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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 November 2015 (05.11.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/166102 A1

(51) International Patent Classification:
H04W 4/00 (2009.01) *H04W 4/24* (2009.01)
H04M 15/00 (2006.01) *H04W 84/04* (2009.01)

(21) International Application Number:
PCT/EP2015/059626

(22) International Filing Date:
1 May 2015 (01.05.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1407848.9 2 May 2014 (02.05.2014) GB
1408770.4 16 May 2014 (16.05.2014) GB

(71) Applicant: **VODAFONE IP LICENSING LIMITED** [GB/GB]; The Connection, Newbury, Berkshire RG14 2FN (GB).

(72) Inventor: **AZZOPARDI, Daniel**; c/o Group Legal (Patents), Vodafone Group Services Limited, One Kingdom Street, London W2 6BY (GB).

(74) Agents: **BOULT WADE TENNANT** et al.; 70 Gray's Inn Road, London WC1 8BT (GB).

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

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

Published:

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

(54) Title: ARCHITECTURE FOR PROVISIONING AND BILLING

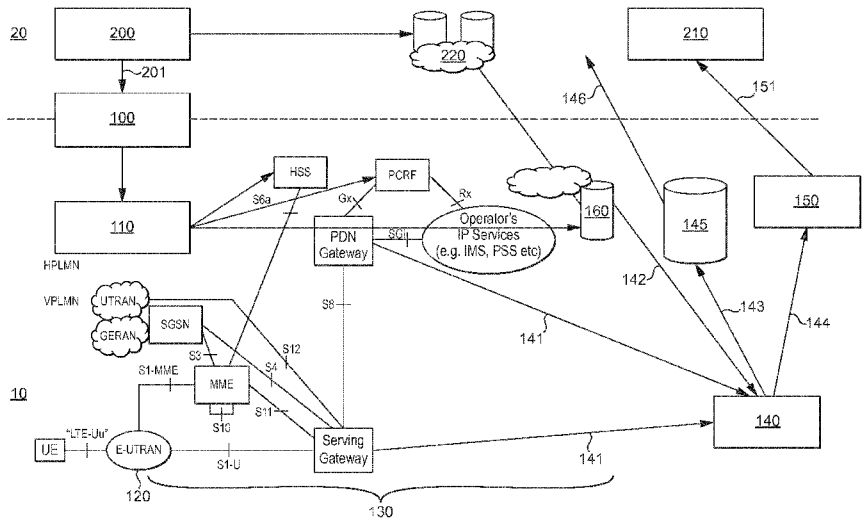

FIG. 1

(57) Abstract: A mobile terminal is provisioned at a cellular network so that the mobile terminal can receive a communications service from a service provider network through the cellular network. The service provider network is logically separate from the cellular network. A provisioning message is communicated from the service provider network to a provisioning system of the cellular network. The provisioning message causes direct adjustment of one or more service parameters of a subscription for the mobile terminal in the cellular network.

WO 2015/166102 A1

ARCHITECTURE FOR PROVISIONING AND BILLING

Background to the Invention

External service providers may be granted access to some parts of a cellular network in order to provide their service. In particular, subscription provisioning, activation and billing functionalities can be provided by interfacing one or more cellular network entities with external entities (such as servers) managed by the service provider.

In this context, a service provider can be a Mobile Virtual Network Operator (MVNO), a corporate network service or an emergency communications service provider. The cellular network entities of interest may be part of the core network, the Operations and Management (O&M) system or a combination of such entities.

For instance, an MVNO can provision a standard 2G (GSM) or 3G (UMTS) subscription. This can provide standardised subscriptions for circuit-switched (such as voice) and/or packet-switched (data) services.

It is desirable to provide this interfacing in a more efficient manner, allowing increased functionality for the service provider, but without negatively impacting operation of the cellular network.

Summary of the Invention

Against this background, there is provided a method of interfacing between a cellular network and a service provider network according to claim 1. There is also provided a computer program in accordance with claim 13 and a network entity in line with claim 14. The invention may also be embodied in the form of programmable logic, firmware or other configurable system. Other preferred features are disclosed with reference to the claims and in the description below.

A mobile terminal is provisioned at a cellular network so that the mobile terminal can receive a communications service from a service provider network through the cellular network. The service provider network is logically separate from the cellular network (and optionally physically separate and/or separately controlled). A provisioning message is communicated (typically, through an interface) from the service provider network to a provisioning system of the cellular network. The provisioning message causes direct (and/or immediate) adjustment of one or more service parameters of a subscription for the mobile terminal in the cellular network.

Direct adjustment allows the provisioning (adjustment of one or more service parameters of an existing subscription, also called re-provisioning in this context) of the

mobile terminal to be effected without complex interactions or negotiation and preferably in an immediate way. This adjustment may be immediate in that the cellular network receives the instruction immediately, especially directly to the core network. However, the instruction is not necessarily effected immediately (although in embodiments, it can be), depending on the core network architecture. This may be especially advantageous for critical communications services, such as emergency services. The communicating may be sending (that is from the service provider network) and/or receiving (that is, at the provisioning system of the cellular network). In particular, the one or more service parameters of the subscription may be adjusted in correspondence with (to match or to change in one or more of the same: direction, or an opposite direction; proportion; and absolute magnitude) one or more parameters of the service set at the service provider network. The provisioning message may provide information to allow this adjustment.

Advantageously, the one or more service parameters comprise one or more of: a data rate or bandwidth; a data volume allowance; a priority; and a Quality of Service (QoS) parameter. These parameters may allow effective re-provisioning of the subscription within the cellular network. Thus, if the service provider wishes to provide a service with one or more of: high QoS, high priority, high volume, high speed, the cellular network may be adapted quickly to provide this service. The cellular network beneficially provides network connectivity, based on at least one lower layer of a networking protocol stack, comprising one or more of: a physical layer; a link layer; a network layer; a transport layer; and a session layer. The service provider network may provide a service based on at least one higher layer of a networking protocol stack, comprising one or more of: a session layer; a presentation layer; and an application layer. As a result, the service provider may effect service-level adjustments to meet user requirements or demands and also effect connectivity-level adjustments by direct interface with the cellular network.

