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(54) Title: METHOD AND APPARATUS FOR USE IN A COMMUNICATIONS NETWORK
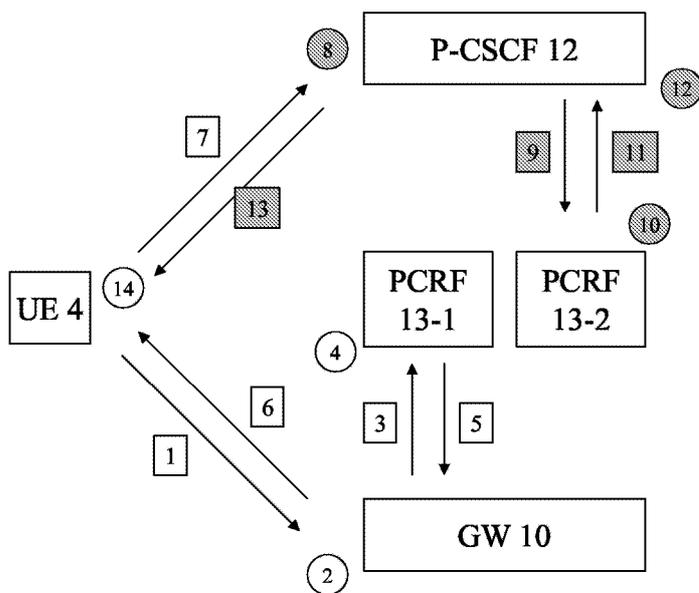
(57) Abstract: A method is provided of register-ing a mobile node (4), such as a User Equipment (UE), 5 of a telecommunications network, such as a Universal Mobile Telecommunications System (UMTS), to a subsystem of the network, such as an IP Multimedia Subsystem (IMS). The network has at least one node (13-1, 13-2), such as a Policy and Charging Rules Function (PCRF), for maintaining or having access to policy and charging rules for users of the network. The network also has at least one node (10), such as a 10 Gateway GPRS Sup-port Node (GGSN), for enforcement of the policy and charging rules to traffic flows. A registration request message, such as a Session Initiation Pro-tocol (SIP) REGISTER message, is received from the mobile node (4) at a proxy node (12), such as a Proxy Call Session Control Function (P-CSCF), of the network. In response, a candidate policy and charging rules node (13-2) is selected for the mo-bile 15 node (4), and it is determined whether the candidate policy and charging rules node (13-2) has already been selected by a policy and charg-ing rules enforcement node (10) to serve the mobile node (4). Subsequent steps of the registration procedure are performed in dependence on the determination.

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TITLE OF THE INVENTION

Method and Apparatus for use in a Communications Network

BACKGROUND OF THE INVENTION

5   1.   Field of the Invention

The present invention relates to a method and apparatus for use in a communications network, for example a Universal Mobile Telecommunications System having an IP Multimedia Subsystem.

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2.   Description of the Related Art

IP Multimedia services provide a dynamic combination of voice, video, messaging, data, etc. within the same session. By growing the number of basic applications and the media which it is possible to combine, the number of services offered to the end users will grow, and the inter-personal communication experience will be enriched. This will lead to a new generation of personalised, rich multimedia communication services, including so-called "combinational IP Multimedia" services.

By way of background, UMTS (Universal Mobile Telecommunications System) is a third generation wireless system designed to provide higher data rates and enhanced services to subscribers. UMTS is a successor to the Global System for Mobile Communications (GSM), with an important evolutionary step between GSM and UMTS being the General Packet Radio Service (GPRS). GPRS introduces packet switching into the GSM core network and allows direct access to packet data networks (PDNs). This enables high-data rate packets switch transmissions well beyond the 64kbps limit of ISDN through the GSM call network, which is a necessity for UMTS data transmission rates of up to 2Mbps. UMTS is standardised by the 3rd Generation Partnership Project (3GPP) which is a conglomeration of regional standards bodies such as the European Telecommunication Standards Institute (ETSI), the Association of Radio Industry Businesses (ARIB) and others. See 3GPP TS 23.002 for more details.

