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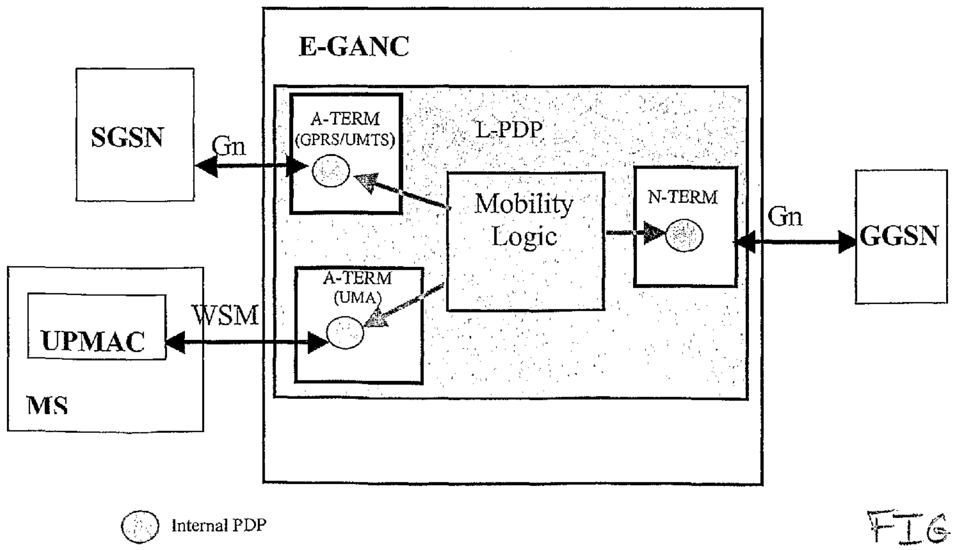

FIG. 12

(57) Abstract: One object of the present invention is α Proxy-Gn entity for mobility between UMA access and GPRS/UMTS access, said Proxy-Gn entity anchoring a PDP context for a Mobile Station MS whatever the access type UMA or GPRS/UMTS for this MS, said anchored PDP context having three terminations, two access terminations and one network termination: - GPRS/UMTS access termination, which receives GTP control messages from a SGSN, - UMA access termination, which receives Session Management requests from the MS, - Network termination, which is the termination towards a GGSN, and which owns the IP address allocated to the MS.

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MOBILITY BETWEEN UMA ACCESS AND GPRS/UMTS ACCESS

The present invention generally relates to mobile communication networks and systems.

Detailed descriptions of mobile communication networks and systems can be found in the litterature, in particular in Technical Specifications published by standardisation bodies such as in particular 3GPP (3rd Generation Partnership Project).

It is simply recalled that in a mobile communication system a mobile terminal (also called Mobile Station MS, or User Equipment UE) has access to mobile services, such as in particular 3GPP services, delivered by a Core Network CN via an Access Network AN. There are different types of mobile services such as in particular Circuit Switched (CS) services and Packet Switched (PS) services, and the CN comprises different domains such as in particular a CS domain and a PS domain.

Mobile services have traditionally been delivered to Mobile Stations via an Access Network corresponding to a Radio Access Network RAN, allowing relatively high mobility but at relatively high cost for the users. Typical examples of RAN are GERAN (GSM/EDGE Radio Access Network, where EDGE stands for Enhanced Data rates for GSM Evolution, and GSM stands for Global System for Mobile communications) and UTRAN (UMTS Terrestrial Radio Access Network, where UMTS stands for Universal Mobile Telecommunication System). A description of RANs such as GERAN or UTRAN can be found in particular in 3GPP Technical Specifications.

Generic Access (GA), also called Unlicensed Mobile Access (UMA), was developed to provide access to 3GPP Core Network using generic IP connection. Generic Access is an extension of GSM/GPRS mobile services into the customer's premises that is achieved by tunnelling certain GSM/GPRS protocols between the customer's premises and the Core Network over broadband IP network, and relaying them through an unlicensed radio link inside the customer's permises.

A description of Generic Access to the A/Gb interface of 3GPP Core Network can be found in particular in 3GPP TS 43.318 and 3GPP TS 44.318.

As recalled in figure 1, taken back from 3GPP TS 43.318, Generic Access Network (GAN) includes a Generic Access Network Controller (GANC). A Generic IP Access network provides connectivity between the MS and the GANC. A single interface, the Up interface, is defined between the GANC and the MS.The GANC appears to the CN as a BSS (Base Station Subsystem) of GERAN. It includes a Security Gateway (SEGW) that terminates secure remote access tunnels from the MS, providing mutual authentication, encryption and data integrity for signalling, voice and data traffic. The GANC is interconnected with the CN via the standardized interfaces (i.e. A-interface and Gb-interface) defined for GERAN A/Gb mode.

The PS Domain Control Plane GAN protocol architecture is recalled in figure 2 taken back from 3GPP TS 43.318. The PS Domain User Plane GAN protocol architecture is recalled in figure 3 taken back from 3GPP TS 43.318. The PS domain MS architecture is recalled in figure 4 taken back from 3GPP TS 43.318.

The present invention more particularly relates to enhancements to Generic Access in PS domain.

A protocol architecture for such enhancement is disclosed in European patent application n° 06291168.0 filed on July 18, 2006 by the Applicant of the present application. Such enhancement is also called E-GAN (Enhanced Generic Access Network), or HIS One Tunnel Mode (where HSI stands for High Speed Internet).

E-GAN protocol architecture is recalled in figure 5 for PS Domain User Plane. Protocols at the Up-interface between MS and E-GANC include, from higher to lower layers:

- GRE,
- Remote IP,
- IPSec ESP,
- Transport IP,
- Access Layers.

Protocols at the Gn-interface between E-GANC and GGSN include, from higher to lower layers:

- GTP-U,
- UDP,
- Transport IP,
- Access Layers.

Protocols at the MS-GGSN interface include:

- IP Layer.

Protocols at the interface between MS and an Application Server (not illustrated) include:

- Application layer.

GRE stands for Generic Routing Encapsulation, a description of which can be found in particular in RFC 2890 published by IETF (Internet Engineering Task Force).

EGAN protocol architecture is recalled in figure 6 for PS Domain Control Plane. Protocols at the Up-interface between MS and E-GANC include, from higher to lower layers:

- W-SM,
- UDP,
- Remote IP,
- IPSec ESP,
- Transport IP,
- Access Layers.

Protocols at the Gn-interface between E-GANC and GGSN include, from higher to lower layers:

- GTP-C,
- UDP,
- Transport IP,
- Access Layers.

The Session Management (3GPP TS 24.008) SM protocol is enhanced (W-SM) with some information related to the GRE tunnel management (exchange of the keys IE used in the GRE tunnel).

The present invention addresses the problem of seamless mobility between UMA (enhanced Generic Access or HSI One Tunnel mode) and GPRS/UMTS.

A solution that could be used to provide the seamless mobility is inter-system Gn mobility as defined in 3GPP TS 24.008 and 29.060.

The inter-system mobility defines how to transfer a MS from a GPRS/UMTS system to an other. The two systems exchange information about the PDP contexts activated by the MS. Within this information are mainly radio related information, location information (RAI) and MS identifier (P-TMSI, TLLI) However:

- To switch toward the Wifi (UMA) side, radio information related to GERAN/UTRAN are of no interest,

- To switch on the GPRS/UMTS side, a question is what value to set to the radio information and how to handle them.

The mobility of the 24.008 is rather complicated and experience has shown that it is expensive to implement and test. It is not desired to develop a new type of SGSN. A simpler and less expensive system, that could be implemented and tested faster, is preferred.

The RNC and the BSS nodes are impacted by the mobility in order not to loose traffic. The equivalent of these nodes on the Wifi side are the Wifi access points which have not the RNC and BSS feature for mobility. It is not conceivable to request the Wifi access points to integrate such features because they are not 3GPP defined nodes. The consequence is that some traffic could be lost.

Another solution that could be used to provide the seamless mobility is Mobile IP Protocol (MIP), as illustrated in figure 7.

Mobile IP is specified by IETF. It is recalled that Mobile IP allows a MN (Mobile Node) to maintain connectivity to an external PDN using a single and unchanging address (its home address) even when the link layer point of attachment is changing. When the MN moves from the home network to a foreign network it registers with its Home Agent HA an IP address (the Care Of Address COA in Colocated mode or with the Foreign Agent Adress in FA mode) that the HA can use to tunnel packets to the MN. The HA intercepts packets addressed to the MN's home address and tunnels these packets to the COA.

With MIP, GGSN would require FA feature. However, some GGSN do not have this feature, and it is not foreseen to implement any new feature on them.

Requiring the operators to change their GGSN or even to only update them to deploy a solution is a big issue.

Furthermore, HA nodes should be deployed in the access networks. These nodes would be bottlenenecks for traffic. Operators are currently asking to reduce the number of nodes and this solution adds one.

In addition, MIP requires to implement a MIP client in the MS. Any way our solution also requires a specific client. This is not an issue. But the problem with the MIP solution is that a MIP client should be instanciated for each APN. This is memory and CPU consuming.

It is an object of the present invention to solve part or all of such problems, or to avoid part or all of such drawbacks.

These and other objects are achieved, in one aspect of the present invention, by a Proxy-Gn entity for mobility between UMA access and GPRS/UMTS access, said Proxy-Gn entity anchoring a PDP context for a Mobile Station MS whatever the access type UMA or GPRS/UMTS for this MS, said anchored PDP context having three terminations, two access terminations and one network termination:

- GPRS/UMTS access termination, which receives GTP control messages from a SGSN,

- UMA access termination, which receives Session Management requests from the MS,

- Network termination, which is the termination towards a GGSN, and which owns the IP address allocated to the MS.

These and other objects are achieved, in another aspect of the present invention, by a Proxy-Gn entity for mobility between UMA access and GPRS/UMTS access, said Proxy-Gn entity anchoring a PDP context for a Mobile Station MS whatever the access type UMA or GPRS/UMTS for this MS, said Proxy-Gn entity exchanging information with the MS, by inserting said information in containers in the Protocol Configuration Options PCO Information Element IE of signalling messages.

These and other objects are achieved, in another aspect of the present invention, by a Mobile Station MS, comprising a UMA Multi-Access Client introduced between its Application layer and Non Access Stratum layer, such that:

- the Service Access Points SAPs between the Application layer and the UMA Multi-Access Client correspond to the SAPs SMREG-SAP, and SN-SAP(xn) for GPRS or RAB1-SAP...RABn-SAP for UMTS, of GPRS/UMTS MS protocol architecture,

- the Service Access Points SAPs between the UMA Multi-Access Client and the SM and SNDCP layers correspond to the SAPs SMREG-SAP, and SN-SAP(xn) for GPRS or RAB1-SAP...RABn-SAP for UMTS, of GPRS/UMTS MS protocol architecture,

- a Service Access Point WSMREG-SAP is introduced, for Control Plane, between the UMA Multi-Access Client and a UDP layer introduced above the Unlicensed Access, IP transport, and IPSec layers of UMA MS protocol architecture,

- a Service Access Point WRAB-SAP is introduced, for User Plane, between the UMA Multi-Access Client and a GRE layer introduced above the Unlicensed Access, IP transport, and IPSec layers of UMA MS protocol architecture.

These and other objects are achieved, in another aspect of the present invention, by a Mobile Station MS, comprising a UMA Multi Access Client introduced above its Non Access Stratum layer, said UMA Multi Access Client exchanging information with a Proxy-Gn entity anchoring a PDP context for the MS whatever the access type UMA or GPRS/UMTS for this MS, by inserting said information in containers in the Protocol Configuration Options PCO Information Element IE of signalling messages.

These and other objects of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings:

- figure 1 is intended to recall GA architecture,
- figure 2 is intended to recall the PS domain control plane GAN protocol architecture,
- figure 3 is intended to recall the PS domain user plane GAN protocol architecture,
- fugure 4 is intended to recall the PS domain GA MS architecture,
- figure 5 is intended to illustrate the PS domain user plane E-GAN protocol architecture ,
- figure 6 is intended to illustrate the PS domain control plane E-GAN protocol architecture,
- figure 7 is intended to illustrate a solution using MIP,
- figure 8 is intended to illustrate a 2G MS protocol architecture according to the present invention,
- figure 9 is intended to illustrate a 3G MS protocol architecture according to the present invention,
- figure 10 is intended to illustrate an E-GANC architecture according to the present invention,
- figure 11 is intended to illustrate an example of system architecture using the present invention,
- figure 12 is intended to illustrate a logical PDP context according to the present invention,

- figure 13 is intended to illustrate a procedure for PDP context activation on GPRS access, according to the present invention,
- figure 14 is intended to illustrate a procedure for PDP context activation on Wifi (GA) access, according to the present invention,
- figure 15 is intended to illustrate a procedure for switching from GPRS access to Wifi (UMA) access, according to the present invention,
- figure 16 is intended to illustrate a first example of a procedure for switching from Wifi (UMA) access to GPRS access, according to the present invention,
- figure 17 is intended to illustrate a second example of a procedure for switching from Wifi (UMA) access to GPRS access, according to the present invention,
- figure 18 is intended to illustrate a first example of a procedure for PDP context de-activation on GPRS access, according to the present invention,
- figure 19 is intended to illustrate a second example of a procedure for PDP context de-activation on GPRS side, according to the present invention,
- figure 20 is intended to illustrate a third example of a procedure for PDP context de-activation on GPRS side, according to the present invention,
- figure 21 is intended to illustrate a first example of a procedure for PDP context de-activation on Wifi (UMA) side, according to the present invention,
- figure 22 is intended to illustrate a second example of a procedure for PDP context de-activation on Wifi (UMA) side, according to the present invention,
- figure 23 is intended to illustrate a third example of a procedure for PDP context de-activation on Wifi (UMA) side, according to the present invention.