In some embodiments, the communicating is through an integration gateway in the cellular network, which may be a network entity used for provisioning, but advantageously adapted for re-provisioning as well. The integration gateway may provide an XML data over HTTPS protocol interface, which can allow communication of the provisioning message. This may particularly provide flexibility and may not require significant processing resource.

In an advantageous embodiment, the step of communicating comprises communicating between a priority management function in the service provider network and the integration gateway. Then, the integration gateway may interface with a policy

database for configuring or controlling the core network to allow priority settings for one or more subscribers to be set by the service provider network. This may allow the service provider to effect direct and/or instantaneous changes to the service parameters in the core network of the cellular network.

The step of interfacing may comprise communication between an Application Server (AS) in the cellular network and an AS in the service provider network, preferably to allow one or more specific services to be set up or configured. Optionally, the step of interfacing comprises interfacing of billing entities between one or both of: an Enterprise Data Warehouse (EDW); and a billing function in the cellular network and a billing / finance function in the service provider network. In some embodiments, the interfacing of billing entities is provided through a Managed File Transfer (MFT) system.

In some embodiments, the step of interfacing comprises remotely accessing one or more entities of the cellular network from a remote access function in the service provider network. The one or more entities of the cellular network may comprise a Customer Relationship Management (CRM) / Billing function for activating subscriptions by applying a price plan on a billing system of the cellular network.

Brief Description of the Drawings

The invention may be put into practice in various ways, a number of which will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows a schematic diagram of a network architecture in accordance with a first embodiment;

Figure 2 shows a schematic diagram of a network architecture in accordance with a second embodiment;

Figure 3 shows a schematic diagram of a network architecture in accordance with a third embodiment;

Figure 4 shows a schematic diagram of a network architecture in accordance with a modified version of the embodiment of Figure 1; and

Figure 5 shows a schematic diagram of a network architecture in accordance with a modified version of the embodiment of Figure 2.

Detailed Description of Preferred Embodiments

Referring first to Figure 1, there is shown a schematic diagram of a network architecture in accordance with a first embodiment. The network architecture is divided

into two parts: a cellular network 10; and a service provider network 20. This division is a logical split and not necessarily a physical split. In some cases, the cellular network 10 and a service provider network 20 are managed separately, although this need not be the case.

The cellular network 10 provides network connectivity, which may include lower layers of the networking protocol stack. For example, this may include one or more of: a physical layer; a link layer; a network layer; and a transport layer. Optionally, it may also include a session layer. The network connectivity typically involves control-plane traffic. User-plane traffic is normally transparent to the service provider network 20.

The network connectivity provided by the cellular network 10 may allow the service provider network 20 to provide a service. The service may be considered at the higher layers of the protocol stack, which may comprise one or more of: a session layer; a presentation layer; and an application layer. For example, the service may comprise one or more of: voice traffic; video traffic; other types of conversational-class traffic; streaming traffic; interactive class (browsing-type) data traffic; and background-class traffic. The service typically comprises the user-plane traffic. The service may be dependent on at least one Quality of Service (QoS) parameter, which may be set in accordance with the type of service. Adjustment to the QoS parameter or another service parameter may be desirable, for example based on the service requirements to change data rate, priority or other characteristic.

Some systems integrate the service provider network 10 and cellular network 20 completely, such that the distinction between the service (higher protocol stack layers) and the network connectivity (lower protocol stack layers) cannot be distinguished. In this scenario the service and the network connectivity are distinguishable and are preferably provided using separate network entities, as noted above and detailed (in the form of some examples) below.

The cellular network 10 comprises: a Radio Access Network (RAN) 120; and a core network 130; a Charging Data Record (CDR) mediation function 140; and a billing function 150. The configuration of the RAN 120 is shown as a conventional E-UTRAN Long Term Evolution (LTE) arrangement. The configuration of the core network 130 is also shown as a conventional System Architecture Evolution (SAE) Long Term Evolution (LTE) arrangement, comprising: a Mobility Management Entity (MME); a Service GPRS Support Node (SGSN); a Serving Gateway; a Packet Data Network (PDN) Gateway; a Home Subscriber Server (HSS); a Policy and Charging Rules Function (PCRF); and

other operator IP services, which may include a Voice over LTE (VoLTE) Application Server (AS) 160.

The Serving Gateway and PDN Gateway generate data service CDRs 141 for data services. The VoLTE AS 160 generates voice CDRs 142. These are provided to the CDR mediation function 140. ASN1 normalised CDRs 143 are provided to Enterprise Data Warehouse (EDW) 145. Voice CDRs and aggregated data CDRs 144 are provided to the billing function 150.

The service provider network 20 comprises: a provisioning function 200; a billing / finance function 210; and a service AS 220. The provisioning function 200 is used to provision a new network subscriber (user) and may be a software system for receiving and storing the subscriber details. This interfaces with the service AS 220 for service provisioning.

An interface is provided between the cellular network 10 and the service provider network 20. This interface uses an integration gateway 100. The integration gateway links to a cellular network provisioning function 110. The cellular network provisioning function 110 then effects provisioning of subscriptions, services or both. The service provider network 20 provides input, which may comprise one or more requests, to the cellular network 10 and the provisioning is based on these. This provisioning is achieved through interfaces with one or more entities of the core network 130, such as the HSS, PCRF and AS 160. The AS 160 can then provide a VoLTE service in this way.

The service provider network 20 uses the provisioning function 200 to provide an interface 201 with the cellular network 10. Preferably, this interface provides low latency and/or high security. This may be desirable for efficient and effective service provision. In this embodiment, interface 201 provides XML data over HTTPS protocol to the integration gateway 100. Other protocols or types of interface may be used instead.