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The standardisation of UMTS has progressed in phases. The first phase was known as Release '99. The Release '99 specifications define the basic architecture that consists of the UMTS Terrestrial Radio Access Network (UTRAN), Circuit Switched Core Network (CS-CN) and Packet Switched Core Network (PS-CN). The release '99

5   specification offers traditional circuit as well as packet-switched services. The next phase in the standardisation process was Release 4, adding new services to the '99 architecture. Release 5 represented a significant shift, offering both traditional telephony as well as packet-switched services over a single converged packet-based network.

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The UMTS Release 5 architecture added a new subsystem known as the IP Multimedia Subsystem (IMS) to the PS-CN for supporting traditional telephony as well as new multimedia services. IMS provides IP Multimedia services over mobile communication networks (3GPP TS 22.228, TS 23.228, TS 24.229, TS 29.228, TS 29.229, TS 29.328

15   and TS 29.329 Releases 5 to 7). IMS provides key features to enrich the end-user person-to-person communication experience through the use of standardised IMS Service Enablers, which facilitate new rich person-to-person (client-to-client) communication services as well as person-to-content (client-to-server) services over IP-based networks. The IMS is able to connect to both PSTN/ISDN (Public Switched

20   Telephone Network/Integrated Services Digital Network) as well as the Internet.

The IMS makes use of the Session Initiation Protocol (SIP) to set up and control calls or sessions between user terminals (or user terminals and application servers). The Session Description Protocol (SDP), carried by SIP signalling, is used to describe and

25   negotiate the media components of the session. Whilst SIP was created as a user-to-user protocol, IMS allows operators and service providers to control user access to services and to charge users accordingly. The 3GPP has chosen SIP for signalling between a User Equipment (UE) and the IMS as well as between the components within the IMS.

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Figure 1 is an illustrative diagram showing a UMTS communications network 200 comprising a User Equipment (UE) 204 located within a Visited Network 202. The UE 204 is attached to a Serving GPRS Support Node (SGSN) 208 via a UTRAN 206,

which is in turn in communication with a Gateway GPRS Support Node (GGSN) 210. Within the Visited Network 202, the GGSN 210 communicates with a Proxy Call Session Control Function (P-CSCF) 212, which is the first point of contact in the visited IMS network for the UE 204. The P-CSCF 212 forwards SIP registration messages and session establishment messages to the Home Network 214.

The first point of contact within the Home Network 214 is the Interrogating Call Session Control Function (I-CSCF) 216, which is an optional node in the IMS architecture, whose main purpose is to query the Home Subscriber Server (HSS) 220 to find the location of the Serving Call Session Control Function (S-CSCF) 218. The S-CSCF 218 performs session management for the IMS network, and there can be several S-CSCFs in the network. The HSS 220 is a centralised subscriber database, and has evolved from the Home Location Register (HLR) from earlier UMTS releases. The HSS 220 interfaces with the I-CSCF and the S-CSCF to provide information about the location of the subscriber and the subscriber's subscription information.

The communications network 200 further comprises an application server 222, a database 224 and a mail server 226 located in the Home Network 214. From the S-CSCF 218, signalling messages are passed to the intended destination, which may be another Release 5 IMS network 228 comprising a UE 230, or to a legacy network 232 comprising a PSTN interfaced through a Media Gateway Control Function (MGCF), or to an IP network 234.

Specific details of the operation of the UMTS communications network 200 and of the various components within such a network can be found from the Technical Specifications for UMTS which are available from http://www.3gpp.org.

Further details of the use of SIP within UMTS can be found from the 3GPP Technical Specification TS 24.228 V5.8.0 (2004-03), but a summary will now be provided with reference to Figure 2, which illustrates schematically how the IMS fits into the mobile network architecture in the case of a GPRS/PS access network (IMS can of course operate over other access networks). Call/Session Control Functions (CSCFs) operate as SIP proxies within the IMS. As mentioned above, the 3GPP architecture defines

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three types of CSCFs: the Proxy CSCF (P-CSCF) which is the first point of contact within the IMS for a SIP terminal; the Serving CSCF (S-CSCF) which provides services to the user that the user is subscribed to; and the Interrogating CSCF (I-CSCF) whose role is to identify the correct S-CSCF and to forward to that S-CSCF a request received from a SIP terminal via a P-CSCF.