A protocol architecture for a handset (or MS) according to the present invention is illustrated in figure 8 for a 2G/1T MS, and in figure 9 for a 3G/1T MS (where 1T stands for "One Tunnel HSI mode").

A specific client, called UMA Multi-Access Client is introduced above the Non Access Stratum of the handset. This is the same client for 2G and 3G handset. The

SM and SNDCP layers (of the protocol architecture for 2G/GPRS or 3G/UMTS as specified in particular in 3GPP TS 24.007) see the UMA Multi-Access Client as an application.

The Service Access Points SAPs between the SM, SNDCP layers and the UMA Multi-Access Client are the SAPs as specified in 3GPP TS 24.007, i.e. : SMREG-SAP, and SN-SAP(xn) for 2G or RAB1-SAP...RABn-SAP for 3G.

A Service Access Point WSMREG-SAP is introduced between UDP layer (of the protocol architecture of 1T/UMA) and the Multi-Access Client, for Control Plane.

A Service Access Point WRAB-SAP is introduced between GRE layer (of the protocol architecture of 1T/UMA) and the Multi-Access Client, for User Plane.

An architecture for a E-GANC according to the present invention is illustrated in figure 10.

The E-GANC comprises the following entities: SGW (Security Gateway), W-SM entity, Proxy-Gn entity.

For 1T/UMA access:

- MS and SGW communicate using an IPSec tunnel; different flows inside this IPSec tunnel include W-SM signalling (Control Plane) and GRE tunnel (User Plane),

- SGW and W-SM communicate using W-SM' (Control Plane) and GRE (User Plane),

- W-SM and Proxy-Gn communicate using GTP-C (Control Plane),

- Proxy-Gn and GGSN communicate using GTP-C (Control Plane),

- W-SM and GGSN communicate using GTP-U (User Plane).

For 2G/GPRS or 3G/UMTS access:

- MS and SGSN communicate using SM (Control Plane) and PDCP or SNDCP (User Plane),

- SGSN and Proxy-Gn communicate using GTP-C (Control Plane),

- Proxy-Gn and GGSN communicate using GTP-C (Control Plane),

- SGSN and GGSN communicate using GTP-U (User Plane).

An example of system architecture using the present invention is illustrated in figure 11. The system comprises:

- Mobile Station (MS),
- 3GPP RAN (GSM BSC, UMTS RNC)

- GAN,
- CN.

In the example of system architecture illustrated in figure 7, GAN comprises:

- WLAN/ IP Network,
- GANC-CS (GANC part handling CS services),
- EGANC-PS (E-GAN part handling PS services),
- SeG (GANC part corresponding to Security Gateway),
- AAA server, connected to SGW via Wm-interface.

In the example illustrated in figure 11, CN comprises:

- Voice Core Network (CN part handling CS services), comprising MSC nodes connected to 3GPP RAN and to GANC-CS via A-interface,
- Packet Core Network (CN part handling PS services), comprising GGSN nodes (connected to other networks or subnetworks, such as PDN or IMS (IP Multimedia Subsystem) and SGSN nodes connected to 3GPP RAN via Gb-interface and Iu-ps interface,
- HLR (Home Location Register) connected to AAA server.

The following paths are illustrated in figure 11 for Control Plane:

- on 1T/UMA access: interface between MS and WLAN/ IP Network - interface UP between WLAN/IP Network and SeG, interface between SeG and EGANC-PS,

- on 2G/GPRS or 3G/UMTS access: interface between MS and GSM BSC or UMTS RNC – interface Gb between GSM BSC and SGSN or Iu-ps interface between UMTS RNC and SGSN – interface Gn between SGSN and EGANC-PS.

The mobility is based on the UMA Multi-access Client of the MS and the Proxy-Gn function of the E-GANC. The Proxy-Gn is the anchor of the PDP context.

The present invention proposes to have in the E-GANC an anchor of the PDP context in the control plane whatever the access type is, as illustrated in figure 12.

The E-GANC handles a logical PDP context per MS PDP context.

The logical PDP context has 3 terminations: 2 access and 1 network terminations:

- GPRS/UMTS access termination

It receives GTP control messages from the SGSN

- UMA access termination

It receives W-SM requests from the UPMAC layer of the MS.

- Network termination:

It is the termination towards the GGSN.

It owns the IP address allocated to the MS.

The new UMA Multi-Access Client (UPMAC) in the MS and the anchor of the PDP context in the E-GANC (Proxy-Gn) exchange some information by inserting them in the Protocol Configuration Options PCO Information Element IE of the signaling messages :

- on GPRS/UMTS side
  - SM messages (3GPP TS 24.008) between MS and SGSN
  - Gn messages (3GPP TS 29.060) betwwen SGSN and Proxy-Gn
- On Wifi (UMA) side
  - W-SM messages.

Information are carried in the PCO IE as new containers. New container identifiers are defined:

- GN_ADDR: contains the IP address of the Proxy-Gn anchoring the PDP context
- MOBILITY_INFO: contains the preferred or requested access mode on which to switch the traffic.

When a MS first activates a PDP context, the access node (SGSN / W-SM of the E-GANC) chooses a Proxy-Gn according to its own criteria.

The Proxy-Gn may delegate to an other Proxy-Gn the activation request for load reasons.

The Proxy-Gn that anchors the PDP context sets its IP address in a new specific container inside the Protocol Configuration Options field of the activation response: GN_ADDR.

The Protocol Configuration Options field is up-warded unchanged up to the MS, so the MS UMA Multi-access Client learns the IP address of the Proxy-Gn for this PDP context.

When activating the same PDP context on an other access type, the MS UMA Multi-access Client sets the IP address of the Proxy-Gn for this PDP context in the GN_ADDR container of the Protocol Configuration Options field of the activation request. This field is interpreted by the E-GANC in order to forward the request to the relevant Proxy-Gn.

An other container MOBILITY_INFO within the Protocol Configuration Options field is used for driving the mobility from one access to an other. This container can be sent either in the Activate PDP context or/and the Modify PDP context. That container contains the preferred or requested access.

Different PDP context related procedures and the signaling exchanged between the different entities involved in these procedures are now decribed in connection with figures 13 to 23.

PDP context activation on GPRS access (figure 13)

Intial conditions:

- It is the first time that the application requests the activation of a PDP context;

- The current radio in use is 2G/3G.

Steps of the procedure:

1) The current Radio Access in use is 2G (or 3G), the UMA Multi-access Client forwards the PDP context activation towards the SM layer.
   This PDP context has not yet been activated on any access, and so:
   - no GN_ADDR container is set in the Protocol Configuration Options field,
2) The SM layer of the MS requests a PDP context activation,
   Note: if the MS is not yet GPRS attached, it will be done by the GMM layer.
3) The SGSN has to forward the PDP context activation request as a Gn create PDP context request. The destination IP address of this request is found thanks to a DNS query on the APN. This APN has so to be specific for UMA MS with mobility. The SGSN retrieves a list of Proxy-Gn IP addresses.
4) The Proxy-Gn receives the PDP context creation request without GN_ADDR container within the PCO information. It resolves the APN to find out a GGSN IP address, and forwards the request to the GGSN:
   a. The IP address and TEID for GTP-C (signaling) are those of the Proxy-Gn;
   b. The IP address and TEID for GTP-U (user plane) are those provided by the SGSN.

5) The GGSN creates the PDP context and returns back the create PDP context response containing:

- the IP address allocated for the MS on this APN (if that field was empty in the request)
- a TEID and an IP address for control plan,
- a TEID and an IP address for user plan,
- eventually some Protocol Configuration Options,
- ...

The GGSN may now forward downlink traffic towards the SGSN.

6) The Proxy-Gn sends back the create PDP context response but:

- replaces the control TEID and IP address of the GGSN by its own control TEID and IP address,
- creates a Protocol Configuration Options field or appends to the existing Protocol Configuration Options field a GN_ADDR container set with Proxy-Gn IP address.

7) The SGSN sends back to the MS the activate PDP accept with the Protocol Configuration Options as received.

8) The SM layer of the MS receives the PDP activate response, and upwards to the UMA Multi-access Client of the MS a confirmation.

9) The UMA Multi-Access Client learns from the Protocol Configuration Options field the address of the Proxy-Gn that is the anchor for the MS in the PS domain.

<u>PDP context activation on Wifi /UMA access (figure 14)</u>

Intial conditions:

- The MS has successfully performed its UMA registration.
- It is the first time that the application requests the activation of a PDP context;
- The current radio in use is Wifi (UMA).

Steps of the procedure:

1) The Application requests the activation of a PDP context. The UMA Multi-access Client selects a GRE tunnel key for the user plane (downlink traffic), since there is no anchor for the MS, the PDP context activation is submitted to the E-GANC (W-SM layer) without GN_ADDR container (within PCO IE). The IP address of the W-

SM entity is the IP address that has been returned to the MS at the IPSec tunnel set-up time.

2) The W-SM performs the User Authorization for that APN (transaction with the AAA server on Wm interface). The W-SM selects a key for the GRE tunnel for the uplink traffic and a TEID (downlink) for the Gn side. Then it sends a create PDP context request to its local Proxy-Gn.

3) The Proxy-Gn receives the PDP context creation request without GN_ADDR container in the PCO IE, so it selects itself as the anchor point for all PDP contexts coming from that MS. It resolves the APN to find out a GGSN IP address, and forwards the request to the GGSN.

Note: if the Proxy-Gn runs out of resources, it may forward the request to another Proxy-Gn.

4) The GGSN creates the PDP context and returns back the create PDP context response containing:
   - the IP address allocated for the MS on this APN,
   - a TEID and an IP address for control plan,
   - a TEID and an IP address for user plan,
   - eventually some Protocol Configuration Options,
   - ...

5) The Proxy-Gn sends back the create PDP context response but:
   - replaces the control TEID and IP address of the GGSN by its own control TEID and IP address,
   - creates a Protocol Configuration Options field or appends to the existing Protocol Configuration Options field a GN_ADDR container set to its IP address.

6) The W-SM sends back to the MS the activate PDP context accept with the Protocol Configuration Options as received as well as its GRE tunnel key.

7) The UMA Multi-access Client of the MS learns from the Protocol Configuration Options of the response the IP address of the Proxy-Gn that anchors the MS in the PS domain.

Switching from GPRS access to Wifi/UMA access (figure 15)

Initial conditions:

- The MS has successfully performed its UMA registration.

- The current radio access is GPRS and the MS is going to move to Wifi.

Steps of the procedure:

1) . The MS formats a W-activate PDP request:
   - the Protocol Configuration Options field contains the GN_ADDR container set to the value of the IP address of the Proxy-Gn handling the PDP context.
   - the Protocol Configuration Options field contains the MOBILITY_INFO container indicating that Wifi should be used for user plane.
   - The GRE tunnel key is chosen by the UMA Multi-access Client and set in the request.

   The MS sends the request to the W-SM IP address that was previously given by the SGW when the IPSec tunnel has been set up.
2) The W-SM entity of the E-GANC receives the PDP context activation request, gets the IP address of the Proxy-Gn (GN_ADDR of PCO IE) and sends a PDP context create request toward this Proxy-Gn keeping the PCO IE unchanged.
3) The Proxy-Gn retrieves the PDP context (based on IMSI and NSAPI values). Since the MOBILITY_INFO container indicates that Wifi must be used for user plane, the Proxy-Gn updates the GGSN with the user plane IP address and TEID given by the W-SM.

Note : if the MOBILITY_INFO container is not present, the Proxy-Gn creates the UMA access termination (internal PDP context), but does not request an update PDP context towards the GGSN.

4) The GGSN updates the user plan with the new TEID and IP address and responds to the Proxy-Gn. The traffic now flows down on the Wifi side.
5) The Proxy-Gn sends back to the W-SM the GGSN IP address and TEID to use for uplink traffic as well as the Proxy-Gn IP address and TEID to use for control plane.
6) The W-SM returns back the W-activate PDP context response adding its GRE key for uplink traffic.
7) The UPMAC layer forwards user traffic (SN-SAP and SN-RAB) on the Wifi side by encapsulating these user frames in the GRE tunnel with the key provided by the EGANC.

Switching from Wifi/UMA access to GPRS access when PDP context present on Wifi/UMA side only (figure 16)

Initial conditions:

- The MS is under GPRS coverage.
- The current radio access is Wifi and the MS is going to move to GPRS.
- The PDP context has already been activated on UMA side but not on GPRS side.

Steps of the procedure:

1) The UMA Multi-Access Client of the MS requests PDP context activation to the SM layer:
   - the Protocol Configuration Options field contains the GN_ADDR container set to the value of the IP address of the Proxy-Gn handling the PDP context.
   - the Protocol Configuration Options field contains the MOBILITY_INFO container indicating that GPRS/UMTS should be used for user plane.
2) The SM layer of the MS sends to the SGSN a PDP context activation request with the received PCO.
3) The SGSN has to forward the PDP context activation request as a Gn create PDP context request. The destination IP address of this request is found thanks to a DNS query on the APN. This APN has so to be specific for UMA MS with mobility. The SGSN retrieves a list of Proxy-Gn IP addresses.
4) The Proxy-Gn chosen by the SGSN receives the PDP context activation request , gets the IP address of the Proxy-Gn (GN_ADDR of PCO IE) and sends a PDP context create request toward this Proxy-Gn keeping the PCO IE unchanged.
5) The Proxy-Gn previously chosen on Wifi side retrieves the PDP context (based on IMSI and NSAPI values). Since the MOBILITY_INFO container indicates that GPRS(UMTS) must be used for user plane, the Proxy-Gn updates the GGSN with the user plane IP address and TEID provided by the SGSN.
6) The GGSN updates the user plan with the new TEID and IP address and responds to the Proxy-Gn. The user traffic now flows down directly to the SGSN.