The AS 160 may interface with the service AS 220. This may allow specific services to be set up or configured. Such services may be conventional in the cellular network 10 or specific to the service provided by the service provider network 20.

For charging purposes, the billing function 150 performs billing at a first rating (typically, a wholesale rating). The CDRs are provided over billing interface 151 to the billing / finance function 210 in the service provider network 20. Also, the EDW 145 can provide reports 146 to the service provider network 20.

The skilled person will understand that, at a simple level, this architecture can be reduced to a cellular network having a core network (preferably comprising a HSS or equivalent, a PCRF or equivalent, a service AS or a combination of such entities); an

external service provider system configured to provide a service to a service provider subscriber over the cellular network; and an integration gateway system, configured to interface between the external service provider system and the cellular network, in order to provision and/or configure a subscription, a service or a combination thereof within the core network.

In particular, the integration gateway system may interface with a provisioning system of the cellular network (which may be a part of a O&M system of the cellular network) to effect provisioning and/or configuration. The provisioning system may interface with the core network. The integration gateway system may be configured to interface with an Application Server in order to provide a voice over packet-switched (such as IP or LTE) service. Configuration aspects may be discussed below. For instance, the integration gateway system may be configured to effect adjustment of one or more service parameters of a subscription. The service parameters may comprise one or more of: data rate or bandwidth; data volume allowance; priority; or one or more other QoS parameter. A method of operation of this architecture may also be understood.

Referring next to Figure 2, there is shown a schematic diagram of a network architecture in accordance with a second embodiment. Where the same elements or entities are shown as in a previous drawing, identical reference numerals have been used.

The majority of the cellular network 10 will be understood as the same as shown in Figure 1, in particular. There are only subtle changes, although these may be significant. The billing function 150 of Figure 1 is replaced with a cellular network Customer Relationship Management (CRM) / Billing function 155. This generates billing at a rating and preferably in a format suitable for the service provider to use directly. This is provided over interface 156 to a billing / finance function 210 of the service provider network 20.

In this embodiment, the service provider network 20 comprises: a remote access function 205; and the billing / finance function 210. The remote access function 205 is configured to allow remote access into one or more entities of the cellular network 10, particularly the CRM / Billing function 155 to allow provisioning. The remote interfacing may be web-based, for example using a HTTP or HTTPS protocol. The CRM / Billing function 155 activates subscriptions by applying the correct price plan on the billing system. The billing system then triggers off a command to the provisioning function 110 to activate the subscription on the cellular network 10.

The cellular network now retains significant technical functionality in respect of the subscription and/or service provision and charging aspects. The service provider network 20 simply accesses these functionalities remotely, without the need for dedicated network entities to provide inputs to these functionalities. Complex integration of the cellular network 10 and the service provider network 20 and the layers that they each control is not required. This solution is therefore significantly simpler. Control and security of the technical charging reporting system is also improved in this way.

Provisioning and configuring of services at the cellular network is also considered. The service provider network 20 adjusts one or more service or QoS parameters. As an example, this type of adjustment may be of benefit to emergency service-type communication services. In such scenarios, a user may demand an increase in data rate, for example in order to go from a voice-based call to share real-time video in addition. This may be useful for immediate response to an emergency and allow the other party (or parties) in the call to see the situation for information and possibly to advise. A similar scenario may exist when a high-priority service is demanded, for example to send an urgent message by voice and/or data.

Then, the service provider network 20 can adjust the service parameters accordingly (at the higher layers of the protocol stack) to meet the new QoS requirements. However, without corresponding adjustment of the network connectivity provided by the cellular network 10, this service parameters change will have limited effect. Therefore, it is desirable to effect changes in the network connectivity parameters in response to the service provider parameter changes. The service provider network 20 may inform the cellular network 10 of the service requirement or parameter changes. The cellular network 10 is then configured to respond accordingly.

With full integration of service and network connectivity, so that the two are not distinguishable (such as when the cellular network 10 is responsible entirely for the service level and uses the same network entities for both service and connectivity), this adjustment is straightforward. The cellular network 10 can readily respond to service requirement changes. By splitting the service and network levels, cross-layer service provisioning and optimising is more difficult. Achieving this will now be discussed.

Referring now to Figure 3, there is shown a schematic diagram of a network architecture in accordance with a third embodiment. Again, where the same elements or entities are shown as in a previous drawing, identical reference numerals have been used.

This embodiment is intended to provide management of one or more of: priority; data rate; and special instantaneous services (for example proximity-based or group / multicast services). Some of the functionality in the cellular network 10 for charging has therefore been omitted from the drawing. However, it will be appreciated that some or all of the features of this embodiment may optionally be combined with either of the two earlier-described embodiments.

In the service provider network 20, a priority management function 206 is provided. This interfaces with the service provider AS 220 for service provisioning. The priority management function 206 also interfaces with the integration gateway 100 through an interface 202. As discussed above, the priority management function 206 may provide XML data over HTTPS protocol to the integration gateway 100 over the interface 202.

The cellular network 10 comprises a policy database 170, which interfaces with the integration gateway 100. The policy database 170 is able to configure or control parts of the core network 130, especially the PCRF. This allows priority settings for individual or groups of subscribers to be set by the service provider network 20. For instance, a mechanism may trigger an action from the priority management function 206 to the policy database 170.

An approach for management of network connectivity parameters has now been discussed with reference to an integration gateway 100. However, it will be understood that this can also be implemented using an approach based on the embodiment shown in Figure 2. Then, the service provider 20 may be provided with remote access to one or more entities of the cellular network 10. This may be used to configure a subscription, a service or a combination thereof within the core network, as discussed herein. This may be achieved whilst still maintaining the split of control between service and network connectivity. In particular, the cellular network 10 and the service provider network 20 can remain logically (and preferably physically) distinct and may be controlled separately.

