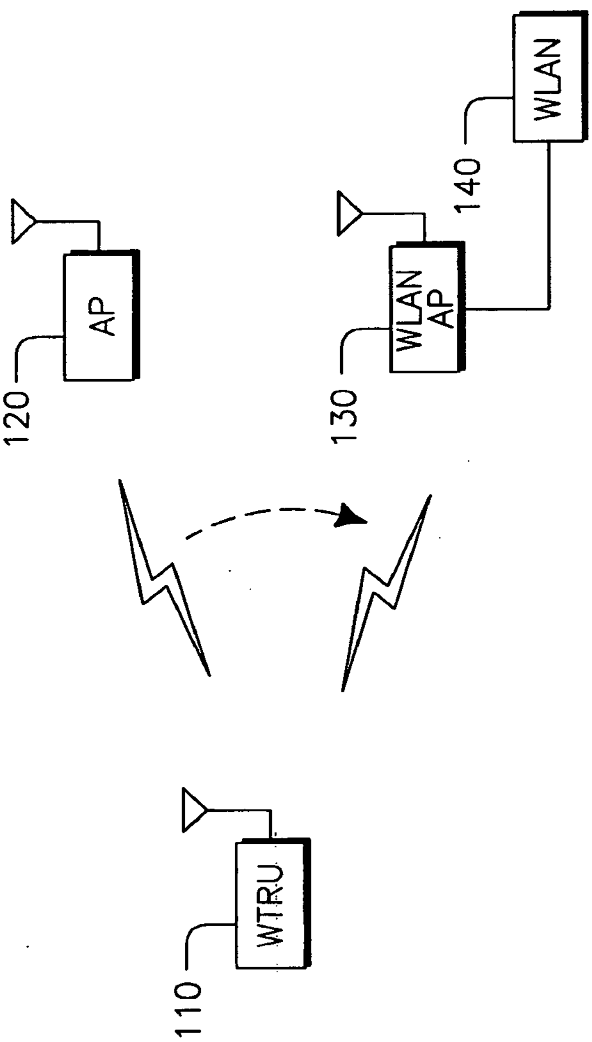


FIG. 1

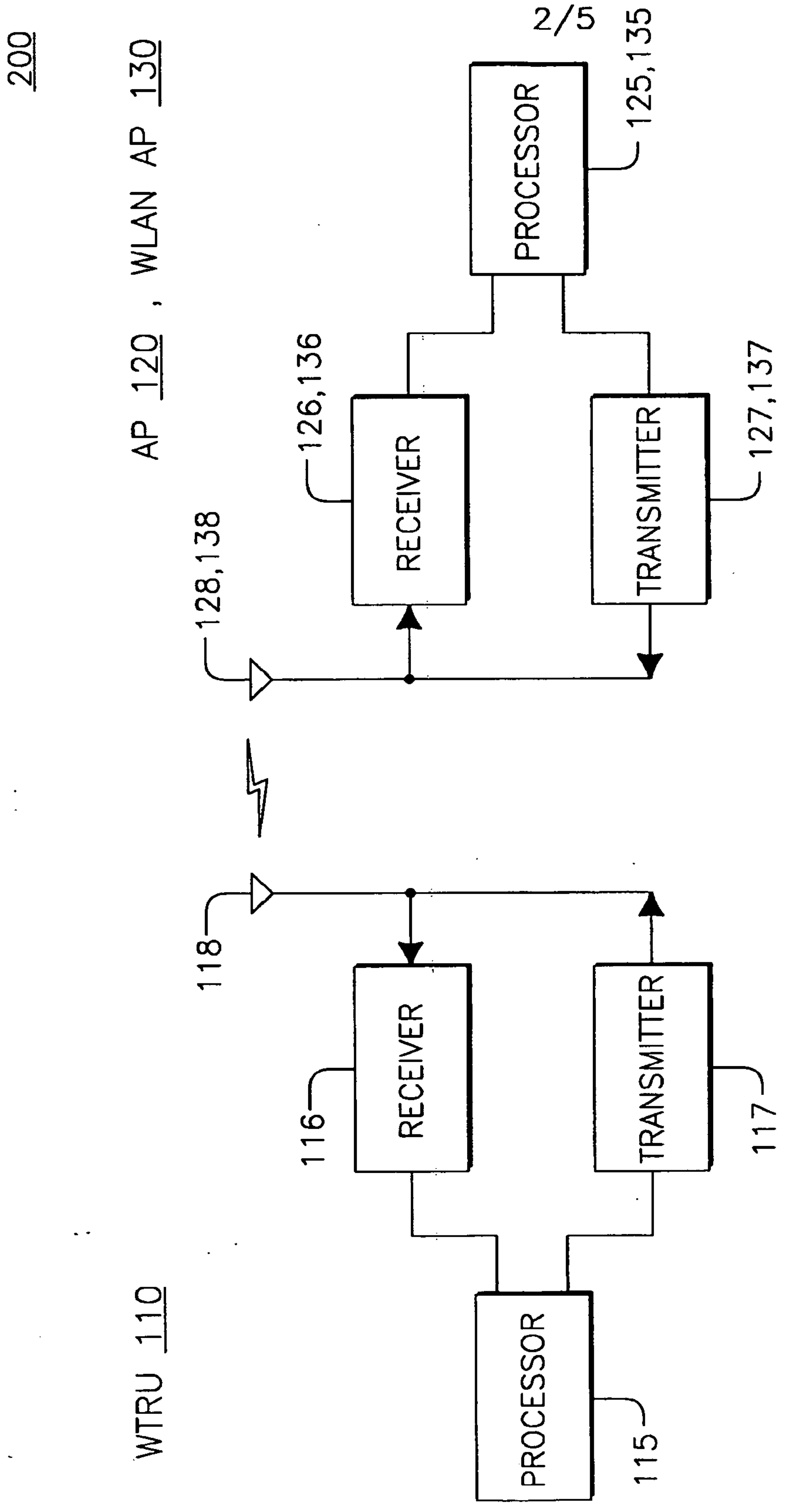

2/5
200
AP 120 , WLAN AP 130
PROCESSOR
125,135
RECEIVER
126,136
TRANSMITTER
127,137
128,138
118
RECEIVER
116
TRANSMITTER
117
WTRU 110
PROCESSOR
115