A user registers with the IMS using the specified SIP REGISTER method. This is a mechanism for attaching to the IMS and announcing to the IMS the address at which a SIP user identity can be reached. In 3GPP, when a SIP terminal performs a registration, the IMS authenticates the user, and allocates a S-CSCF to that user from the set of available S-CSCFs. Whilst the criteria for allocating S-CSCFs is not specified by 3GPP, these may include load sharing and service requirements. It is noted that the allocation of an S-CSCF is key to controlling (and charging for) user access to IMS-based services. Operators may provide a mechanism for preventing direct user-to-user SIP sessions which would otherwise bypass the S-CSCF.

During the registration process, it is the responsibility of the I-CSCF to select an S-CSCF if a S-CSCF is not already selected. The I-CSCF receives the required S-CSCF capabilities from the home network's Home Subscriber Server (HSS), and selects an appropriate S-CSCF based on the received capabilities. [It is noted that S-CSCF allocation is also carried out for a user by the I-CSCF in the case where the user is called by another party, and the user is not currently allocated an S-CSCF.] When a registered user subsequently sends a session request to the IMS, the P-CSCF is able to forward the request to the selected S-CSCF based on information received from the S-CSCF during the registration process.

Within the IMS service network, the Application Servers (ASs) are for implementing IMS service functionality. Application Servers provide services to end-users in an IMS system, and may be connected either as end-points over the 3GPP defined Mr interface, or "linked in" by an S-CSCF over the 3GPP defined ISC interface. In the latter case, Initial Filter Criteria (IFC) are used by an S-CSCF to determine which Applications Servers should be "linked in" during a SIP Session establishment (or indeed for the purpose of any SIP method, session or non-session related). The IFCs are received by

the S-CSCF from an HSS during the IMS registration procedure as part of a user's User Profile.

An important function of any mobile core network is the enforcement of service level policies. These policies dictate, *inter alia,* what particular users may and may not do, and what they will be charged. Another policy might dictate the Quality of Service (QoS) that particular users will receive. Service level policies, which might be thought of as general policy statements, are enforced using detailed policy "rules". A single policy may require a set of policy rules. Each policy rule will comprise a first subject part identifying the packets that the policy rule will be applied to, and a second action part. The subject part may in some cases be a packet filter. Policy rules are installed into a node through which all traffic of the users pass or into multiple nodes, which collectively handle all traffic of the user.

In the case of 3GPP, it is envisaged that policing and charging functionality will be controlled from a so-called Policy and Charging Rules Function (PCRF) logical node, based on signalling from Application Functions (AFs) providing high level services to users. Consider for example the IP Multimedia Subsystem (IMS) described above. When a call is set up over the IMS, the IMS Proxy Call/State Control Function (P-CSCF) acts as AF from a policy and charging point of view and informs the PCRF of the new session. In particular, the P-CSCF sends to the PCRF a descriptor of the IP flow, and an abstract definition of the QoS to apply. The PCRF has installed into it, for each user, a policy which describes how packet flows for that user are to be handled, i.e. allowed/denied services, charges, actual QoS, etc. (This may be installed manually into the PCRF or may be installed remotely, e.g. by a user's home network where the PCRF is located in a "visited" network.)

Considering this scenario in more detail, the AF sends to the PCRF a flow descriptor in the form of a complete or partial five-tuple vector containing: (1) IP source address, (2) IP destination address, (3) an identification of the used transport protocol (e.g., TCP or UDP), (4) source port number and (5) destination port number. The PCRF applies the policy to this vector to generate a set of policy rules. For example, the policy may specify the charge and QoS to be applied to a call between the IP addresses and port

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numbers contained in the vector. The resulting rules will contain the five tuple vector as the subject part and the appropriate charging and QoS actions in the action part. The PCRF installs the policy rules into the traffic node at which the rules will be enforced. If the addresses/port numbers of a packet passing through the enforcement node match the filter part of a rule, the action specified at that rule is carried out. The traffic node is referred to as the Policy Enforcement Function (PEF) and, in the case of a cellular network incorporating GPRS, is usually located in a GPRS Gateway Support Node (GGSN), or an evolution of the GGSN.