In a variation of the above described approaches, a Managed File Transfer (MFT) system can optionally be additionally provided. This can provide a further interface between the cellular network 10 and the service provider network 20. In particular, all billing records (whether rated by the billing systems or not) can be transferred using the MFT. The MFT can further improve security of the interface between the two networks. Moreover, the number of interface points between the cellular network 10 and the

service provider network 20 can be reduced using the MFT. The implementation of the MFT in the embodiments of Figures 1 and 2 will now be briefly discussed.

Referring to Figure 4, there is shown a schematic diagram of such a network architecture in accordance with a modified version of the embodiment of Figure 1. Much of the architecture is the same as shown in Figure 1 and where the same elements or entities are shown as in this drawing, identical reference numerals have been used. An MFT 310 is provided for interfacing between the cellular network 10 and the service provider network 20. The MFT 310 provides a central interface for the EDW 145 and billing function 150 in the cellular network 10 with the billing / finance function 210 in the service provider network 20 and to provide reports 146 to the service provider network 20.

Referring to Figure 5, there is shown a schematic diagram of a network architecture in accordance with a modified version of the embodiment of Figure 2. Again, this architecture is largely the same as that of Figure 2 and where the same elements or entities are shown as in this drawing, identical reference numerals have been used. An MFT 311 is provided for interfacing between the cellular network 10 and the service provider network 20. The MFT 311 provides a central interface for the EDW 145 and CRM / Billing function 155 in the cellular network 10 with the billing / finance function 210 in the service provider network 20 and to provide reports 146 to the service provider network 20.

Although specific embodiments have now been described, the skilled person will understand that various modifications and variations are possible. Also, combinations of any specific features shown with reference to one embodiment or with reference to multiple embodiments are also provided, even if that combination has not be explicitly detailed herein. For instance, the approach shown in Figure 3 may be implemented in conjunction with the approach shown in Figure 1 or that shown in Figure 2 (or those shown in Figures 4 or 5 respectively). Similarly, a service provisioning and/or configuration approach based on the architecture shown in Figures 2 or 5 (as discussed above) may be combined with a subscription provisioning approach based on the architecture shown in Figures 1 or 4 or that shown in Figure 2. Other combinations will also be appreciated.

CLAIMS

1. A method for provisioning a mobile terminal at a cellular network so that the mobile terminal can receive a communications service from a service provider network through the cellular network, wherein the service provider network is logically separate from the cellular network, the method comprising:

communicating a provisioning message from the service provider network to a provisioning system of the cellular network, wherein said provisioning message causes direct adjustment of one or more service parameters of a subscription for the mobile terminal in the cellular network.

2. The method of claim 1, wherein the one or more service parameters comprise one or more of: a data rate or bandwidth; a data volume allowance; a priority; and a Quality of Service, QoS, parameter.

3. The method of claim 1 or claim 2, wherein the provisioning message provides information to adjust the one or more service parameters of the subscription in correspondence with one or more parameters of the service set at the service provider network.

4. The method of any preceding claim, wherein the step of communicating comprises communication through an integration gateway in the cellular network.

5. The method of claim 4, wherein the integration gateway provides an XML data over HTTPS protocol interface to allow communication of the provisioning message.

6. The method of claim 4 or claim 5, wherein the step of communicating comprises communicating between a priority management function in the service provider network and the integration gateway, the integration gateway interfacing with a policy database for configuring or controlling the core network to allow priority settings for one or more subscribers to be set by the service provider network.

7. The method of any one of claims 4 to 6, wherein the step of communicating further comprises communicating between an Application Server, AS, in the cellular network and an AS in the service provider network.

8. The method of claim 7, wherein the communication between the AS in the cellular network and the AS in the service provider network allows one or more specific services to be set up or configured.

9. The method of any one of claims 4 to 8, wherein the step of communicating further comprises interfacing of billing entities between one or both of: an Enterprise Data Warehouse, EDW; and a billing function in the cellular network and a billing / finance function in the service provider network.

10. The method of claim 9, wherein the interfacing of billing entities is provided through a Managed File Transfer, MFT, system.

11. The method of any one of claims 1 to 3, wherein the step of communicating comprises remotely accessing one or more entities of the cellular network from a remote access function in the service provider network.

12. The method of claim 11, wherein the one or more entities of the cellular network comprise a Customer Relationship Management / Billing function for activating subscriptions by applying a price plan on a billing system of the cellular network.

13. The method of any preceding claim, wherein the cellular network provides network connectivity, based on at least one lower layer of a networking protocol stack, the at least one lower layer comprising one or more of: a physical layer; a link layer; a network layer; a transport layer; and a session layer, and wherein the service provider network provides a service based on at least one higher layer of a networking protocol stack, the at least one higher layer comprising one or more of: a session layer; a presentation layer; and an application layer.

14. A computer program, configured when operated by a processor to perform operate the method of any preceding claim.

15. A network entity of a cellular network or a service provider network, configured to operate in accordance with the method of any one of claims 1 to 13.

