

[0001] **METHOD AND ARCHITECTURE FOR ACCESSING
AN INTERNET PROTOCOL MULTIMEDIA SUBSYSTEM (IMS)
OVER A WIRELESS LOCAL AREA NETWORK (WLAN)**

[0002] **FIELD OF INVENTION**

[0003] The present invention generally relates to internet multimedia subsystems, and more particularly to a method and architecture for accessing internet protocol multimedia subsystems (IMSs) in a wireless local area network.

[0004] **BACKGROUND**

[0005] The architecture for accessing an IMS in regular networks is very popular and is fairly well known in the art. Accessing an IMS in WLANs, however, is a different matter because certain modifications to the architecture of known WLANs are required. Such modifications have neither been addressed in known architecture, nor in standards that regulate and guide the use of an IMS in WLANs. Therefore, there is a need for a suitable architecture and method for accessing an IMS in WLANs as well as WWANs.

[0006] The following list of acronyms used in this specification assists in a better understanding of the invention:

3GPP	third generation partnership project
AAA	authentication, authorization, accounting
BG	border gateway
CCF	call control function
C-GW	control gateway
CSCF	call state control function
GGSN	gateway GPRS support node
GMSC	gateway MSC
GPRS	general packet radio system
HLR	home location register
HSS	home subscriber service
IMS	internet protocol multimedia subsystem
IM	internet protocol multimedia

IP	internet protocol
I-WLAN	interworked WLAN
IWMSC	interworking MSC for SMS
MGCF	media gateway control function
MGW	media gateway
MT	mobile terminal
OCS	on line charging system
PDG	packet data gateway
PDN	packet data network
PS	packet switched
RP-DA	relay sublayer protocol-destination address
R-SGW	roaming SGW
S-CSCF	serving call state control function
SGSN	serving GPRS support node
SGW	signaling gateway
SIP	session initiation protocol
SMS	short messaging service
SNCI	serving network contact information
TE	terminal equipment
TPDU	transfer protocol data unit
T-SGW	transport SGW
UE	user equipment
UMTS	universal mobile telecommunication system
UTRAN	UMTS terrestrial radio access network
VLR	visitor location register
WLAN	wireless local area network
WWAN	wireless wide area network

[0007]

SUMMARY

[0008] Example embodiments of the present invention provide a method and architecture for accessing an IMS over WLANs/WWANs generally, and more particularly over

WLANs/WWANs viewed in light of existing related standards. More specifically, example embodiments may provide new interfaces enabling IMS access over WLANs/WWANs, and an exemplary method and architecture for such an interface.

[008a] In accordance with a first aspect of the present invention, there is provided a packet data gateway (PDG) for enabling a wireless transmit/receive unit (WTRU) to access an internet protocol multimedia subsystem (IMS), wherein the PDG is configured to communicate with the IMS and a wireless Internet Protocol (IP) based network and adapted to provide IMS services to a WTRU operating in the wireless IP based network, and the PDG is a subsystem of a call state control function.

[0009] BRIEF DESCRIPTION OF THE DRAWING(S)

[0010] A more detailed understanding of the invention may be had from the following description of preferred embodiments, given by way of example and to be understood in conjunction with the accompanying drawings wherein like elements are designated by like numerals and wherein:

[0011] Figure 1 is a schematic diagram showing a conventional architecture having a direct connection between the call state control function (CSCF) and gateway GPRS support mode GGSN via a Gi interface;

[0012] Figure 2 is a schematic diagram showing an interworking WLAN and 3GPP network;

[0013] Figure 3 is a schematic diagram showing a connection point Wi between the IMS subsystem (i.e. CSCF) and the PDG;

[0014] Figure 4 is a flow diagram showing a session initiation protocol (SIP) registration over an interworked - WLAN (I-WLAN), where the user is not registered;

[0015] Figure 5 is a flow diagram showing termination of IMS based services over a WLAN; and,

[0016] Figure 6 is a schematic diagram showing an interface between a media gateway (MGW) and the PDG.