7) The Proxy-Gn returns back to the SGSN the GGSN IP address and TEID to use for uplink traffic as well as the Proxy-Gn IP address and TEID to use for control plane.
8) The SGSN sends back to the MS the PDP context activate response
9) The SM layer of the MS upwards to the UMA Multi-Access Client the activation success. Now the uplink user traffic is submitted by the UPMAC client to the SN-SAP (GPRS) or RAB-SAP (UMTS)

Switching from Wifi/UMA access to GPRS access when PDP context exists on both sides (figure 17)

Initial conditions:

- The MS is under GPRS coverage.
- The current radio access is Wifi and the MS is going to move to GPRS.
- The PDP context has already been activated on both sides.

Steps of the procedure:

1) The UMA Multi-access Client of the MS requests PDP context modification to the SM layer with a PCO IE only:
    - the Protocol Configuration Options field contains the GN_ADDR container set to the value of the IP address of the Proxy-Gn handling the PDP context.
    - the Protocol Configuration Options field contains the MOBILITY_INFO container indicating that GPRS/UMTS should be used for user plane.
2) The SM layer of the MS sends to the SGSN a PDP context modification request with the received PCO.
3) The SGSN sends an update PDP context request to the IP address that it has register to the GTP-C control plane (IP address of the Proxy-Gn).
4) The Proxy- retrieves the PDP context (based on TEID). Since the MOBILITY_INFO container indicates that GPRS(UMTS) must be used for user plane, the Proxy-Gn updates the GGSN with the user plane IP address and TEID provided by the SGSN.

    Note : some other information may be changed, see 29.060 for details.
5) The GGSN updates the user plan with the new TEID and IP address and responds to the Proxy-Gn. The user traffic now flows down directly to the SGSN.

6) The Proxy-Gn returns back to the SGSN the GGSN IP address and TEID to use for uplink traffic as well as the Proxy-Gn IP address and TEID to use for control plane.

Note : the information related to the user plane are those of the GGSN if it provides new ones. For the control plane, the information are still the information related to the Proxy-Gn.

7) The SGSN sends back to the MS the modify PDP context response
8) The SM layer of the MS upwards to the UMA Multi-Access Client the modify PDP context confirmation. Now the uplink user traffic is submitted by the UPMAC client to the SN-SAP (GPRS) or RAB-SAP (UMTS)

PDP context teardown

The PDP context can be teardown by

1) The MS:

When the communication is terminated, the UPMAC of the MS has to teardown the PDP context on any access where it has been activated.

2) The SGW:

When the IPSec tunnel of the MS is teardown, the W-SM of the E-GANC has to teardown all the PDP contexts that were activated on Wifi side for this MS.

3) The SGSN:

On error detection the SGSN may request a teardown of all or some of the PDP contexts previously activated for a MS.

When a PDP context is deactivated on both sides, the Proxy-Gn do not immediately request a PDP deletion to the GGSN but starts a timer waiting for MS reconnection. This gives some time to the MS in order to re-connect on the same APN in case it quickly recover radio access. The MS must try to reconnect its PDP context setting in the Protocol Configuration Options of its requests the IP address of the Proxy-Gn as defined in paragraphs Switching from one access to another.

If the timer expires on the Proxy-Gn without any PDP reconnection, the Proxy-Gn request a PDP context deletion to the GGSN and frees all resources allocated for this PDP context.

De-activation on GPRS side – Wifi/UMA access is set up and active (figure 18)

1) The SGSN sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS, or by fault detection from the SGSN for this MS.
2) The Proxy-Gn deletes the UMTS/GPRS termination of the PDP context and responds to the SGSN.

<u>De-activation on GPRS side – Wifi/UMA access is set up and standby (figure 19)</u>

1) The SGSN sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS, or by fault detection from the SGSN for this MS
2) The Proxy-Gn deletes the UMTS/GPRS termination of the PDP context and responds to the SGSN. Since the Wifi path is set up, it updates the GGSN with the user plan IP address and TEID of the SGW. The downlink traffic now flows on Wifi side.

<u>De-activation on GPRS side - Wifi/UMA access is not set up (figure 20)</u>

1) The SGSN sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS, or by fault detection from the SGSN for this MS
2) The Proxy-Gn deletes the UMTS/GPRS termination of the PDP context and responds to the SGSN. The Proxy-Gn starts a timer waiting for a re-connection of this PDP context.
3) The Proxy-Gn timer expires for this PDP context and no reconnection has occurred. The Proxy-Gn deletes the PDP context on the GGSN and frees all its associated resources.

<u>De-activation on Wifi/UMA side - GPRS access is set up and active (figure 21)</u>

1) The W-SM sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS UPMAC, or by an IPSec tunnel teardown for this MS.
2) The Proxy-Gn deletes the UMA termination of the PDP context and responds to the W-SM.

<u>De-activation on Wifi/UMA side - GPRS access is set up and standby (figure 22)</u>

1) The W-SM sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS UPMAC, or by an IPSec tunnel teardown for this MS
2) The Proxy-Gn deletes the UMA termination of the PDP context and responds to the SGW. Since the GPRS path is set up, it updates the GGSN with the user plan IP address and TEID of the SGSN. The downlink traffic flows on GPRS side.

<u>De-activation on Wifi/UMA side - GPRS access is not set up (figure 23)</u>

1) The SGW sends a Delete PDP context request to the Proxy-Gn. This request is either triggered by a PDP context deactivation request sent from the MS, or by an IPSec tunnel teardown for this MS.
2) The Proxy-Gn deletes the UMA termination of the PDP context and responds to the SGW. The Proxy-Gn starts a timer waiting for a re-connection of this PDP context.
3) The Proxy-Gn timer expires for this PDP context and no reconnection has occurred. The Proxy-Gn deletes the PDP context on the GGSN and frees all its associated resources.

Compared to the inter-system mobility solution, the present invention in particular has the following advantages:

- Easier to implement
- No need to handle on Wifi/UMA side UTRAN/GERAN notion such as TLLI, RAI,...
- No change required in Wifi/UMA access points not to loose traffic

Compared to the MIP solution, the present invention in particular has the following advantages:

- No need to update GGSN with FA feature
- No need to deploy HA in the accessed IP network
- Do not prevent MIP can still be used above UPMAC layer if needed by application.

CLAIMS

1. A Proxy-Gn entity for mobility between UMA access and GPRS/UMTS access, said Proxy-Gn entity anchoring a PDP context for a Mobile Station MS whatever the access type UMA or GPRS/UMTS for this MS, said anchored PDP context having three terminations, two access terminations and one network termination:

- GPRS/UMTS access termination, which receives GTP control messages from a SGSN,
- UMA access termination, which receives Session Management requests from the MS,
- Network termination, which is the termination towards a GGSN, and which owns the IP address allocated to the MS.

2. A Proxy-Gn entity for mobility between UMA access and GPRS/UMTS access, said Proxy-Gn entity anchoring a PDP context for a Mobile Station MS whatever the access type UMA or GPRS/UMTS for this MS, said Proxy-Gn entity exchanging information with the MS, by inserting said information in containers in the Protocol Configuration Options PCO Information Element IE of signalling messages.

3. A Proxy-Gn entity according to claim 2, wherein said signalling messages include:

- on GPRS/UMTS access:
    - o Session Management SM messages between MS and SGSN,
    - o GTP-c messages between SGSN and Proxy-Gn,
- on UMA access:
    - o Session Management (W-SM) messages between MS and a Session Management entity (W-SM) in a serving Generic Access Network Controller (E-GANC).

4. A Proxy-Gn entity according to claim 2 or 3, wherein said containers include a GN_ADDR container containing the IP address of the Proxy-Gn entity anchoring the PDP context.

5. A Proxy-Gn entity according to claim 4, configured to set its IP address in the GN_ADDR container of the PCO IE of the PDP Context Activation Response when the MS first activates a PDP context.

6. A Proxy-Gn entity according to claim 4, configured to select itself as an anchor point for all PDP context requests received from the MS, when said Proxy-Gn entity receives a first PDP Context Creation request for this MS without a GN_ADDR container in the PCO IE.

7. A Proxy-Gn entity according to any of claims 1 to 6, said Proxy-Gn entity being configured such that, for a PDP context activation on GPRS/UMTS access:

- said Proxy-Gn entity receiving from a SGSN a PDP context creation request without a GN_ADDR container within the PCO IE, it selects itself as the anchor point for all PDP contexts coming from the MS, and forwards the request to a GGSN where :

- the IP address and TEID for GTP-C are those of the Proxy-Gn entity,
- the IP address and TEID for GTP-U are those provided by the SGSN,

- said Proxy-Gn entity sends back to said SGSN a create PDP context response:

  - said Proxy-Gn entity replacing the control TEID and IP address of the GGSN by its own control TEID and IP address,
  - said Proxy-Gn entity creating a PCO IE or appending to the existing PCO IE a GN_ADDR container set with the Proxy-Gn entity IP address.

8. A Proxy-Gn entity according to any of claims 1 to 6, said Proxy-Gn entity being configured such that, for a PDP context activation on UMA access:

- said Proxy-Gn entity receiving from a W-SM entity of a serving Generic Access Controller (E-GANC) a PDP context creation request without a GN_ADDR container in the PCO IE, it selects itself as the anchor point for all PDP contexts coming from the MS, and forwards the request to a GGSN,

- said Proxy-Gn entity sends back to said W-SM entity a create PDP context response:

- said Proxy-Gn entity replacing the control TEID and IP address of the GGSN by its own control TEID and IP address,
- said Proxy-Gn entity creating a PCO IE or appending to the existing PCO IE a GN_ADDR container set to its IP address.

9. A Proxy-Gn entity according to any of claims 1 to 6, said Proxy-Gn entity being configured such that, for switching from GPRS/UMTS access to UMA access:

- said Proxy-Gn entity anchoring the PDP context retrieves the PDP context based on IMSI and NSAPI values,

- said Proxy-Gn entity updates the GGSN with the user plane IP address and TEID given by the W-SM entity,

- said Proxy-Gn entity sends back to the W-SM entity the GGSN IP address and TEID to use for uplink traffic as well as the Proxy-Gn IP address and TEID to use for control plane.

10. A Proxy-Gn entity according to any of claims 1 to 6, said Proxy-Gn entity corresponding to a Proxy-Gn entity chosen by a SGSN for switching from UMA access to GPRS/UMTS access, and being configured such that:

- said Proxy-Gn entity receiving a PDP context activation request from said SGSN, gets the IP address of the Proxy-Gn previously chosen on UMA access from the GN_ADDR container of the PCO IE of said request, and sends a PDP context create request towards this Proxy-Gn keeping the PCO IE unchanged.

11. A Proxy-Gn entity according to any of claims 1 to 6, said Proxy-Gn entity corresponding to a Proxy-Gn entity previously chosen on UMA access, for switching from UMA access to GPRS/UMTS access, and being configured such that:

- said Proxy-Gn entity receiving a PDP context create request from a Proxy-Gn entity chosen by a SGSN, retrieves the anchored PDP context, based on IMSI and NSAPI values,

- said Proxy-Gn entity updates the GGSN with the user plane IP address and TEID provided by a SGSN,

- said Proxy-Gn returns back to said SGSN the GGSN IP address and TEID to use for uplink traffic as well as the Proxy-Gn IP address and TEID to use for control plane.

12. A Generic Access Network Controller (E-GANC), comprising a Proxy-Gn entity according to any of claims 1 to 11.

13. A Generic Access Network Controller (E-GANC) comprising a Session Management entity W-SM, said W-SM entity being configured such that, on UMA access:

- on reception of a PDP context activation submitted by a Mobile Station MS to said W-SM entity without a GN_ADDR container within PCO IE containing the IP address of a Proxy-Gn entity anchoring the PDP context for the MS, said W-SM entity performs User Authorization for the APN,

- said W-SM entity selects a key for a GRE tunnel for the uplink traffic between MS and W-SM entity, and a TEID for downlink traffic for the Gn interface side of the W-SM entity, and sends a create PDP context request to its local Proxy-Gn entity.

14. A Generic Access Network Controller (E-GANC) comprising a Session Management entity W-SM, said W-SM entity being configured such that, for switching from GPRS/UMTS access to UMA access:

- said W-SM entity receives from a Mobile Station MS a PDP context activation request, gets the IP address of the Proxy-Gn anchoring the PDP context from the GN_ADDR container of PCO IE, and sends a PDP context create request towards this Proxy-Gn keeping the PCO IE unchanged,

- said W-SM entity returns back to the MS a W-activate PDP context response adding its GRE key for uplink traffic.

15. A Mobile Station MS, comprising a UMA Multi-Access Client introduced between its Application layer and Non Access Stratum layer, such that:

- the Service Access Points SAPs between the Application layer and the UMA Multi-Access Client correspond to the SAPs SMREG-SAP, and SN-SAP(xn) for GPRS or RAB1-SAP...RABn-SAP for UMTS, of GPRS/UMTS MS protocol architecture,

- the Service Access Points SAPs between the UMA Multi-Access Client and the SM and SNDCP layers correspond to the SAPs SMREG-SAP, and SN-SAP(xn) for GPRS or RAB1-SAP...RABn-SAP for UMTS, of GPRS/UMTS MS protocol architecture,

- a Service Access Point WSMREG-SAP is introduced, for Control Plane, between the UMA Multi-Access Client and a UDP layer introduced above the Unlicensed Access, IP transport, and IPSec layers of UMA MS protocol architecture,

- a Service Access Point WRAB-SAP is introduced, for User Plane, between the UMA Multi-Access Client and a GRE layer introduced above the Unlicensed Access, IP transport, and IPSec layers of UMA MS protocol architecture.