Flexible Bearer Charging (FBC) and Service Based Local Policy are two policy control architectures defined in 3GPP Rel-6 (TS 23.125 and TS 23.207 respectively). The two architectures are being harmonised for 3GPP Rel-7 into one Policy and Charging Control (PCC) architecture, in line with the evolution direction set out in TR 23.803. The policy functionality is distributed in the network across a number of entities: the Application Function (AF), the Policy Control and Charging Rules Function (PCRF), and the Gateway (GW), as shown in Figure 3 of the accompanying drawings (from TR 23.803).

For Rel-6 policy control over Go the binding mechanism uses an Authorization Token and one or more Flow Identifiers. An important role for the token is to provide address information to the GGSN (GW) for finding the Policy Decision Function (PDF) that issued the token, thus being the node to contact for seeking authorization for the flows described by the Flow Identifiers. The Rel-6 Flow Based Charging architecture ensures that both the Traffic Plane Function (TPF) (in the GW) and an AF, which requires information being provided to the Charging Rules Function (CRF) for the user session, contacts the same CRF. For Flow Based Charging, the TPF contacts the CRF based on access point the UE connects to (i.e. Access Point Name, APN) and the AF contacts the CRF based on the end user (IP) address as experienced at the AF.

The Rel-7 PCC will re-use the Rel-6 FBC TPF to CRF addressing mechanism of Flow Based Charging for the GW to PCRF addressing. As the Flow Based Charging solves the problem of the AF finding the same CRF that the TPF contacts, the Rel-7 AF will re-use the Rel-6 AF to CRF addressing mechanism of Flow Based Charging for the AF

to PCRF addressing. It is therefore the GW that will select the PCRF to be serving the UE, and the AF will ensure that it provides its authorisations to the same serving PCRF.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a method of registering a mobile node of a telecommunications network to a subsystem of the network, the network having at least one node for maintaining or having access to policy and charging rules for users of the network and at least one node for enforcement of the policy and charging rules to traffic flows, the method comprising receiving a registration request message from the mobile node at a proxy node of the network, selecting a candidate policy and charging rules node for the mobile node, determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, and performing subsequent steps of the registration procedure in dependence on the determination.

The network may be a Universal Mobile Telecommunications System.

The mobile node may be a User Equipment of the Universal Mobile Telecommunications System.

The or each policy and charging rules node may comprise a Policy and Charging Rules Function of the Universal Mobile Telecommunications System.

The or each policy and charging rules enforcement node may comprise a Gateway Node of the Universal Mobile Telecommunications System, such as a Gateway GPRS Support Node.

The proxy node may comprise an Application Function of the Universal Mobile Telecommunications System.

The proxy node may comprise a Proxy Call Session Control Function of the Universal Mobile Telecommunications System.

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The subsystem may be an IP Multimedia Subsystem.

The determining step may comprise sending a validation request from the proxy node to the candidate policy and charging rules node comprising information for use by the candidate policy and charging rules node in determining whether it has already been selected by a policy and charging rules enforcement node to serve the mobile node, and basing the determination on a reply received from the candidate policy and charging rules node.

The validation request may be sent as part of an Application Function session between the proxy node and the candidate policy and charging rules node.

The information may comprise an IP address of the mobile node.

The method may comprise checking whether the IP address of the mobile node is already stored in the candidate policy and charging rules node.

The method may comprise, if it is determined that the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, continuing with steps to register the mobile node to the subsystem.

The method may comprise, if it is determined that the candidate policy and charging rules node has not already been selected by a policy and charging rules enforcement node to serve the mobile node, performing the selecting and determining steps again for one or more further candidate policy and charging rules node either until one is selected for which it is determined that it has already been selected by a policy and charging rules enforcement node to serve the mobile node or until there are no further candidates to select.