[0017] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0018] The present invention will be described with reference to the drawing figures wherein like numerals represent like elements throughout.

[0019] Hereafter, a user equipment (UE) includes but is not limited to a wireless transmit/receive unit (WTRU), mobile station, fixed or mobile subscriber unit, pager, or any other type of device capable of operating in a wireless environment. When referred to hereafter, a base station includes but is not

limited to a Node-B, site controller, access point, or any other interfacing device in a wireless environment.

[0020] The present invention is directed to a method and architecture for accessing IMS services over a WLAN. The details of a connection point and an interface between the IMS subsystem (CSCF) and the PDG on the one hand, and the media gateway (MGW) and the PDG on the other are described. A methodology is set forth herein for accessing IMS to be incorporated into existing standard TS 23.234. More particularly, reference may be had to section 7.8 of the existing standard, directed to procedures for IMS access. The description that follows is generally directed to an architecture which is applicable to existing standards including 802.11 in a UMTS or CDMA 2000 setting, for example. However, the broad concept of the invention is applicable without limitation to other transmission systems as well.

[0021] Making reference to Figure 1, there is shown a conventional architecture which is incorporated into the standard TS 23.234 to enable accessing IMS over a WLAN. The existing reference architecture indicates that direct connection between the CSCF and GGSN via a Gi interface may be necessary. This connection is used to route originated/terminated SIP messages between devices operating in packet switched (PS) domains and the IMS subsystem (i.e., CSCF).

[0022] In order to access IMS services over an interworked WLAN (I-WLAN) using a WLAN-UMTS network architecture model as shown in Figure 2, however, a direct connection is provided between the newly added PDG node and the IMS sub-system (CSCF). This reference point functions in a manner which is similar to other reference points.

[0023] More specifically, Figure 2 is a hardware block diagram showing WLAN-3GPP interworking architecture 100 respectively comprising home and visiting 3GPP networks 123 and 113 utilizing an optional WLAN border gateway (BG). A WLAN user equipment (UE) 105 is coupled to a WLAN access network 109. WLAN access network 109 typically includes one or more intermediate

networks. WLAN access network 109 is coupled to the Internet and/or an Intranet, denoted as Intranet/Internet 101.

[0024] WLAN access network 109 accesses a 3GPP visited network 113 by way of a WLAN BG 117, and/or optionally via a 3GPP AAA proxy server 120. Communications between WLAN access network 109 and WLAN access gateway 117 is by way of a Wn interface, denoting the tunneling of data through intermediate networks. The link between WLAN access network 109 and optional 3GPP AAA proxy server 120 is by way of a Wr/Wb interface, wherein Wr signifies wireless LAN authentication (information flow to 3GPP), and Wb refers to wireless LAN charging functions. WLAN BG 117 is also coupled to a PDG 119 which, in turn, accesses a packet data network (PDN) 138 over a Wi interface, denoting access to a PDN 138. 3GPP AAA proxy server 120 is coupled to a control gateway - call control function (C-Gw CCF) 122, over a Wf interface, denoting a charging gateway function.

[0025] A second PDG 124 is linked to WLAN BG 117 of 3GPP visited network 113 over a Wn interface which, as described above, signifies the tunneling of data through intermediate networks. PDG 124 is linked to a PDN 136 over the above-described Wi interface. PDN 136 may be the same network as PDN 138. PDG 124 is linked to a 3GPP AAA proxy server 126 over a Wm interface. 3GPP AAA proxy server 126 is linked to 3GPP AAA proxy server 120 of 3GPP visited network 113 over a Wr/Wb interface, described above. 3GPP AAA proxy server 126 is also linked to online charging system (OCS) 128, HSS 130, HLR 132, and C-Gw CCF 134. The link between OCS 128 and 3GPP AAA proxy server 126 is a Wo interface which implements online charging, whereas the link between HLR 132 and 3GPP AAA proxy server 126 uses a D'/Gr' interface which provides authentication of the UE 105, and the link between HSS 130 and 3GPP AAA proxy server 126 utilizes a Wx interface for implementing authentication procedures.