FIG.2

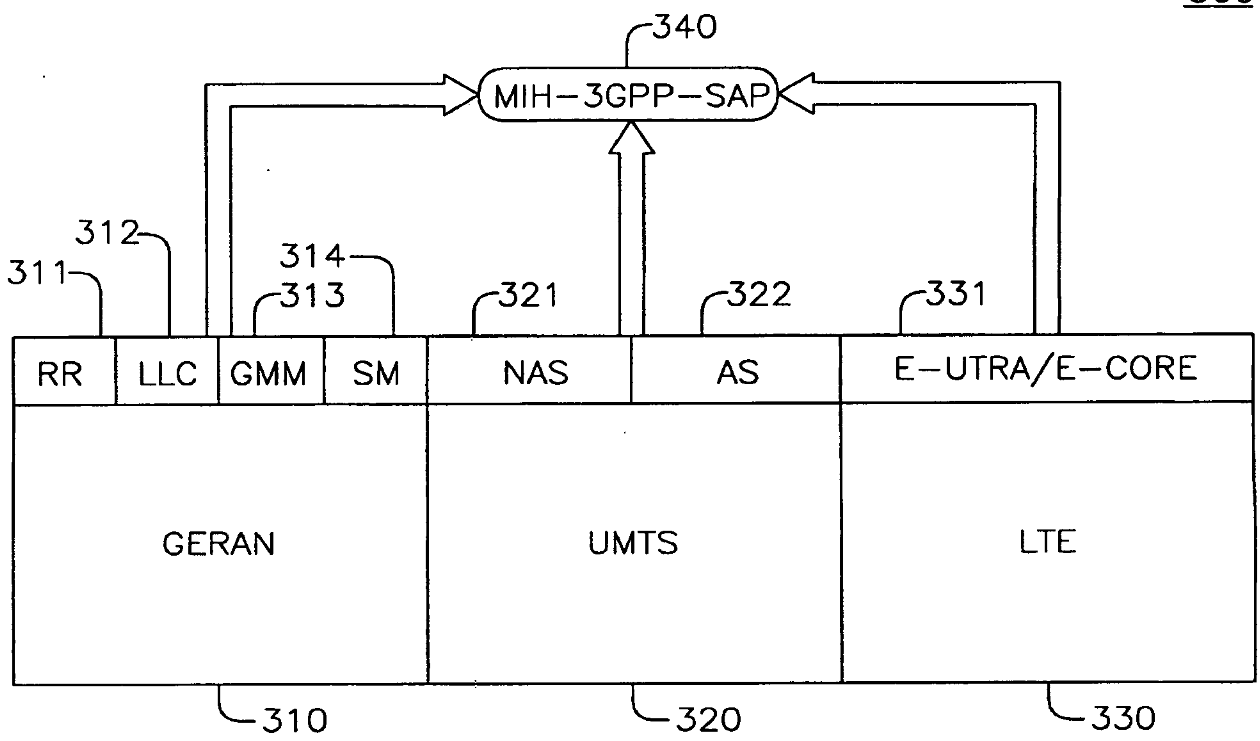

300
340
MIH-3GPP-SAP
311
312
313
314
321
322
331
RR
LLC
GMM
SM
NAS
AS
E-UTRA/E-CORE
GERAN
UMTS
LTE
310
320
330

FIG.3

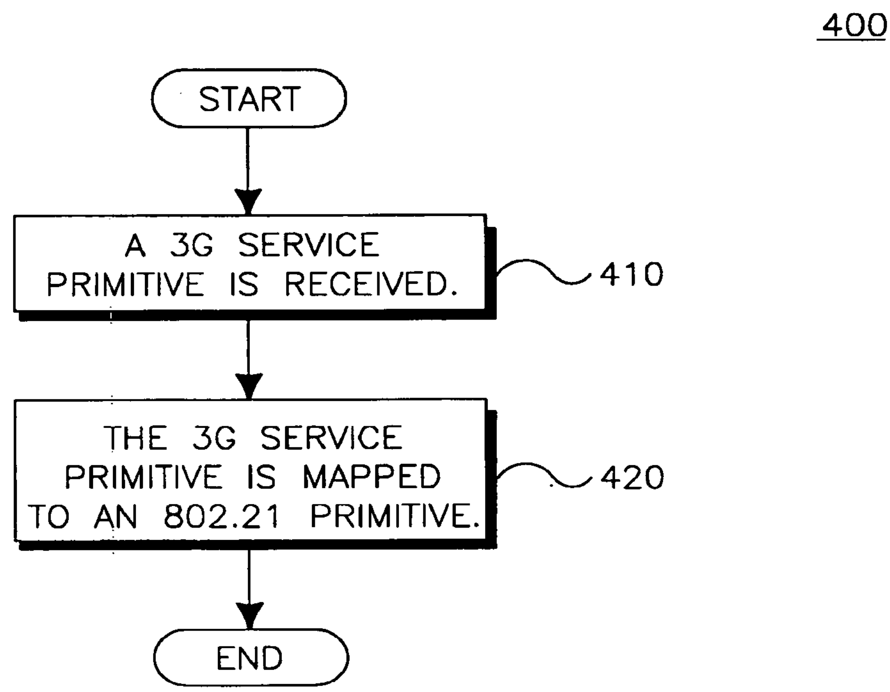

400
START
A 3G SERVICE PRIMITIVE IS RECEIVED.
410
THE 3G SERVICE PRIMITIVE IS MAPPED TO AN 802.21 PRIMITIVE.
420
END

FIG.4