16. A Mobile Station MS, comprising a UMA Multi Access Client introduced above its Non Access Stratum layer, said UMA Multi Access Client exchanging information with a Proxy-Gn entity anchoring a PDP context for the MS whatever the access type UMA or GPRS/UMTS for this MS, by inserting said information in

containers in the Protocol Configuration Options PCO Information Element IE of signalling messages.

17. A Mobile Station according to claim 14, wherein said messages include:

- on GPRS/UMTS access:
    - o Session Management SM messages between MS and SGSN,
    - o GTP-c messages between SGSN and Proxy-Gn
- on UMA access:
    - o Session Management W-SM messages between MS and a Session Management entity W-SM in a serving Generic Access Network Controller (E-GANC).

18. A Mobile Station according to claim 16 or 17, wherein said containers include a GN_ADDR container containing the IP address of the Proxy-Gn entity anchoring the PDP context.

19. A Mobile Station according to claim 18, configured such that :

- the UMA Multi Access Client learns the IP address of the Proxy-Gn entity anchoring a PDP context for the MS, in the GN_ADDR container of the PCO IE of a PDP Context Activation Response when the MS first activates a PDP context,

- the UMA Multi Access Client sets this IP address in the GN_ADDR container of the PCO IE of a PDP Context Activation Request when the MS activates the same PDP context on another access type.

20. A Mobile Station according to any of claims 15 to 19, said Mobile Station being configured such that, on GPRS/UMTS access:

- on request from the Application, the UMA Multi-Access Client forwards a PDP context activation request towards the SM layer, with no GN_ADDR container set in the Protocol Configuration Options field,

- the SM layer receiving a PDP activate response, upwards a confirmation to the UMA Multi-Access Client,

- the UMA Multi-Access Client learns from the PCO field the address of the Proxy-Gn entity that is the anchor for the MS in the PS domain.

21. A Mobile Station according to any of claims 15 to 19, said Mobile Station being configured such that, on UMA access:

- the Application layer requests the activation of a PDP context,

- the UMA Multi-Access Client selects a GRE tunnel key for the user plane downlink traffic, the PDP context activation is submitted to the W-SM entity of the serving E-GANC without GN_ADDR container within PCO IE, the IP address of the W-SM entity being the IP address that has been returned to the MS at IPSec tunnel set-up time,

- the UMA Multi-Access Client of the MS learns from the PCO of the response sent back to the MS by the W-SM entity, the IP address of the Proxy-Gn entity that anchors the MS in the PS domain.

22. A Mobile Station according to any of claims 15 to 19, said Mobile Station being configured such that, for switching from GPRS/UMTS access to UMA access:

- the UMA Multi-Access Client formats a W-activate PDP context request containing:

- a PCO field containing the GN_ADDR container set to the value of the IP address of the Proxy-Gn entity handling the PDP context,
- a GRE tunnel key chosen by the UMA Multi-access Client,

- the MS sends the request to the W-SM entity IP address that was previously given by a Security Gateway when a IPSec tunnel has been set up,

-the MS receives a W-activate PDP context response returned back by the W-SM entity,

- the UMA Multi-Access Client forwards user traffic on UMA access by encapsulating user frames in a GRE tunnel with the key provided by the Generic Access Network Controller (E-GANC).

23. A Mobile Station, according to any of claims 15 to 19, said Mobile Station being configured such that, for switching from UMA access to GPRS/UMTS access:

- the UMA Multi-Access Client of the MS requests PDP context activation to the SM layer:

- the PCO field contains the GN_ADDR container set to the value of the IP address of the Proxy-Gn entity handling the PDP context,

- the MS receives a PDP context activate response sent back by a SGSN,

- the SM layer upwards to the UMA Multi-Access Client the activation success,

- the uplink user traffic is submitted by the UMA Multi-Access Client to the SN-SAP for GPRS or RAB-SAPs for UMTS.

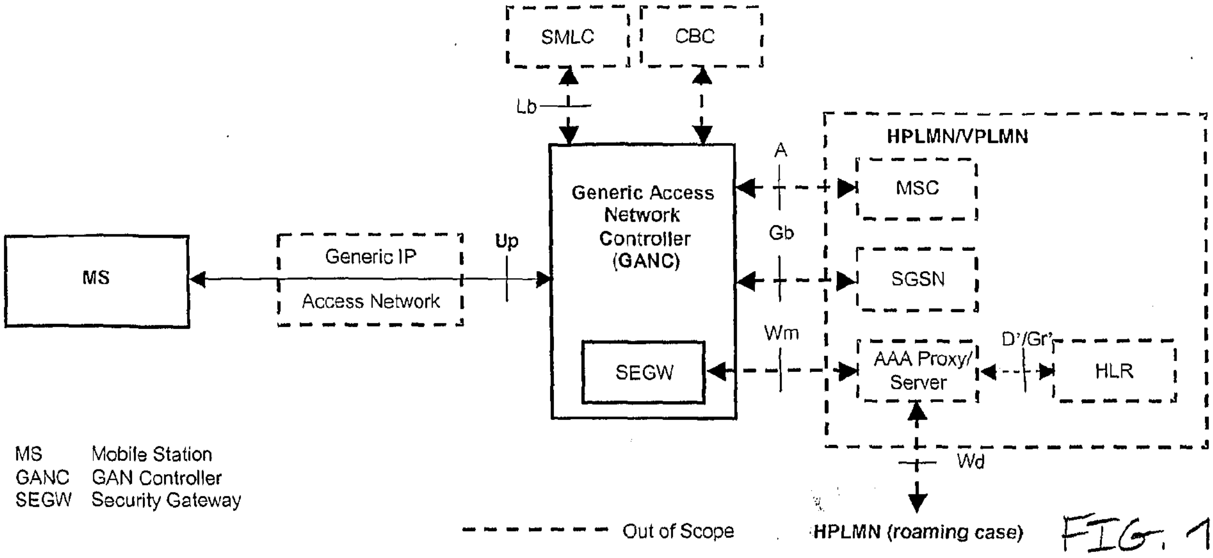

FIG. 1

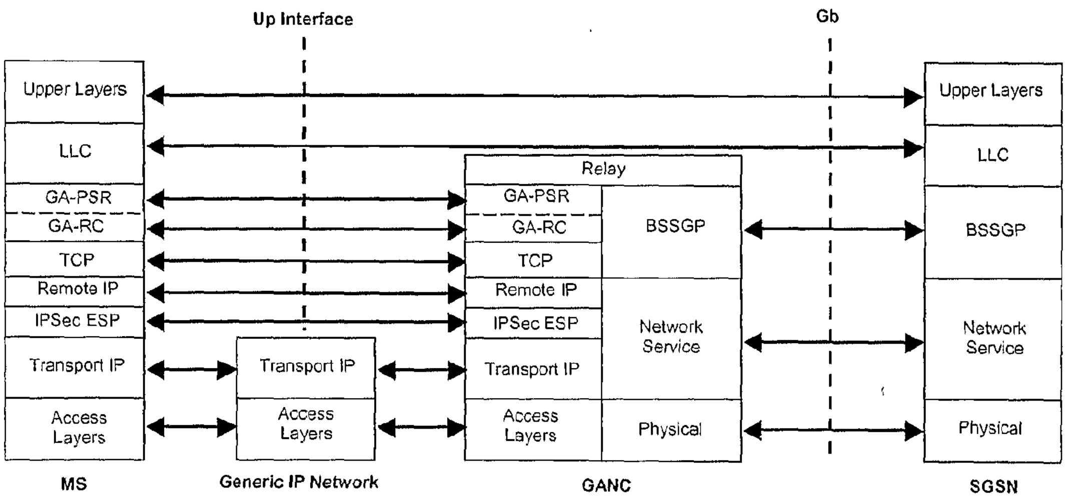

FIG. 2

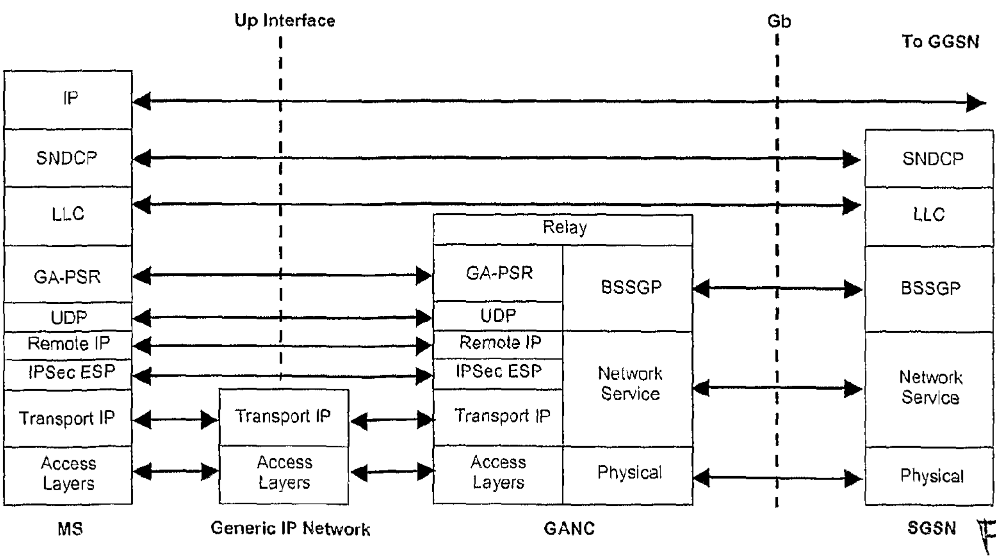

FIG. 3

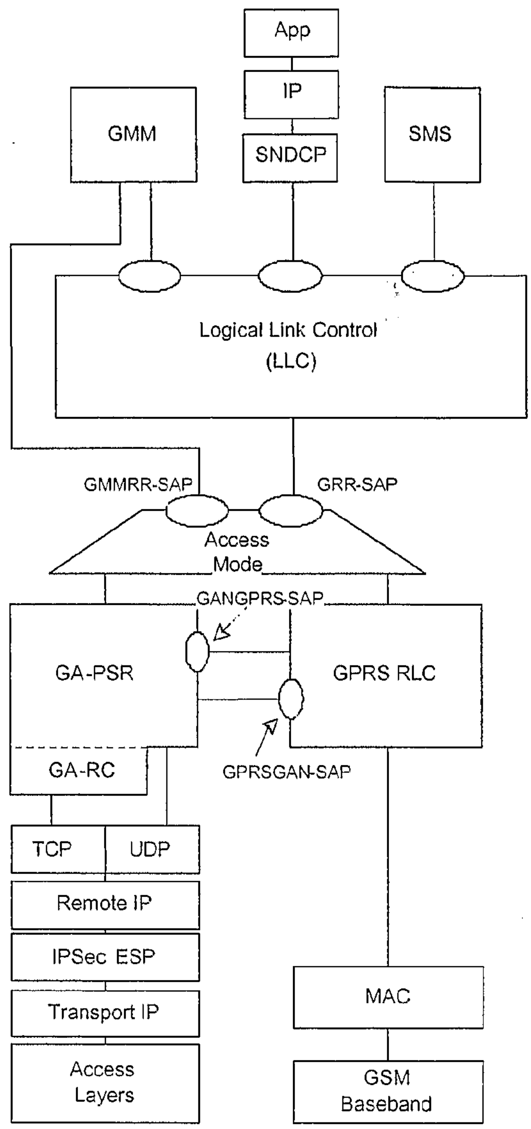
App
IP
SNDCP
GMM
SMS
Logical Link Control
(LLC)
GMMRR-SAP
GRR-SAP
Access
Mode
GANGPRS-SAP
GA-PSR
GPRS RLC
GA-RC
GPRSGAN-SAP
TCP
UDP
Remote IP
IPSec ESP
Transport IP
Access
Layers
MAC
GSM
Baseband

FIG. 4

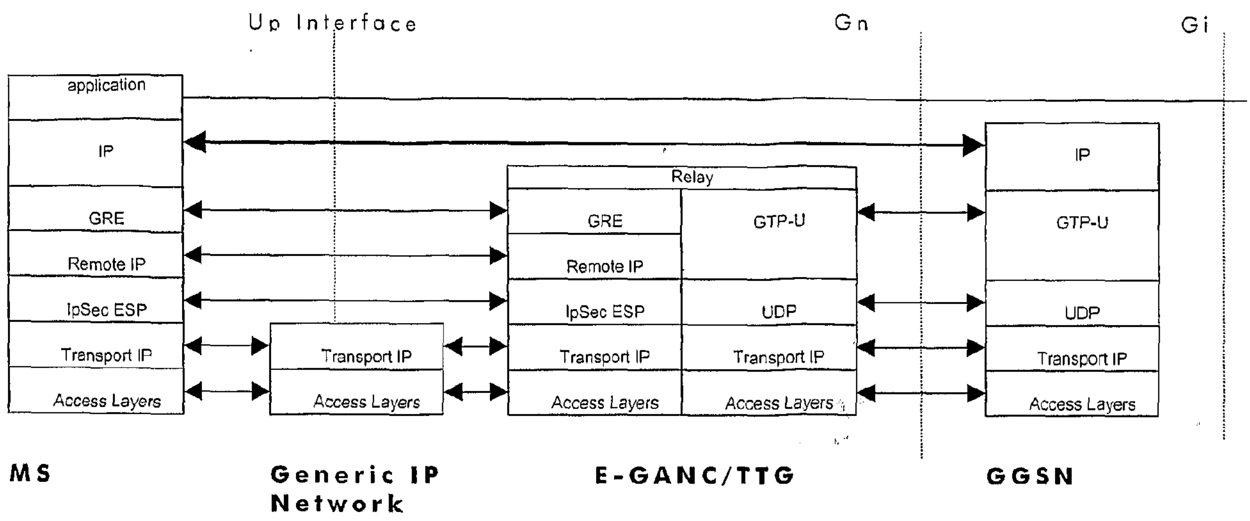
Up Interface
Gn
Gi
application
IP
GRE
Remote IP
IpSec ESP
Transport IP
Access Layers
Transport IP
Access Layers
Relay
GRE
GTP-U
Remote IP
IpSec ESP
UDP
Transport IP
Transport IP
Access Layers
Access Layers
IP
GTP-U
UDP
Transport IP
Access Layers
MS
Generic IP Network
E-GANC/TTG
GGSN