[0026] The PDG is a node by which PDNs are connected to a 3GPP interworking WLAN. The location of the PDG is different for each specific service accessed WLAN. For some WLAN connections, no PDG is used. For some

accessed services the PDG is in the home network and for some accessed services the PDG used is located in one of the visited networks.

[0027] The PDG contains routing information for WLAN-3GPP connected users; routes the packet data received from/sent to the PDN 140, shown in Figures 3 and 6, to/from the WLAN-3GPP connected user; performs address translation and mapping; performs encapsulation; and generates charging information related to user data traffic for offline and online charging purposes.

[0028] When receiving a short message Transfer Protocol Data Unit (TPDU) from the SMS-gateway MSC (GSMSC) (i.e., the CSCF 121 shown in Figure 3), the PDG 119 is responsible for reception of the short message TPDU.

[0029] If errors are detected by PDG 119, the PDG 119 returns the appropriate error information to the SMS-GMSC (i.e., the CSCF 121 shown in Figure 3) in a failure report. If no errors are detected by PDG 119, the PDG 119 encapsulates and transfers the short message to UE 105 through WLAN 109.

[0030] When receiving a confirmation that the message is received by UE 105, PDG 119 relays the delivery confirmation to the SMS-GMSC (CSCF) (i.e., CSCF 121 shown in Figure 3) in a delivery report.

[0031] When receiving a failure report of the short message transfer to the UE 105, PDG 119 returns the appropriate error information to the SMS-GMSC 121 (shown in Figure 3) in a failure report.

[0032] When receiving a short message TPDU from the UE 105, the PDG 119 is responsible for reception of the short message TPDU and inspection of the relay sub-layer protocol - destination address (RP-DA) parameter.

[0033] If the parameters are not correct, the PDG 119 returns the appropriate error information to the UE 105 in a failure report.

[0034] If no parameter errors are found, the PDG 119 transfers the short message TPDU to the SMS-GMSC (i.e., CSCF 121 shown in Figure 3).

[0035] When receiving the report of a short message from a short message service - interworking message service center (SMS-IWMCS), not shown for simplicity, the PDG relays the report to the UE 105.

[0036] The new reference point Wi is an interface between the IMS-Subsystem (CSCF) 121 and the PDG 119, as shown in Figure 3.

[0037] The Wi reference point is similar to the Gi reference point provided by the PS domain. Interworking with packet data networks is provided via the Wi reference point based on IP. Services offered by mobile terminals via reference point Wi are globally addressable through the operators' public addressing scheme or through the use of a private addressing scheme. When a 3GPP network, for example, is provided for an IP multi media (IM) - core network (CN), i.e., IM-CN subsystem, the reference point Wi provides a policy control interface.

[0038] Figure 4 shows the SIP registration procedure over I-WLAN, when the user is not registered. The application level registration is initiated after access registration is performed and after IP connectivity for the signaling has been attained from the access network. The procedure is explained below.

[0039] After the UE has obtained IP connectivity through the WLAN network, at step S1, the UE performs the IM registration. The UE, at step S2, sends the SIP registration information flow to the PDG. The PDG, at step S3, examines the registration message to determine the target CSCF and forwards the registration message to the target CSCF, at step S4.

[0040] Upon receipt of the registration information flow, the CSCF, at step S5, checks the user profile in the HLR/HSS and, at step S6, sends Cx-Query information to the HSS (for subscriber identity, home domain name). The HSS determines if the user is already registered and, at step S7, a Cx-Query Response (Resp) is sent from the HLR/HSS to the CSCF. If, at step S6, the HSS determines that the Cx-Query is not successful, the Cx-Query Resp rejects the registration attempt.

[0041] At this stage, it is assumed that the authentication of the user has been completed, although it may have been determined at an earlier point in the information flow.

[0042] The CSCF (i.e., serving CSCF (S-CSCF)), at step S8, updates the user profile and sends a Cx-Put message (subscriber identity, S-CSCF name) to

the HLR/HSS at step S9. The HSS, responsive to step S9, stores the S-CSCF name for that subscriber and, at step S10, the HSS sends a Cx-Put Resp message to the S-CSCF to acknowledge receipt of the Cx-Put message.