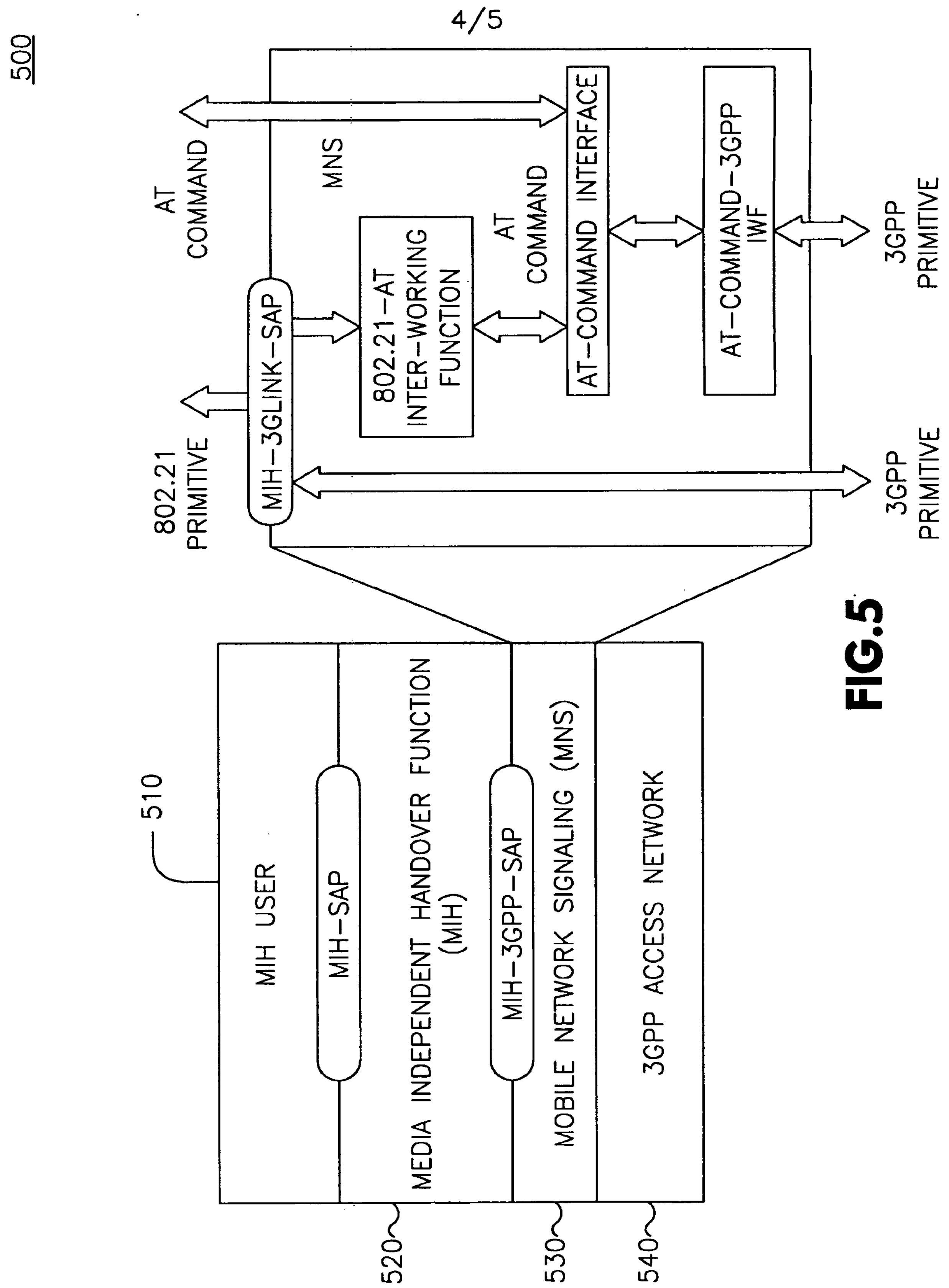

500
510
MIH USER
MIH-SAP
MEDIA INDEPENDENT HANDOVER FUNCTION (MIH)
MIH-3GPP-SAP
MOBILE NETWORK SIGNALING (MNS)
3GPP ACCESS NETWORK
520
530
540
802.21 PRIMITIVE
AT COMMAND
MNS
MIH-3GLINK-SAP
802.21-AT INTER-WORKING FUNCTION
AT COMMAND
AT-COMMAND INTERFACE
AT-COMMAND-3GPP IWF
3GPP PRIMITIVE
3GPP PRIMITIVE