FIG. 5

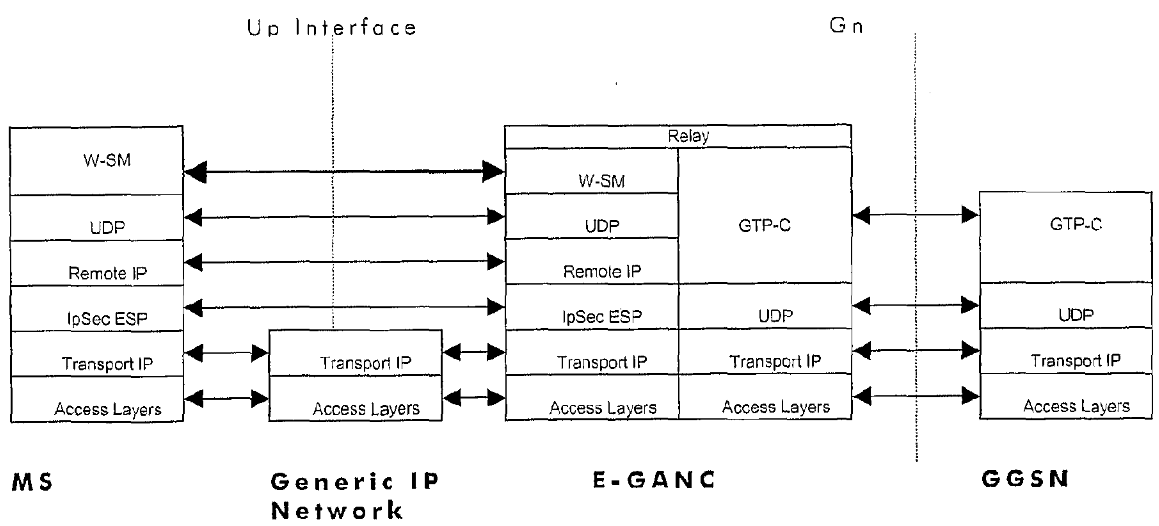
Up Interface
Gn
W-SM
UDP
Remote IP
IpSec ESP
Transport IP
Access Layers
Transport IP
Access Layers
Relay
W-SM
UDP
GTP-C
Remote IP
IpSec ESP
UDP
Transport IP
Transport IP
Access Layers
Access Layers
GTP-C
UDP
Transport IP
Access Layers
MS
Generic IP Network
E-GANC
GGSN

FIG. 6

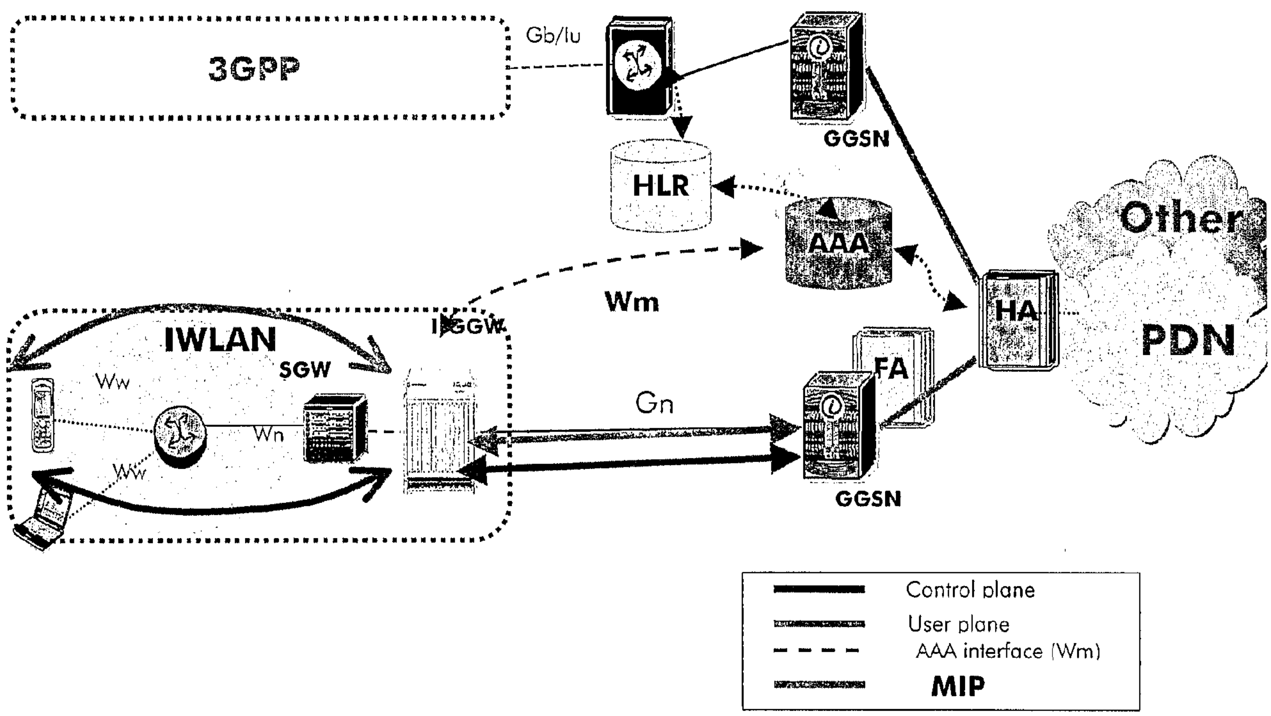
3GPP
Gb/Iu
GGSN
HLR
AAA
Other
PDN
HA
Wm
IWLAN
SGW
Ww
Wn
Ww
Gn
FA
GGSN
Control plane
User plane
AAA interface (Wm)
MIP

FIG. 7

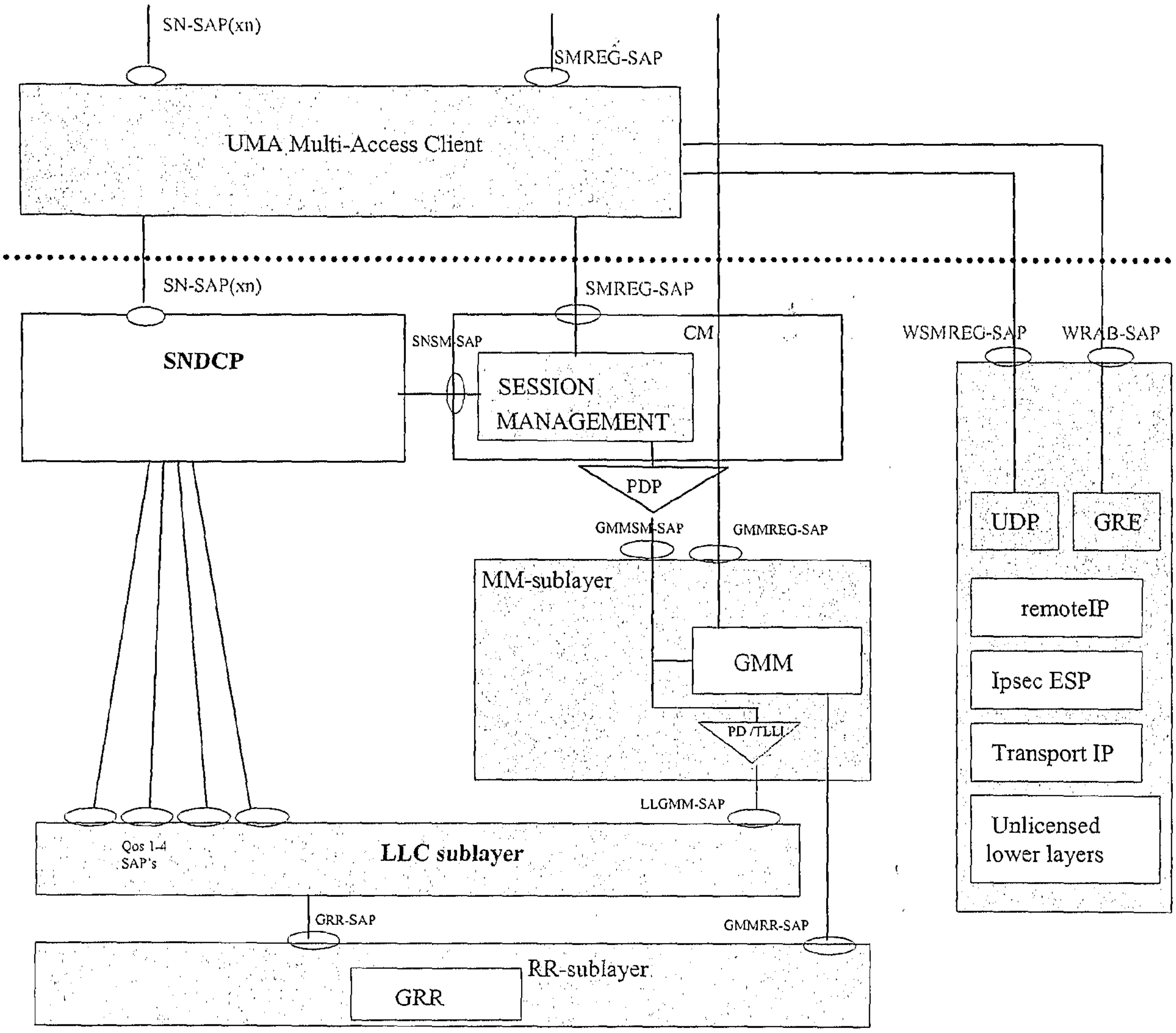
SN-SAP(xn)
SMREG-SAP
UMA Multi-Access Client
SN-SAP(xn)
SMREG-SAP
SNDCP
SNSM-SAP
CM
SESSION
MANAGEMENT
WSMREG-SAP
WRAB-SAP
PDP
UDP
GRE
GMMSM-SAP
GMMREG-SAP
MM-sublayer
remoteIP
GMM
Ipsec ESP
PD /TLLI
Transport IP
LLGMM-SAP
Unlicensed
lower layers
Qos 1-4
SAP's
LLC sublayer
GRR-SAP
GMMRR-SAP
RR-sublayer
GRR

FIG. 8

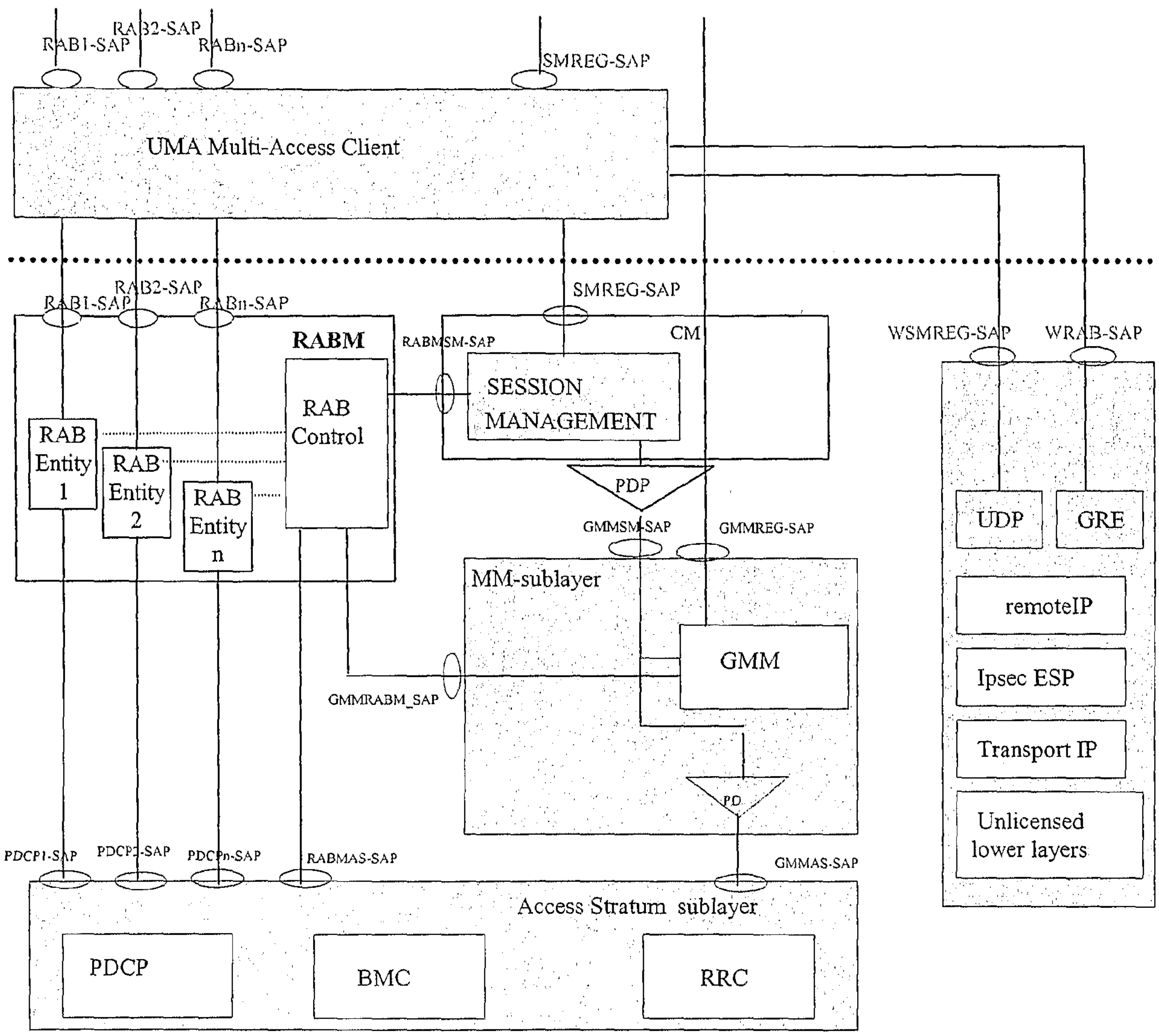
RAB1-SAP
RAB2-SAP
RABn-SAP
SMREG-SAP
UMA Multi-Access Client
RAB1-SAP
RAB2-SAP
RABn-SAP
SMREG-SAP
RABM
RABMSM-SAP
CM
WSMREG-SAP
WRAB-SAP
RAB Control
SESSION MANAGEMENT
RAB Entity 1
RAB Entity 2
RAB Entity n
PDP
GMMSM-SAP
GMMREG-SAP
UDP
GRE
MM-sublayer
remoteIP
GMM
Ipsec ESP
GMMRABM_SAP
Transport IP
PD
Unlicensed lower layers
PDCP1-SAP
PDCP2-SAP
PDCPn-SAP
RABMAS-SAP
GMMAS-SAP
Access Stratum sublayer
PDCP
BMC
RRC