The method may comprise, if no candidate policy and charging rules node is selected for which it is determined that it has already been selected by a policy and charging

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rules enforcement node to serve the mobile node, rejecting the request to register the mobile node to the subsystem, at least in respect of the participating proxy node.

The method may comprise performing the steps again for a further proxy node.

According to a second aspect of the present invention there is provided an apparatus for use in registering a mobile node of a telecommunications network to a subsystem of the network, the network having at least one node for maintaining or having access to policy and charging rules for users of the network and at least one node for enforcement of the policy and charging rules to traffic flows, the apparatus comprising means for receiving a registration request message from the mobile node, means for selecting a candidate policy and charging rules node for the mobile node, means for determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, and means for performing subsequent steps of the registration procedure in dependence on the determination.

According to a third aspect of the present invention there is provided a method for use by an apparatus as part of a method of registering a mobile node of a telecommunications network to a subsystem of the network, the apparatus being one of at least one node of the network for maintaining or having access to policy and charging rules for users of the network and the network having at least one node for enforcement of the policy and charging rules to traffic flows, the method comprising, following receipt at a proxy node of the network of a registration request message from the mobile node and the selection of the apparatus as a candidate policy and charging rules node for the mobile node, determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, such that subsequent steps of the registration procedure can be performed in dependence on the determination.

According to a fourth aspect of the present invention there is provided an apparatus for use in a method of registering a mobile node of a telecommunications network to a subsystem of the network, the apparatus being one of at least one node for maintaining

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or having access to policy and charging rules for users of the network and the network having at least one node for enforcement of the policy and charging rules to traffic flows, the apparatus comprising means for determining, following the receipt at a proxy node of the network of a registration request message from the mobile node and the

5   selection of the apparatus as a candidate policy and charging rules node for the mobile node, whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, such that subsequent steps of the registration procedure can be performed in dependence on the determination.

10   According to a fifth aspect of the present invention there is provided an operating program which, when run on an apparatus, causes the apparatus to carry out a method according to the first or third aspect of the present invention.

According to a sixth aspect of the present invention there is provided an operating program which, when loaded into an apparatus, causes the apparatus to become

15   apparatus according to the second or fourth aspect of the present invention.

The operating program may be carried on a carrier medium. The carrier medium may be a transmission medium. The carrier medium may be a storage medium.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1, discussed hereinbefore, is a schematic diagram illustrating parts of a UMTS

20   network;

Figure 2, also discussed hereinbefore, illustrates schematically the integration of an IP Multimedia Subsystem into a 3G mobile communications system;

Figure 3, also discussed hereinbefore, illustrates schematically the network entities

25   proposed to handle policy functionality in 3GPP Rel-7;

Figure 4 schematically illustrates signalling flow according to an embodiment of the present invention in the case of successful IMS registration; and

Figure 5 schematically illustrates signalling flow according to an embodiment of the present invention in the case of unsuccessful IMS registration.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5   The present applicants have appreciated that above-described proposed 3GPP Rel-7 Policy and Charging Control (PCC) architecture specifications are missing aspects of redundancy to allow the entities implementing the policy control functions to pass responsibility over to alternative entities either due to failure of such entities or loss of communication between them.

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The proposed specifications do not ensure that the P-CSCF discovered and selected for the UE to communicate with the IMS is the one able to act as an AF for the UE for the purposes of policy and charging control. As a result, the UE may successfully register to the IMS, but may later be prevented from using the IMS services when it attempts to

15   invoke a service if the P-CSCF has selected a PCRF entity different from the PCRF entity serving the UE.

As a consequence of using an embodiment of the present invention, it is generally ensured, at the time the UE attempts to register to the IMS, that the P-CSCF is able to

20   communicate with the correct PCRF entity serving the UE. This may be achieved by arranging for the P-CSCF to check with the selected PCRF that it is the correct one. The basic mechanism is for the P-CSCF that is discovered and selected by the UE to determine, at the time the UE is registering to the IMS, whether the PCRF entity the P-CSCF selects for the UE is the one already serving the UE.