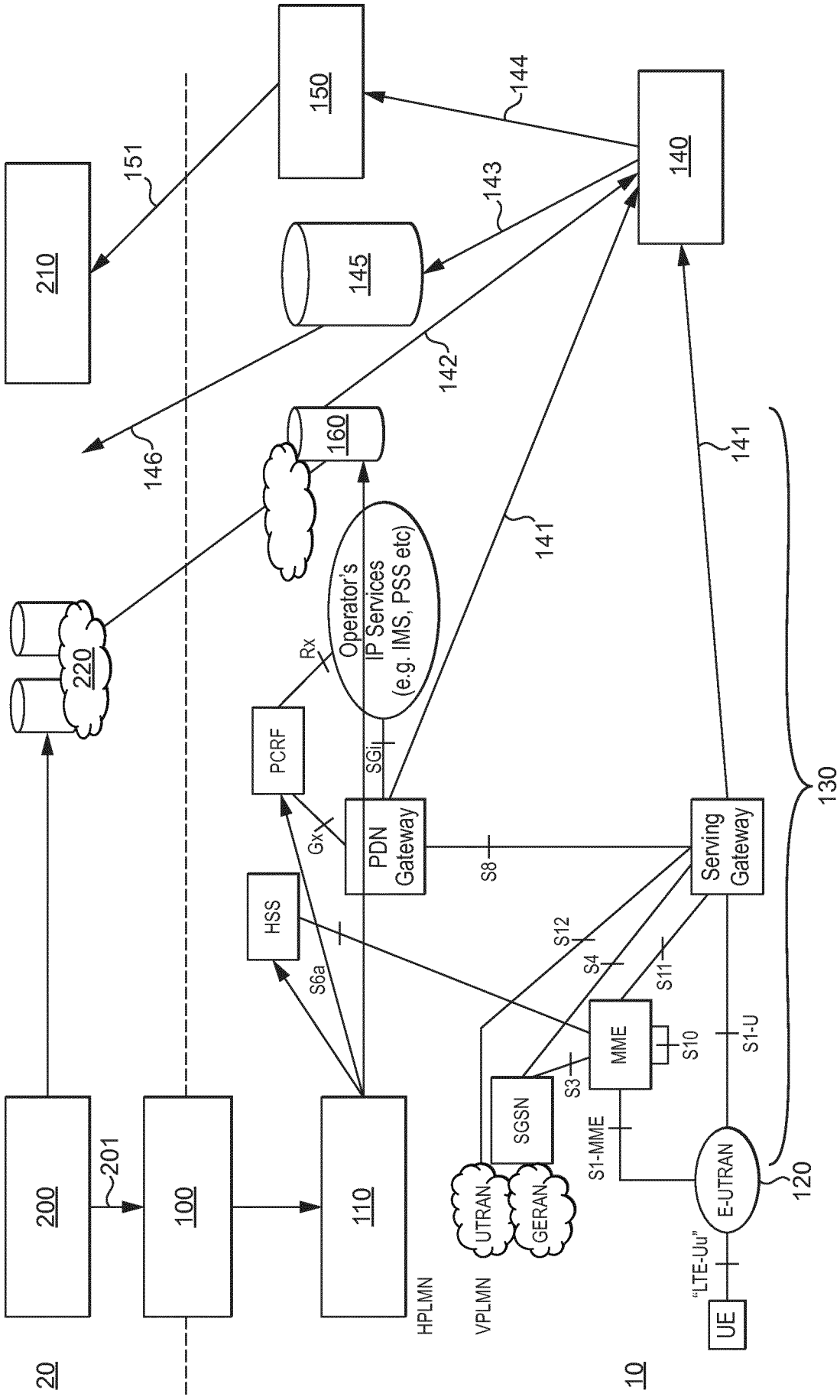
150
144
140
151
143
210
145
142
146
160
141
141
220
Operator's IP Services (e.g. IMS, PSS etc)
Rx
PCRF
SGi
PDN Gateway
Gx
S8
Serving Gateway
130
HSS
S6a
S12
S4
S11
MME
S10
S1-U
S3
SGSN
S1-MME
E-UTRAN
120
UTRAN
GERAN
"LTE-Uu"
UE
200
201
100
110
HPLMN
VPLMN
20
10

FIG. 1

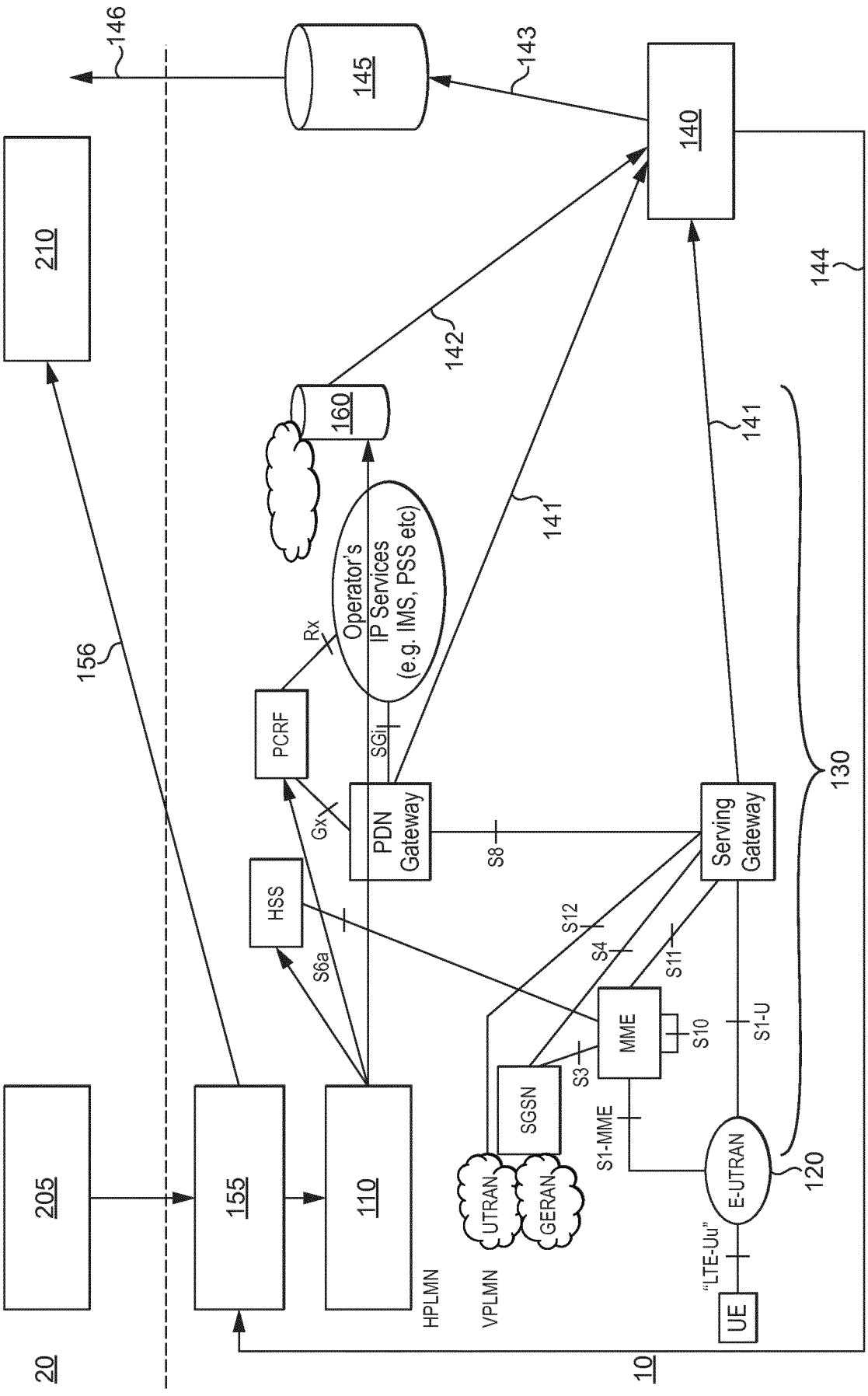
146
145
143
140
210
144
142
160
141
Operator's
IP Services
(e.g. IMS, PSS etc)
Rx
156
PCRF
SGi
141
130
Gx
PDN
Gateway
S8
Serving
Gateway
HSS
S12
S4
S11
S6a
MME
S10
S1-U
S3
SGSN
S1-MME
205
155
110
UTRAN
GERAN
E-UTRAN
120
"LTE-Uu"
UE
HPLMN
VPLMN
20
10