FIG. 9

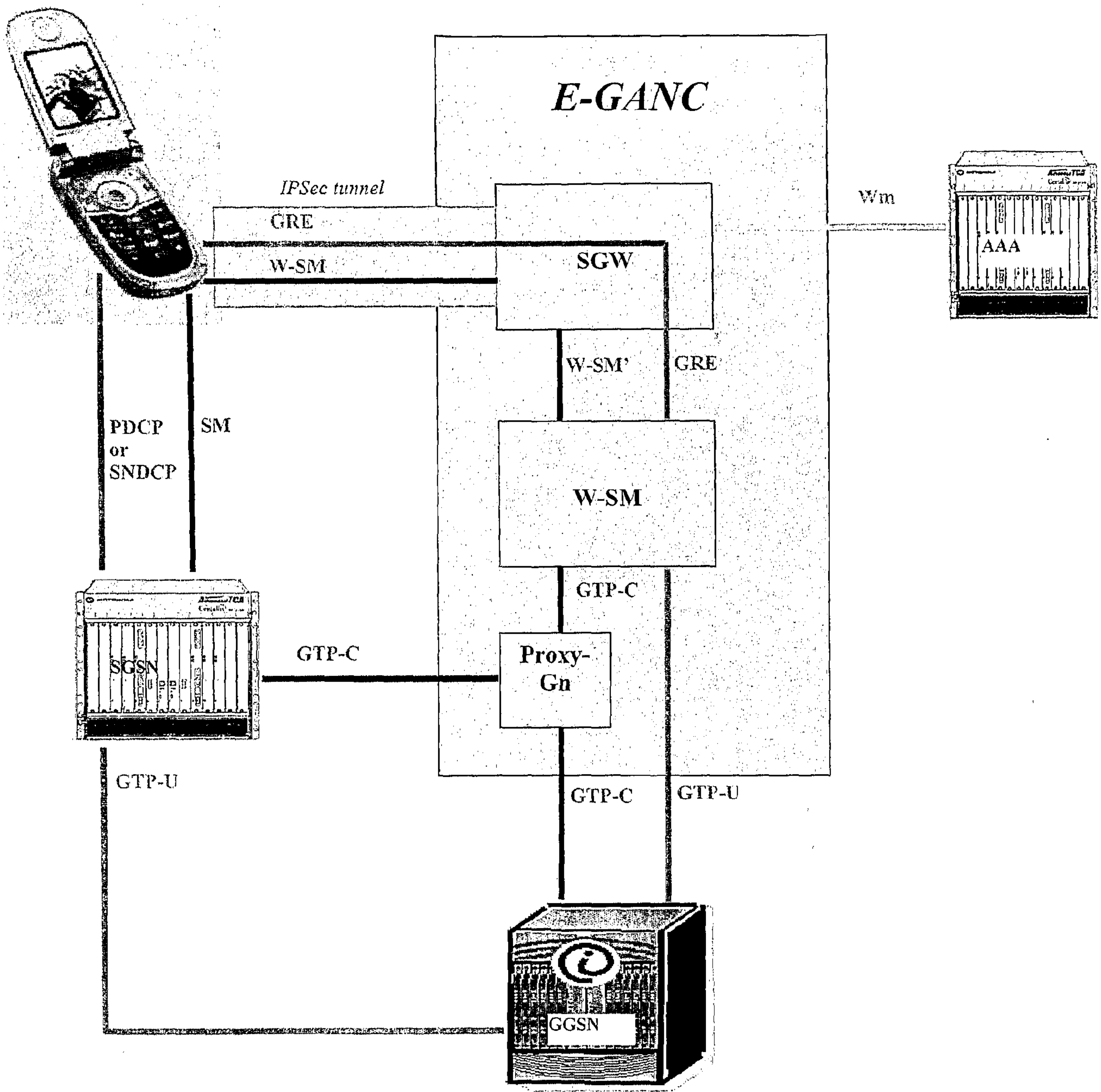
E-GANC
IPSec tunnel
GRE
W-SM
SGW
Wm
AAA
W-SM'
GRE
PDCP
or
SNDCP
SM
W-SM
GTP-C
SGSN
GTP-C
Proxy-
Gn
GTP-U
GTP-C
GTP-U
GGSN

FIG. 10

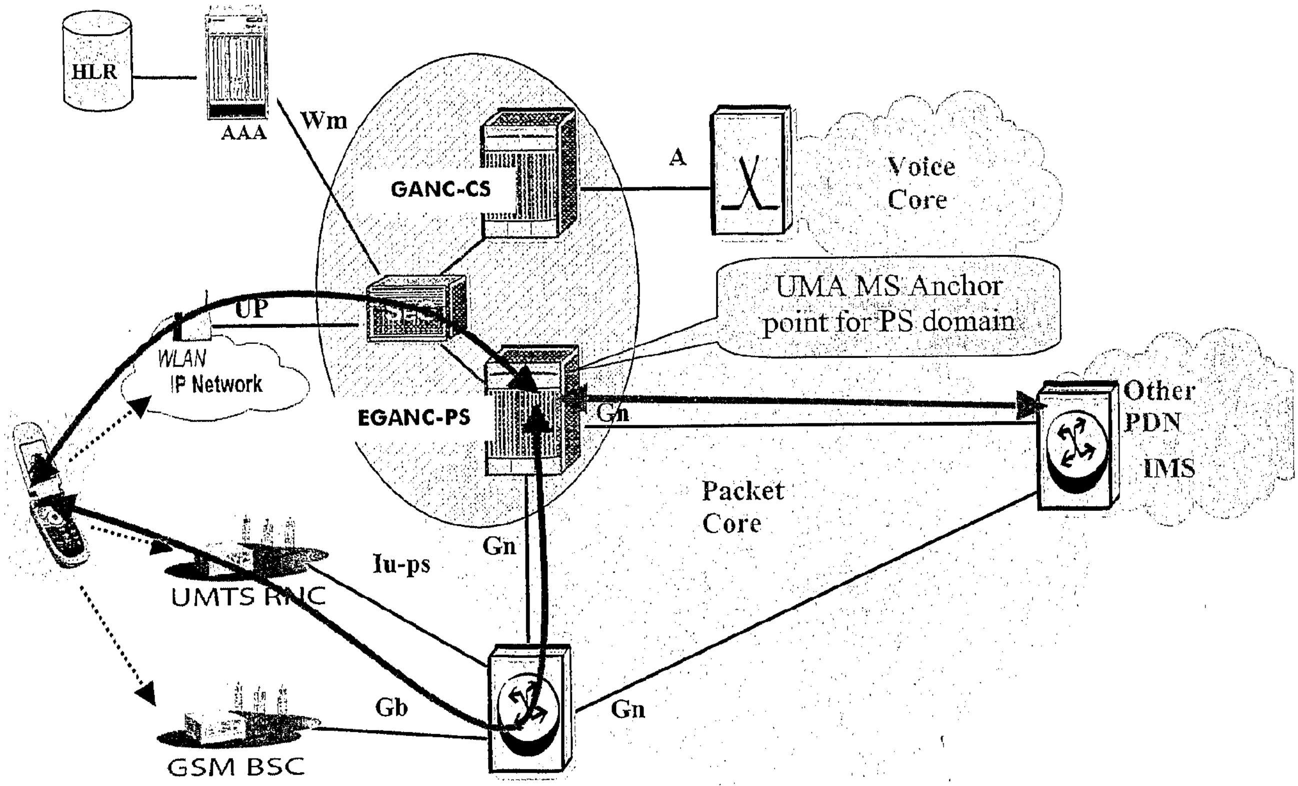
HLR
AAA
Wm
GANC-CS
A
Voice
Core
UMA MS Anchor
point for PS domain
UP
WLAN
IP Network
EGANC-PS
Gn
Other
PDN
IMS
Packet
Core
Gn
Iu-ps
UMTS RNC
Gb
Gn
GSM BSC

FIG. 11

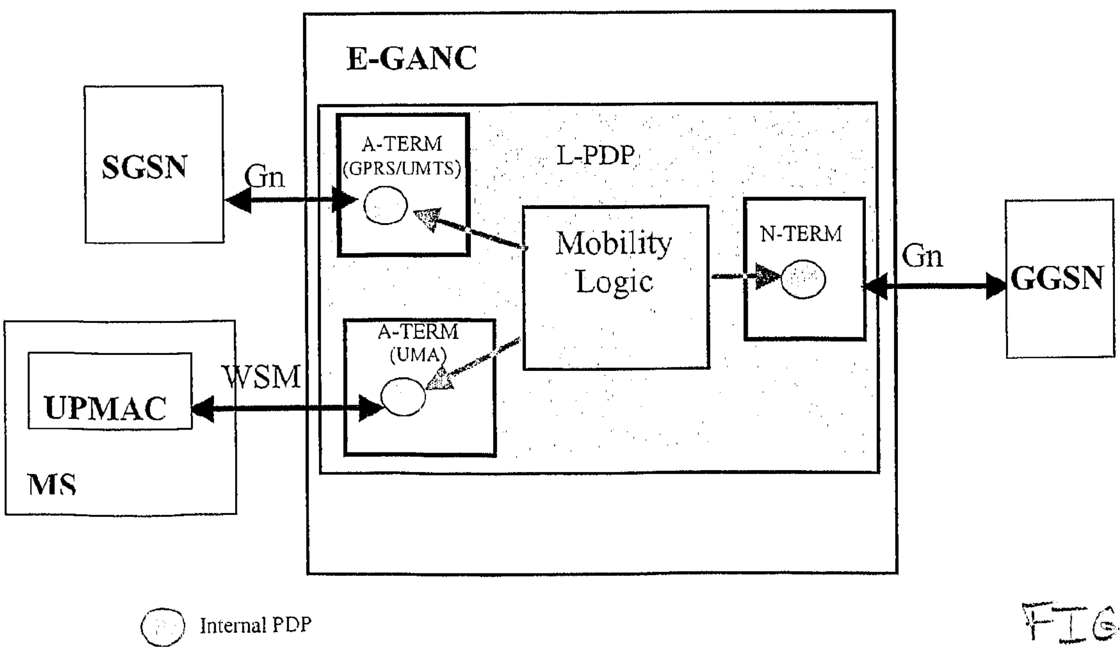
E-GANC
SGSN
Gn
A-TERM
(GPRS/UMTS)
L-PDP
Mobility
Logic
N-TERM
Gn
GGSN
UPMAC
WSM
A-TERM
(UMA)
MS
Internal PDP

FIG. 12

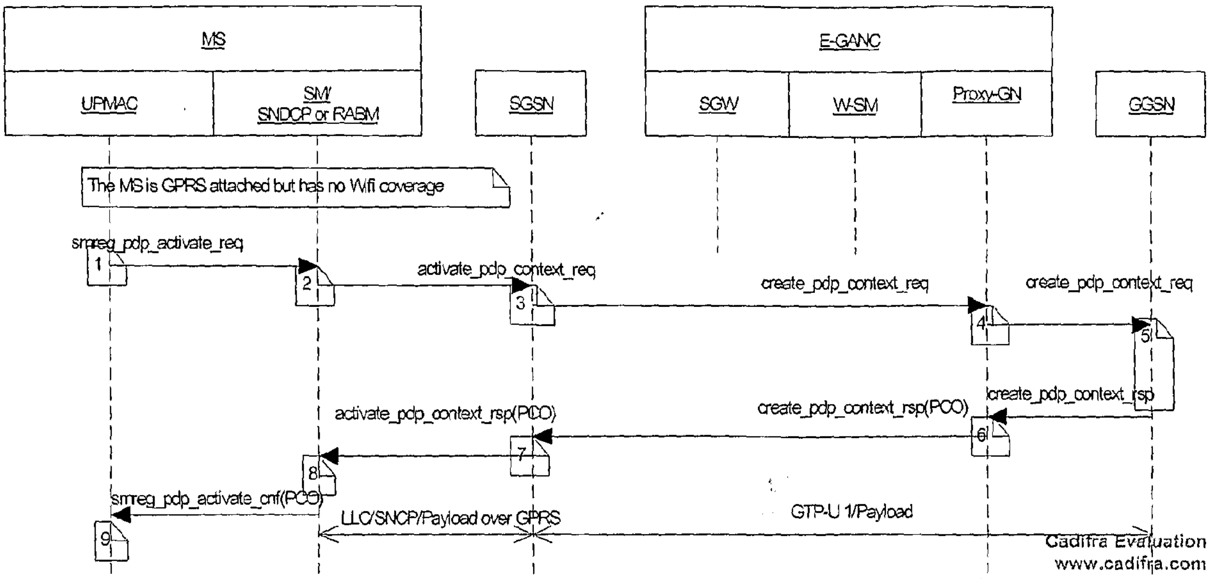
MS
UPMAC
SM/
SNDCP or RABM
SGSN
E-GANC
SGW
W-SM
Proxy-GN
GGSN
The MS is GPRS attached but has no Wifi coverage
smreg_pdp_activate_req
activate_pdp_context_req
create_pdp_context_req
create_pdp_context_req
create_pdp_context_rsp
activate_pdp_context_rsp(PCO)
create_pdp_context_rsp(PCO)
smreg_pdp_activate_cnf(PCO)
LLC/SNCP/Payload over GPRS
GTP-U 1/Payload
Cadifra Evaluation
www.cadifra.com