[0043] On receipt of the Cx-Put Resp message, the S-CSCF, at step S11, sends Cx-Pull information flow (subscriber identity) to the HSS which, at step S12, downloads the relevant information from the subscriber profile to the S-CSCF.

[0044] The S-CSCF, at step S13, stores the information for the indicated user. In addition to the names/addresses information, security information can also be sent for use within the S-CSCF.

[0045] The S-CSCF, at step S14, returns the SIP 200 OK information flow (serving network contact information (SNCI)) to the PDG.

[0046] The PDG, at step S15, sends information flow SIP 200 OK (SNCI) to the WLAN. The WLAN sends the SIP 200 OK message to the UE, at step S16.

[0047] Figure 5 is a data flow diagram setting forth a procedure for the termination of IMS-based services over a WLAN. WLAN 203 is coupled to UE 201 and also to a PDG 205. Communications between WLAN 203, UE 201, and PDG 205 are over standard IP-based links, (see step S0). Upon receipt of an incoming SIP call, at step S1, CSCF 202 retrieves mobile routing information and, at step S2, sends the routing information to HLR 204. In response to this routing information, HLR 204, at step S3, sends a PDG address to CSCF 202. CSCF 202, at step S4, sends an SIP Invite message to PDG 205 at the PDG address returned by HLR 204. Upon receipt of the SIP Invite message, PDG 205, at step S5, locates the WLAN 203/UE 201 and, at step S6, notifies WLAN 203 by sending WLAN 203 an SIP Invite message. WLAN 203, at step S7, alerts UE 201 as to the existence of an incoming SIP call. If the SIP call is to be accepted at UE 201, UE 201, at step S8, sends an acceptance message to WLAN 203. WLAN 203, at step S9, sends an SIP 200 OK message to PDG 205. PDG 205 responds to the SIP 200 OK message, at step S10, by sending an SIP 200 OK message to CSCF 202. CSCF 202, at step S11, sends the SIP 200 OK message to the cellular network.

[0048] Figure 6 illustrates an exemplary reference point Wi for use as an interface between the MGW, identified as a CSCF 123 and the PDG 119, the details of PDG being as explained above. It is noted that Figure 3, as explained earlier, illustrates interface Wi for use as an interface between the IMS subsystem (CSCF) and the PDG.

[0049] The foregoing describes an exemplary method and architecture for accessing an IP multimedia subsystem (CSCF) over a WLAN. While this invention has been particularly shown and described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention described hereinabove.

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CLAIMS

1. An packet data gateway (PDG) for enabling a wireless transmit/receive unit (WTRU) to access an internet protocol multimedia subsystem (IMS), wherein the PDG is configured to communicate with the IMS and a wireless Internet Protocol (IP) based network and adapted to provide IMS services to a WTRU operating in the wireless IP based network, and the PDG is a subsystem of a call state control function.

2. The PDG of claim 1, wherein the IMS includes a processor configured to route session initiation protocol (SIP) messages.

3. The PDG of claim 1, further comprising:
the PDG comprising a processor configured to communicate packet data between a Packet Data Network and one the wireless IP based network.

4. The PDG of claim 1, further comprising:
a media gateway; and
the PDG comprising a processor configured to couple media services from the media gateway to one of the wireless IP based network.

5. The PDG of claim 1 further configured to generate charging information relating to user traffic.

6. The PDG of claim 1 further configured to generate offline charging and for one of the wireless IP based network interworking with a 3GPP network.

7. The PDG of claim 1 further configured to access a packet data network over a Wi interface.

8. The PDG of claim 1 further configured to perform address translation and mapping.

9. The PDG of claim 1 further configured to receive a short message transfer protocol data unit.

10. The PDG of claim 9 further configured to detect errors in a received short message.

11. The PDG of claim 9 further configured to encapsulate the received short message; and
transfer the received short message to a WTRU.