FIG. 2

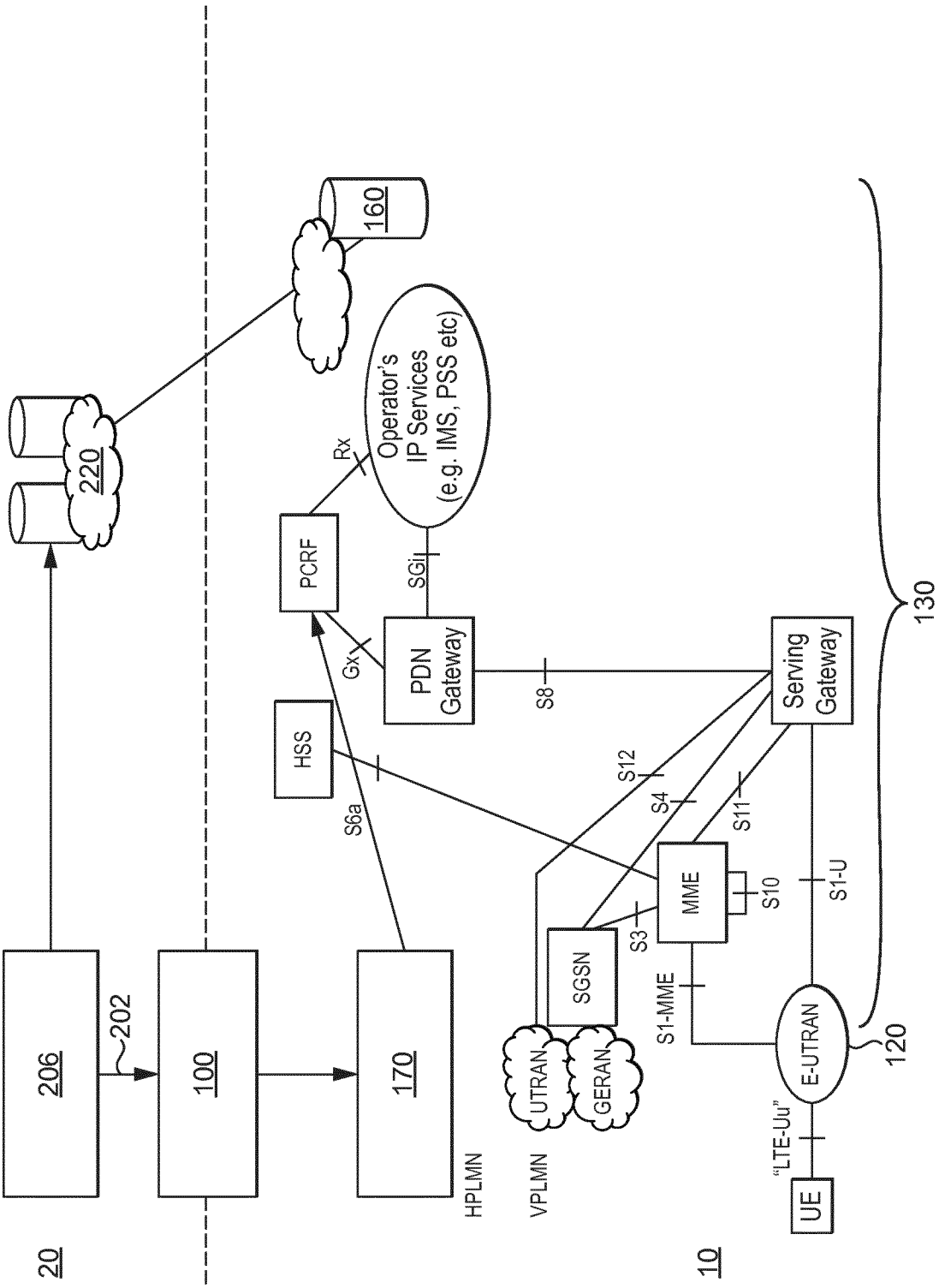
20
206
202
100
170
HPLMN
VPLMN
10
220
160
Operator's
IP Services
(e.g. IMS, PSS etc)
Rx
SGi
PCRF
Gx
PDN
Gateway
S8
HSS
S6a
Serving
Gateway
130
S12
S4
S11
MME
S10
S3
S1-U
S1-MME
SGSN
UTRAN
GERAN
E-UTRAN
120
"LTE-Uu"
UE