FIG.5

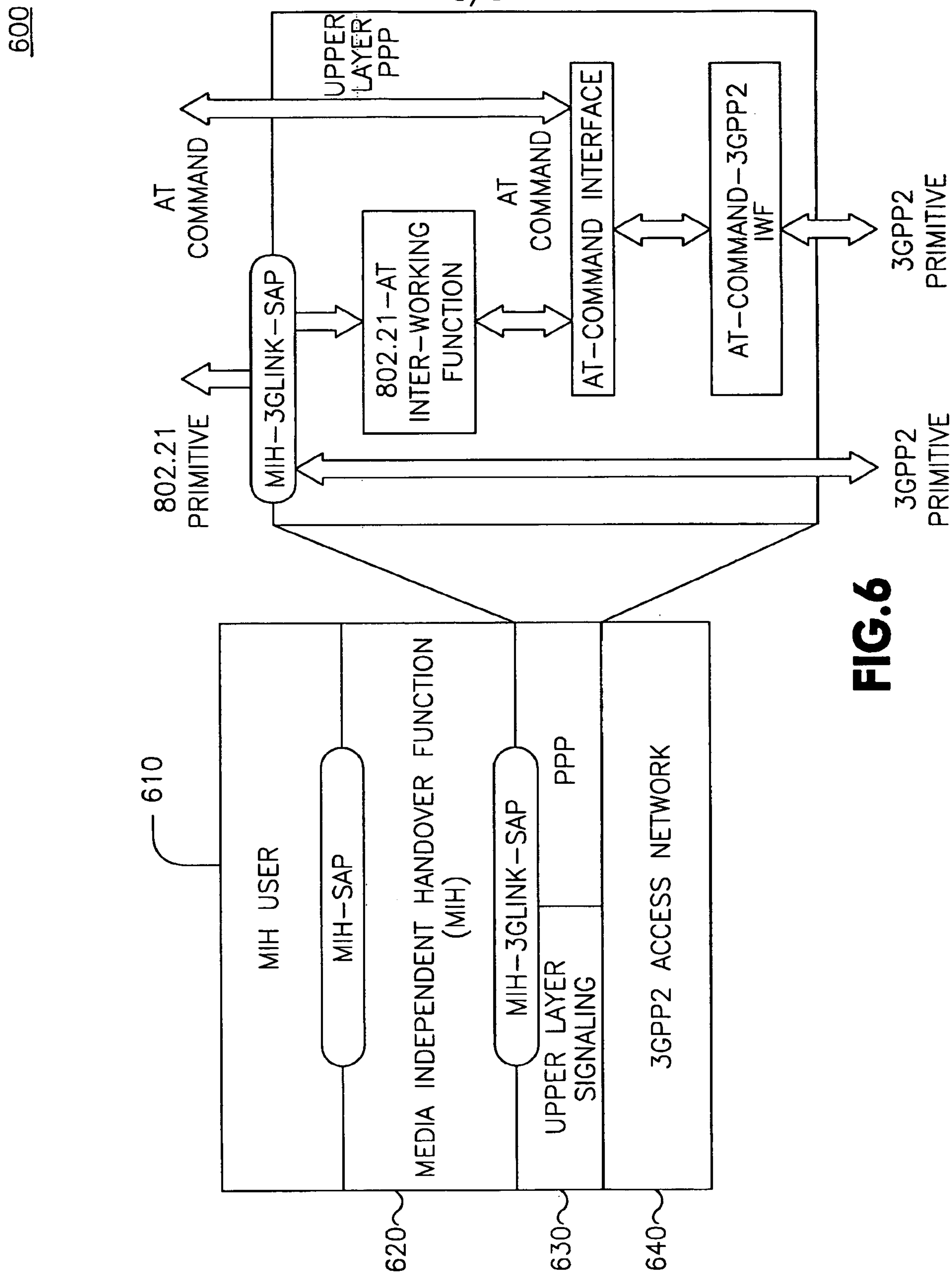

600
610
MIH USER
MIH-SAP
MEDIA INDEPENDENT HANDOVER FUNCTION (MIH)
MIH-3GLINK-SAP
UPPER LAYER SIGNALING
PPP
3GPP2 ACCESS NETWORK
620
630
640
802.21 PRIMITIVE
AT COMMAND
UPPER LAYER PPP
MIH-3GLINK-SAP
802.21-AT INTER-WORKING FUNCTION
AT COMMAND
AT-COMMAND INTERFACE
AT-COMMAND-3GPP2 IWF
3GPP2 PRIMITIVE
3GPP2 PRIMITIVE

FIG.6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/016800

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04Q7/38

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)
H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ULISES OLVERA: "Media Independent Handover: Functions and Services Specification" IEEE 802.21 MIHO, 17 July 2006 (2006-07-17), pages 1-11, XP002460275 Internet the whole document	1-9, 11-15, 21, 27-30, 36,42,43
Y		10, 16-20, 22-26, 31-35, 37-41

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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 document 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	Date of mailing of the international search report
28 November 2007	10/12/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Vaskimo, Kimmo

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/016800