25   This concept will now be described in more detail with reference to Figures 4 and 5. Figure 4 illustrates a UE 4, a Gateway (GW) 10, a P-CSCF 12, and a PCRF 13-1, with the rest of the IMS being represented by the part labelled 15. Figure 5 shows many of the same parts as Figure 4, except that two different PCRFs 13-1 and 13-2 are shown, while the rest of the IMS 15 is not shown. The signalling flow shown in Figure 4 is for

30   use in illustrating a case where registration to the IMS is ultimately successful, while the

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signalling flow shown in Figure 5 is for use in illustrating a case where registration to the IMS is ultimately unsuccessful.

Reference will now be made to Figure 4 to describe an example of successful IMS registration according to an embodiment of the present invention.

5   Step 1 of Figure 4

The UE 4 sends a bearer request for use by the IMS signalling.

Step 2 of Figure 4

The GW 10 may allocate an IP address to the UE 4, if not already allocated. The GW 10 selects one of the PCRF entities to serve the UE 4; in this example it selects the

10   PCRF 13-1.

Step 3 of Figure 4

The GW 10 sends an authorisation request to the PCRF 13-1, including the IP address ofthe UE 4.

Step 4 of Figure 4

15   The PCRF 13-1 may create a state for the UE 4 and store its IP address, if not already created. The PCRF 13-1 authorises the bearer and its usage for IMS signalling according to a pre-configured policy. The PCRF 13-1 determines relevant PCC rules for the IMS signalling.

Step 5 of Figure 4

20   The PCRF 13-1 sends a successful authorisation response with the PCC rules for the IMS signalling.

Step 6 of Figure 4

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The GW 10 sends a successful bearer response to the UE 4.

Step 7 of Figure 4

The UE 4 discovers and selects the P-CSCF 12, and attempts to register to the IMS by sending a registration request (SIP REGISTER message) to the P-CSCF 12.

5   (Steps 1 to 7 of Figure 4 are steps that can be carried out according to previously-proposed mechanisms.)

Step 8 of Figure 4

When the P-CSCF 12 receives the registration request, it identifies from the request the IP address of the UE 4 attempting to register. The P-CSCF 12 selects one of the PCRF

10   entities configured for the IP address, in this case the PCRF 13-1, and decides to check the validity of the selection.

(Selecting the PCRF entity at this point and deciding to check the validity of the selection has not been previously proposed.)

Step 9 of Figure 4

15   The P-CSCF 12 sends a validation request to the selected PCRF 13-1 including the IP address identified in Step 8 of Figure 4. As different implementation options, the validation request may either initiate a stand-alone transaction (unrelated to an AF session), or a new AF session. When an AF session is used for the validation, the P-CSCF 12 may create an association between this AF session and the IMS registration

20   and/or the IMS signalling flow in the user plane.

(This step has not been previously proposed.)

Step 10 of Figure 4

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The PCRF 13-1 checks if it is serving this IP address. In this example, the result is successful.

(This step has not been previously proposed.)

Step 11 of Figure 4

5   The PCRF 13-1 sends a successiul validation response to the P-CSCF 12.

(This step has not been previously proposed.)

Steps 12 to 14 of Figure 4

Successiul registration to the IMS is concluded according to previously-proposed mechanisms.

10   Reference will now be made to Figure 5 to describe an example of unsuccessful IMS registration according to an embodiment of the present invention.

Steps 1 to 7 of Figure 5

These steps are the same as Steps 1 to 7 of Figure 4 described above.

Step 8 of Figure 5

15   When the P-CSCF 12 receives the registration request, it identifies from the request the IP address of the UE 4 attempting to register. The P-CSCF 12 selects one of the PCRF entities configured for the IP address, in this case the PCRF 13-2, and decides to check the validity of the selection.

(Selecting the PCRF entity at this point and deciding to check the validity of the
20   selection has not been previously proposed.)

Step 9 of Figure 5

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The P-CSCF 12 sends a validation request to the selected PCRF 13-2 including the IP address identified in Step 8 of Figure 5. As different implementation options, the validation request may either initiate a stand-alone transaction (unrelated to an AF session), or a new AF session. When an AF session is used for the validation, the P-CSCF 12 may create an association between this AF session and the IMS registration and/or the IMS signalling flow in the user plane.