FIG. 13

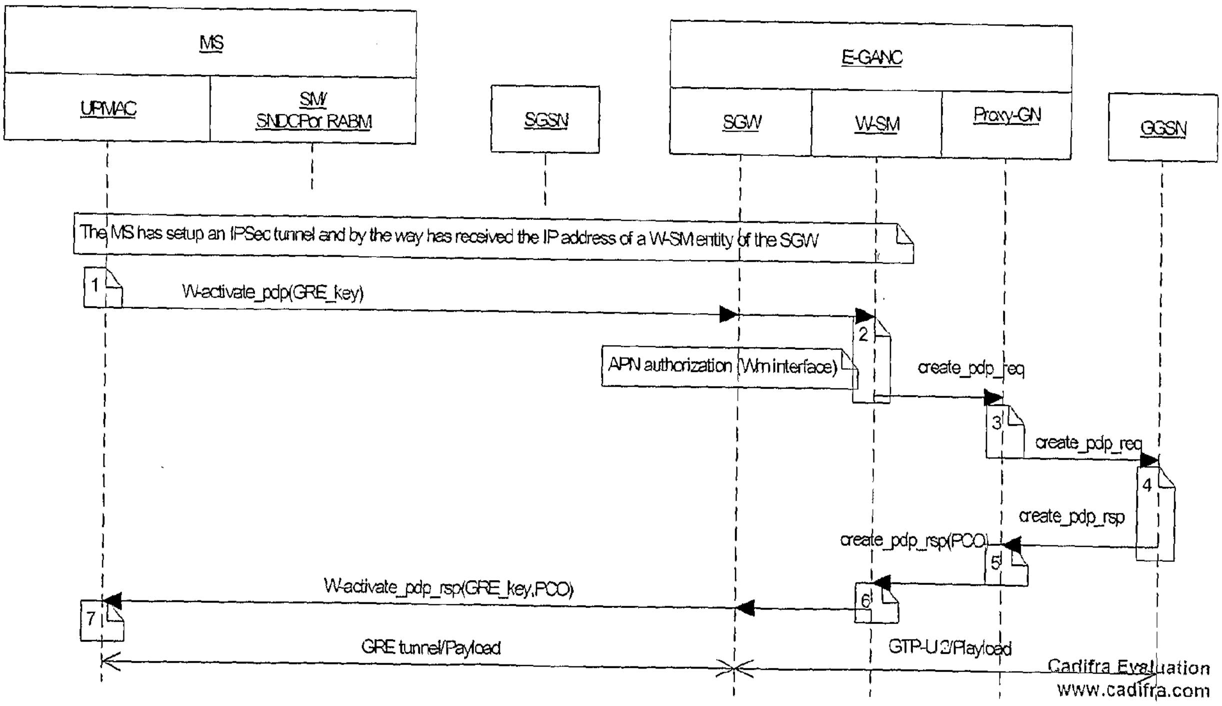
MS
UPMAC
SM/
SNDCPor RABM
SGSN
E-GANC
SGW
W-SM
Proxy-GN
GGSN
The MS has setup an IPSec tunnel and by the way has received the IP address of a W-SM entity of the SGW
W-activate_pdp(GRE_key)
APN authorization (Wm interface)
create_pdp_req
create_pdp_req
create_pdp_rsp
create_pdp_rsp(PCO)
W-activate_pdp_rsp(GRE_key,PCO)
GRE tunnel/Payload
GTP-U 2/Payload
Cadifra Evaluation
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FIG. 14

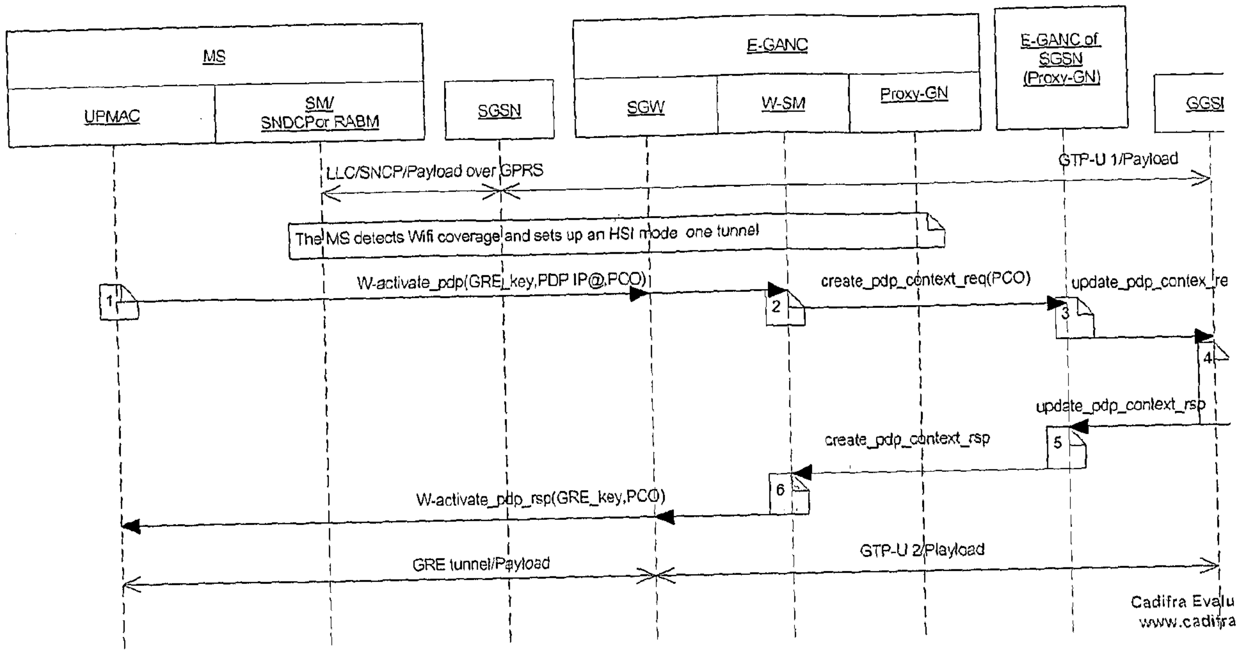
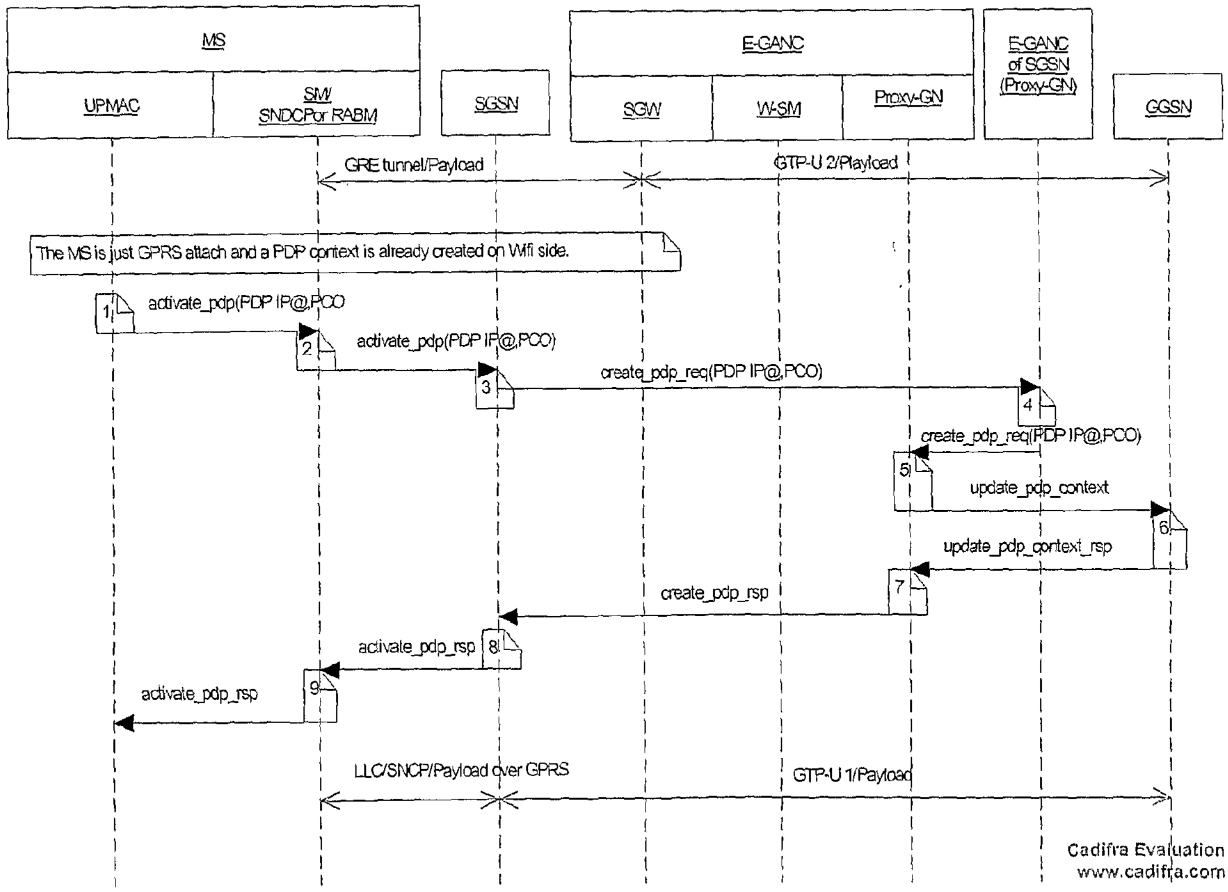

MS
UPMAC
SM/
SNDCPor RABM
SGSN
E-GANC
SGW
W-SM
Proxy-GN
E-GANC of SGSN (Proxy-GN)
GGSI
LLC/SNCP/Payload over GPRS
GTP-U 1/Payload
The MS detects Wifi coverage and sets up an HSI mode one tunnel
W-activate_pdp(GRE_key,PDP IP@,PCO)
create_pdp_context_req(PCO)
update_pdp_contex_re
update_pdp_context_rsp
create_pdp_context_rsp
W-activate_pdp_rsp(GRE_key,PCO)
GTP-U 2/Playload
GRE tunnel/Payload
Cadifra Evalu
www.cadifra

FIG. 15


MS
UPMAC
SM/
SNDCPor RABM
SGSN
E-GANC
SGW
W-SM
Proxy-GN
E-GANC of SGSN (Proxy-GN)
GGSN
GRE tunnel/Payload
GTP-U 2/Playload
The MS is just GPRS attach and a PDP context is already created on Wifi side.
activate_pdp(PDP IP@,PCO
activate_pdp(PDP IP@,PCO)
create_pdp_req(PDP IP@,PCO)
create_pdp_req(PDP IP@,PCO)
update_pdp_context
update_pdp_context_rsp
create_pdp_rsp
activate_pdp_rsp
activate_pdp_rsp
LLC/SNCP/Payload over GPRS
GTP-U 1/Payload
Cadifra Evaluation
www.cadifra.com