FIG. 3

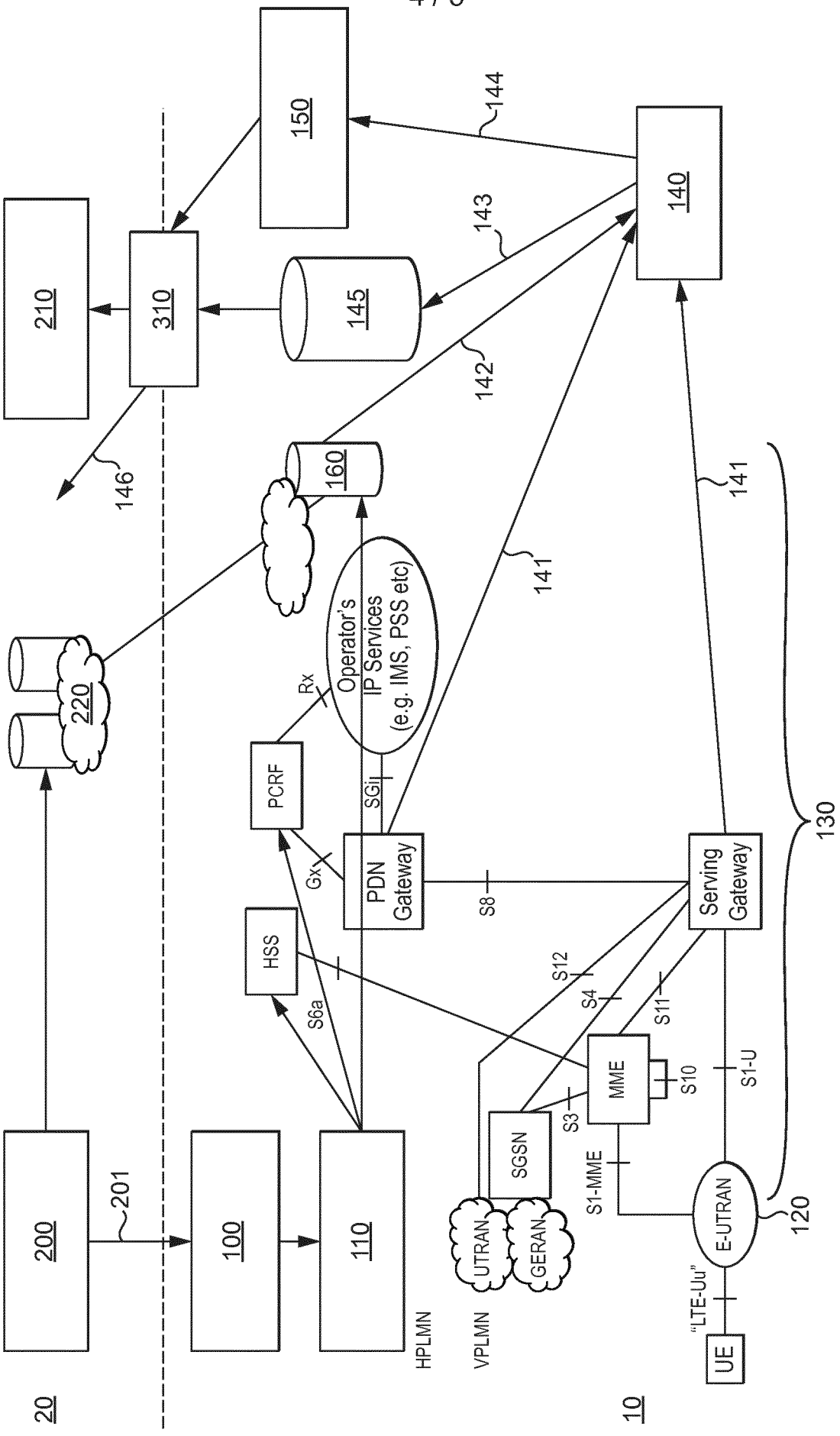
150
144
140
143
210
310
145
142
146
160
141
Operator's
IP Services
(e.g. IMS, PSS etc)
Rx
220
PCRF
SGi
Gx
PDN
Gateway
S8
Serving
Gateway
130
HSS
S6a
S12
S4
S11
MME
S10
S1-U
S3
SGSN
S1-MME
E-UTRAN
120
UTRAN
GERAN
"LTE-Uu"
UE
200
201
100
110
HPLMN
VPLMN
20
10