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ULISES OLVERA: "Media Independent Handover: Functions and Services Specification" IEEE 802.21 MIHO, 9 January 2006 (2006-01-09), pages 1-9, XP002460276 Internet the whole document	1-9, 11-14, 27-29, 42,43
Y		10,16-20
A		15, 21-26, 30-41
Y	US 2005/025182 A1 (NAZARI ALA [SE]) 3 February 2005 (2005-02-03) paragraph [0002] - paragraph [0022] paragraph [0042] paragraph [0050] paragraph [0113] paragraph [0121] paragraph [0135] paragraph [0140] paragraph [0178] paragraph [0185] paragraph [0190] paragraph [0193] - paragraph [0194] paragraph [0200] paragraph [0211] paragraph [0228] claim 11	16-20, 22-26, 31-35, 37-41
A	IEEE 802 21: JOINED HARMONIZED CONTRIBUTION: "Media Independent Handover" INTERNET CITATION, [Online] 3 May 2005 (2005-05-03), XP002428336 Retrieved from the Internet: URL:http://www.ieee802.org/21/doctree/2005-05_meeting_docs/> [retrieved on 2007-04-05] the whole document	1,12,27, 42,43
A	802 21: 3GPP LIAISON PACKAGE DEVELOPMENT AD HOC GROUP: "21-05-0300-12-0000-AdHoc3GPPLiasionPackage" INTERNET CITATION, [Online] 22 September 2005 (2005-09-22), XP002428337 Retrieved from the Internet: URL:http://www.ieee802.org/21/doctree/2005-09_meeting_docs/> [retrieved on 2007-04-05] the whole document	1,12,27, 42,43

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2007/016800

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005025182 A1	03-02-2005	WO 2005004437 A1	13-01-2005