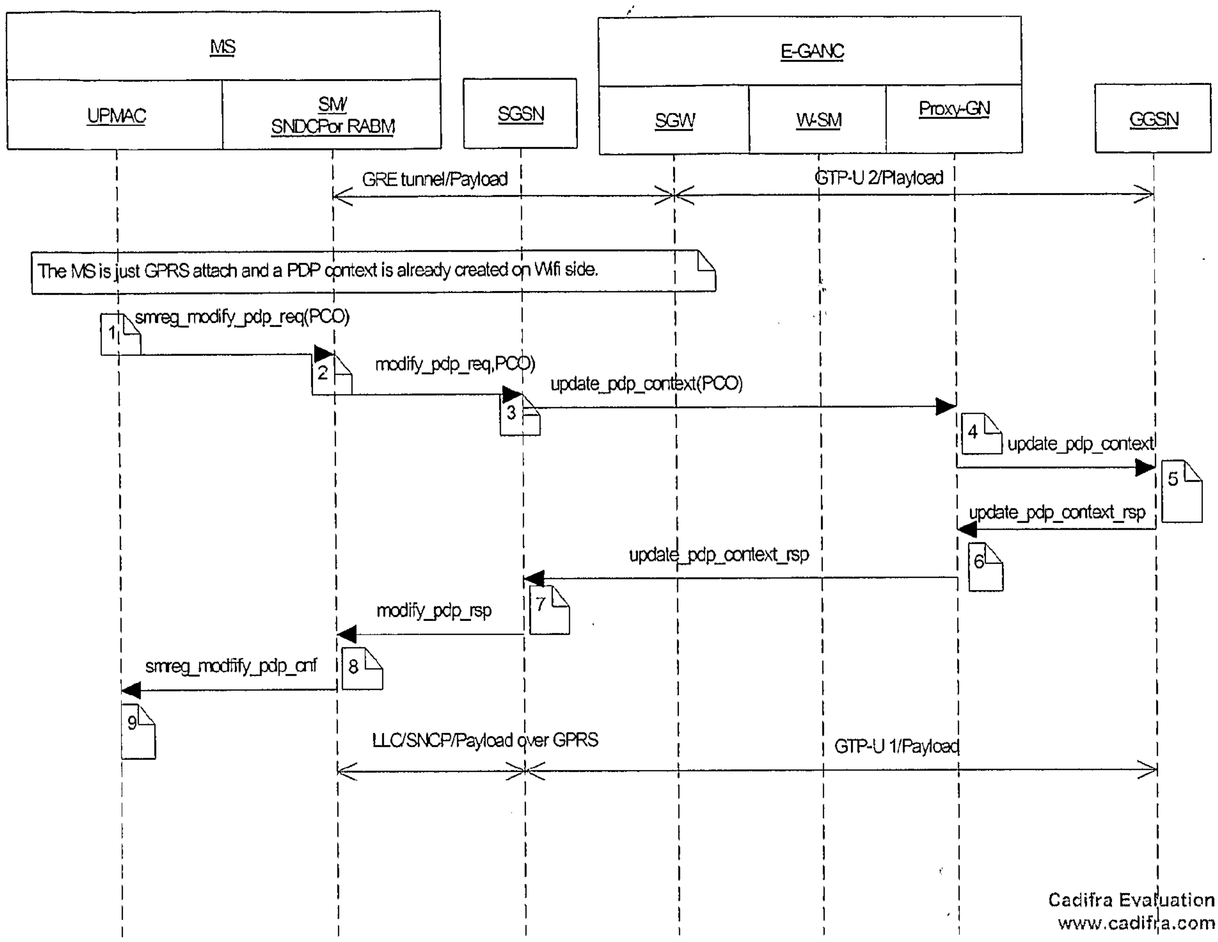

MS
E-GANC
UPMAC
SM/
SNDCPor RABM
SGSN
SGW
W-SM
Proxy-GN
GGSN
GRE tunnel/Payload
GTP-U 2/Playload
The MS is just GPRS attach and a PDP context is already created on Wifi side.
smreg_modify_pdp_req(PCO)
1
modify_pdp_req,PCO)
2
update_pdp_context(PCO)
3
4
update_pdp_context
5
update_pdp_context_rsp
update_pdp_context_rsp
6
modify_pdp_rsp
7
smreg_modifiy_pdp_cnf
8
9
LLC/SNCP/Payload over GPRS
GTP-U 1/Payload
Cadifra Evaluation
www.cadifra.com

FIG. 17

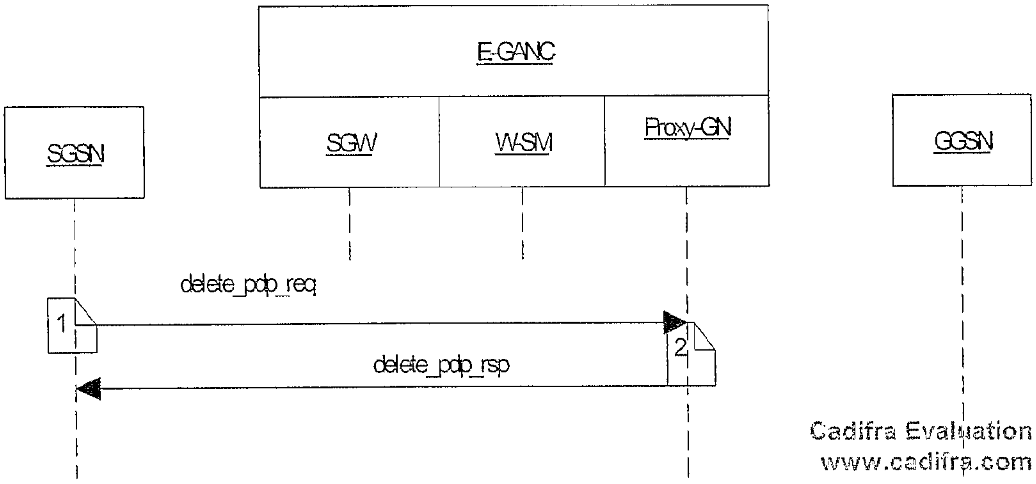

E-GANC
SGSN
SGW
W-SM
Proxy-GN
GGSN
delete_pdp_req
1
2
delete_pdp_rsp

FIG. 18

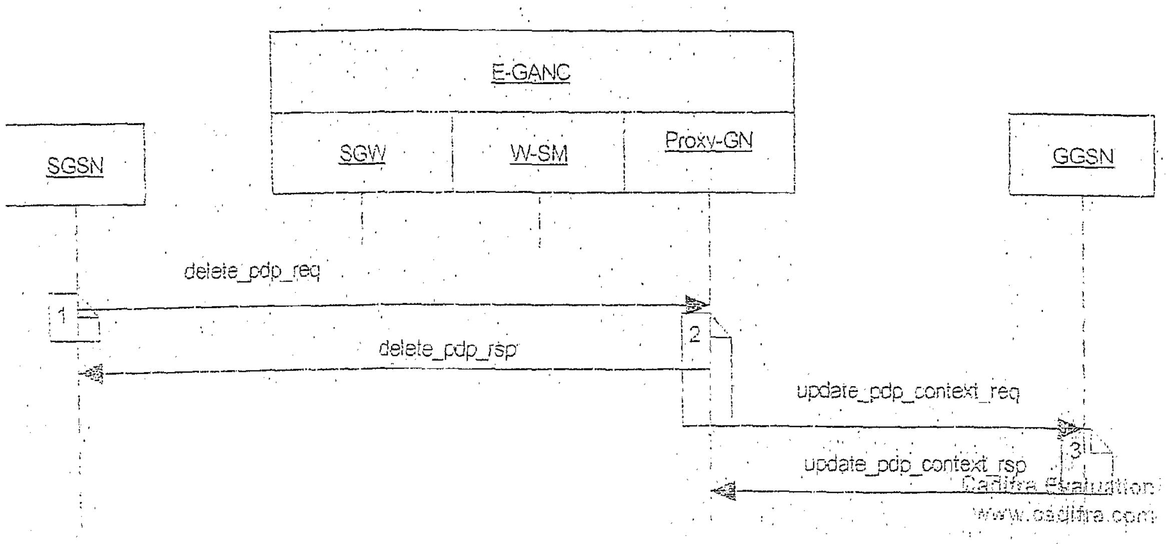

E-GANC
SGSN
SGW
W-SM
Proxy-GN
GGSN
delete_pdp_req
1
2
delete_pdp_rsp
update_pdp_context_req
3
update_pdp_context_rsp
Cadifra Evaluation
www.cadifra.com

FIG. 19

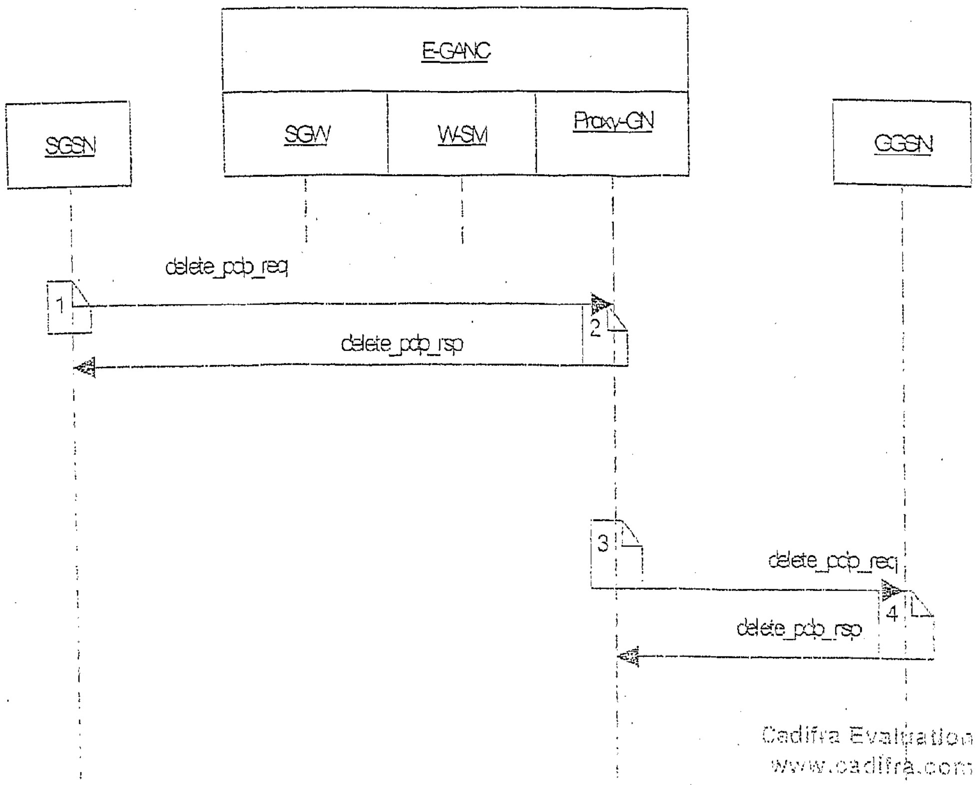

E-GANC
SGSN
SGW
W-SM
Proxy-GN
GGSN
delete_pdp_req
1
2
delete_pdp_rsp
3
delete_pdp_req
4
delete_pdp_rsp
Cadifra Evaluation
www.cadifra.com

FIG. 20

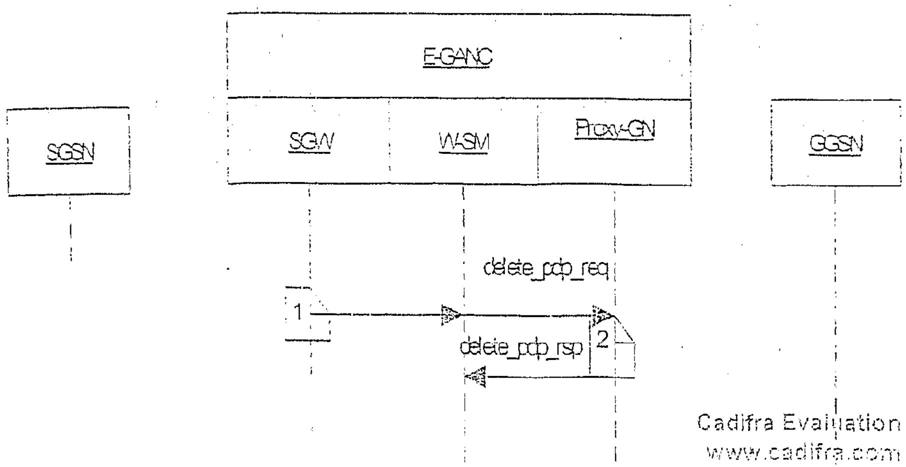

E-GANC
SGSN
SGW
W-SM
Proxy-GN
GGSN
delete_pdp_req
1
2
delete_pdp_rsp
Cadifra Evaluation
www.cadifra.com

FIG. 21

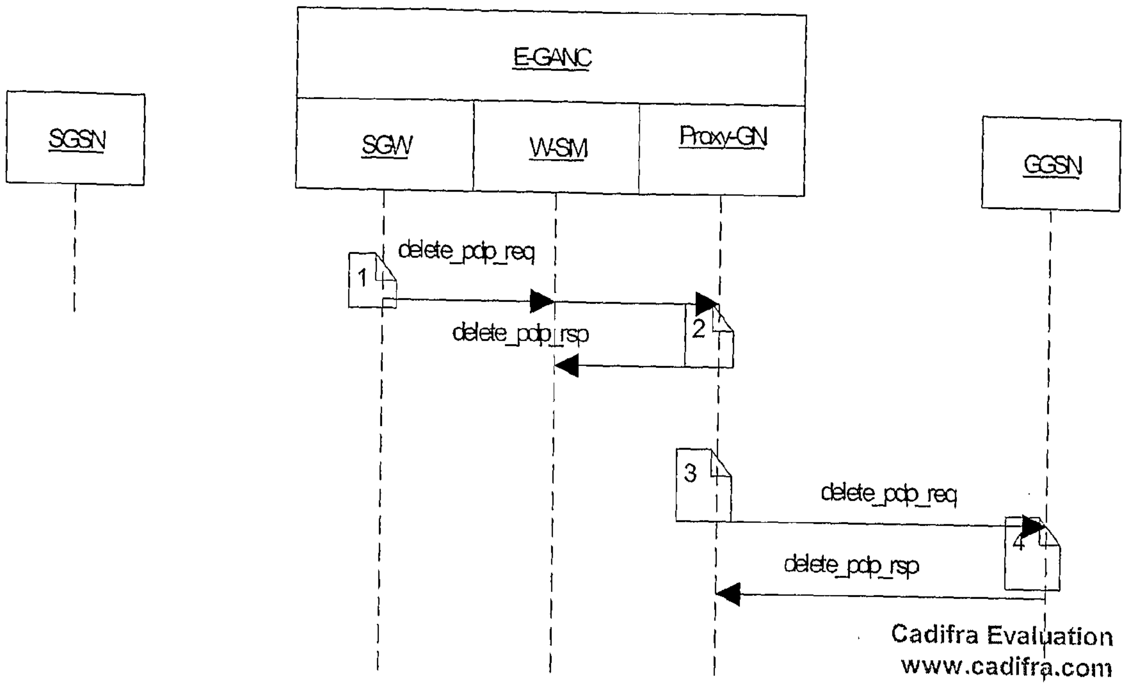

E-GANC
SGSN
SGW
W-SM
Proxy-GN
GGSN
delete_pdp_req
1
delete_pdp_rsp
2
3
delete_pdp_req
4
delete_pdp_rsp
Cadifra Evaluation
www.cadifra.com

FIG. 22