FIG. 4

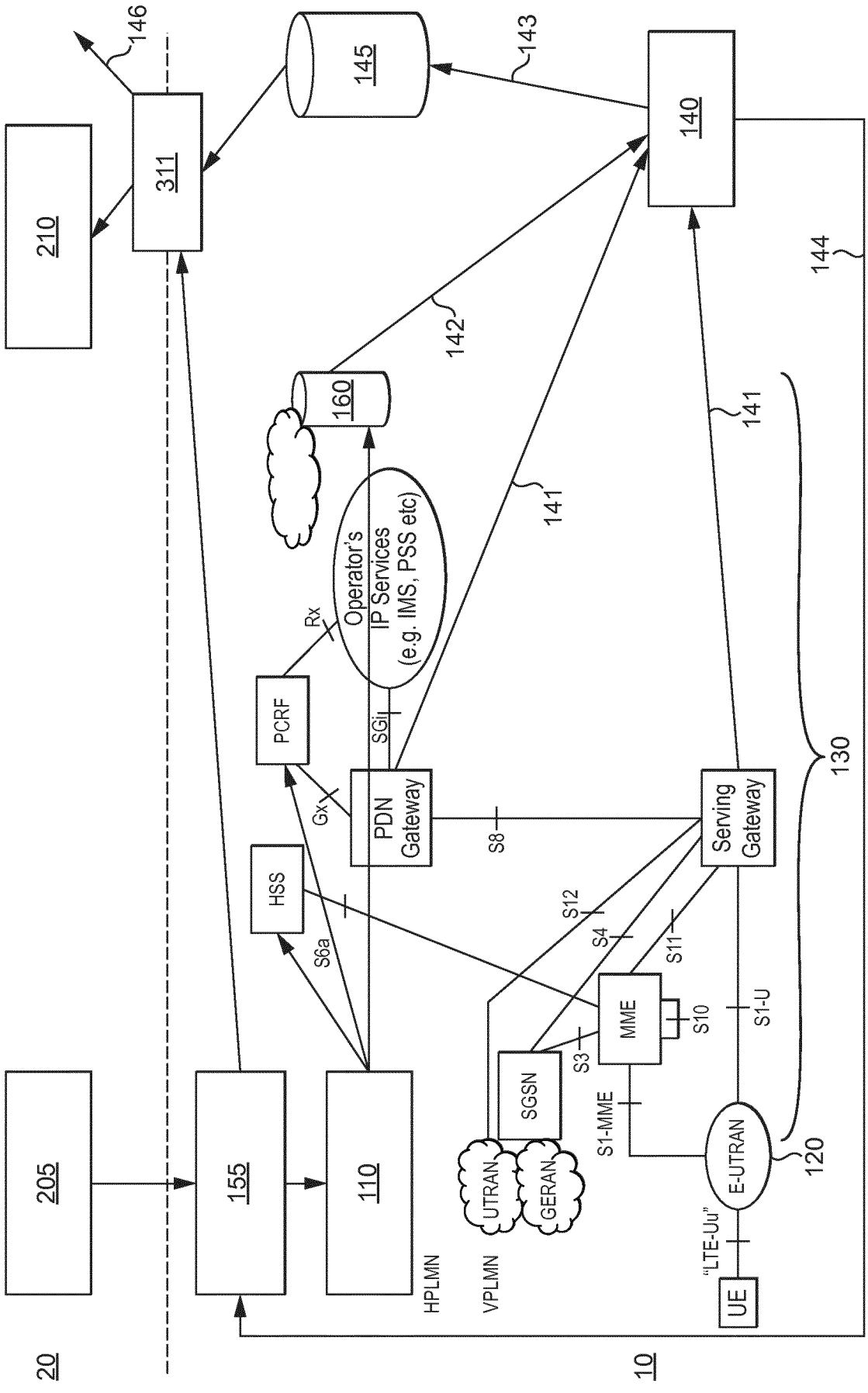
146
145
143
140
311
210
144
142
160
141
141
Operator's IP Services (e.g. IMS, PSS etc)
Rx
PCRF
SGi
PDN Gateway
Gx
S8
Serving Gateway
130
HSS
S6a
S12
S4
S11
MME
S10
S1-U
S3
SGSN
S1-MME
E-UTRAN
120
205
155
110
UTRAN
GERAN
HPLMN
VPLMN
"LTE-Uu"
UE
20
10

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/059626

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W4/00
ADD. H04M15/00 H04W4/24 H04W84/04

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W H04M

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 practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 03/024139 A2 (RESEARCH IN MOTION LTD [CA]; KRUIS DAVID P [CA]; GILHULY BARRY J [CA]) 20 March 2003 (2003-03-20) abstract page 8, line 20 - page 17, line 4 page 30, line 6 - page 35, line 8 page 57, line 12 - page 61, line 15 figures 1-6,11	1-15
X	US 2007/178895 A1 (BOT MENNO [PH]) 2 August 2007 (2007-08-02) abstract paragraph [0033] - paragraph [0036] paragraph [0049] - paragraph [0062] figures 1,4,5	1-15

-/--

[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 application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 July 2015	16/07/2015

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, Fax: (+31-70) 340-3016	Hodgins, Will

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/059626

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/137890 A1 (KALKE CATHERINE [US]) 15 July 2004 (2004-07-15) abstract paragraph [0061] - paragraph [0064] figure 3 -----	1-15
X	EP 1 705 872 A1 (BITFONE CORP [US]) 27 September 2006 (2006-09-27) abstract paragraph [0015] - paragraph [0028] figures 1,2 -----	1-15
X	WO 02/073944 A1 (EVOICE INC [US]) 19 September 2002 (2002-09-19) abstract page 3, line 32 - page 7, line 7 page 7, line 37 - page 8, line 30 figures 1,3 -----	1-15

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/059626

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03024139 A2	20-03-2003	AT 488104 T	15-11-2010
		AU 2002325124 A1	24-03-2003
		CA 2356823 A1	10-03-2003
		EP 1428399 A2	16-06-2004
		HK 1063128 A1	01-04-2011
		US 2004242209 A1	02-12-2004
		US 2011034161 A1	10-02-2011
		US 2012015643 A1	19-01-2012
		US 2012021719 A1	26-01-2012
		US 2013225114 A1	29-08-2013
		WO 03024139 A2	20-03-2003
US 2007178895 A1	02-08-2007	NONE	
US 2004137890 A1	15-07-2004	US 2004137890 A1	15-07-2004
		US 2010121736 A1	13-05-2010
EP 1705872 A1	27-09-2006	AT 418836 T	15-01-2009
		CN 1863095 A	15-11-2006
		EP 1705872 A1	27-09-2006
		US 2006236325 A1	19-10-2006
WO 02073944 A1	19-09-2002	US 6546095 B1	08-04-2003
		WO 02073944 A1	19-09-2002