(This step has not been previously proposed.)

Step 10 of Figure 5

The PCRF 13-2 checks if it is serving this IP address. In this example, the result is unsuccessful because the selected PCRF 13-2 is not serving the UE 4.

(This step has not been previously proposed.)

Step 11 of Figure 5

The PCRF 13-2 sends a failed validation response to the P-CSCF 12.

(This step has not been previously proposed.)

Step 12 of Figure 5

Upon receipt of the failed validation response, the P-CSCF 12 may select another PCRF entity, if more than one is configured for the UE 4, and may re-attempt the validation, performing Steps 9 to 12 of Figure 5 again for a different PCRF entity. This would continue until either a successful validation response is received (in which case Steps 12 to 14 of Figure 4 could be performed) or until it is determined that no more PCRF entities can be identified. In this particular example, the result is unsuccessful.

(This step has not been previously proposed.)

Step 13 of Figure 5

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The P-CSCF 12 sends a failed registration response to the UE 4 as a result of the failed validation.

(This step has not been previously proposed.)

Step 14 of Figure 5

5   The UE 4 may select another P-CSCF entity and re-attempt registration to the IMS.

One advantage of an embodiment of the present invention is the improved registration procedure, during which it is ensured that the policy control entities are correctly selected and addressed, avoiding otherwise possible IMS service rejections.

Another advantage is the possibility for the P-CSCF to be notified when IMS signalling
10   flow between the UE and the GW is adversely affected, and therefore the possibility for the IMS to take appropriate actions in such conditions. This advantage is related to the second option described above in connection with Step 9 of Figures 4 and 5, in which an AF session is created between the P-CSCF and the PCRF at IMS registration. The IP flows authorised by the P-CSCF for this AF session correspond to the SIP signalling
15   flows between the UE and the P-CSCF. This AF session will exist for the duration of the registration. Since an AF session is also a framework for the PCRF to notify an AF (here, the P-CSCF) of the loss of the bearer that carries the authorised flows, this option opens up the possibility for the P-CSCF to know when its SIP signalling flows are affected.

20   Although the above embodiments have been described in the context of UMTS and IMS, it will be appreciated that the same scheme can be implemented in a telecommunications network corresponding to UMTS having a subsystem of the network corresponding to IMS to which a mobile node would require registration. In the same way that UMTS/IMS does, such a network would have at least one node for
25   maintaining or having access to policy and charging rules for users of the network (corresponding to the PCRFs as described above), at least one node for enforcement of the policy and charging rules to traffic flows (corresponding to the GWs as described

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above), and at least one proxy node (corresponding to the P-CSCFs as described above). The method would generally comprise receiving a registration request message from the mobile node at a proxy node of the network, selecting a candidate policy and charging rules node for the mobile node, determining whether the candidate policy and charging

5   rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, and performing subsequent steps of the registration procedure in dependence on the determination.

It will be appreciated that operation of one or more of the above-described components can be controlled by a program operating on the device or apparatus. Such an operating

10 program can be stored on a computer-readable medium, or could, for example, be embodied in a signal such as a downloadable data signal provided from an Internet website. The appended claims are to be interpreted as covering an operating program by itself, or as a record on a carrier, or as a signal, or in any other form.

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WHAT IS CLAIMED IS:

1.   A method of registering a mobile node of a telecommunications network to a subsystem of the network, the network having at least one node for maintaining or having access to policy and charging rules for users of the network and at least one node for enforcement of the policy and charging rules to traffic flows, the method comprising receiving a registration request message from the mobile node at a proxy node of the network, selecting a candidate policy and charging rules node for the mobile node, determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, and performing subsequent steps of the registration procedure in dependence on the determination.

2.   A method as claimed in any preceding claim, wherein the network is a Universal Mobile Telecommunications System.

3.   A method as claimed in claim 2, wherein the mobile node is a User Equipment of the Universal Mobile Telecommunications System.

4.   A method as claimed in claim 2 or 3, wherein the or each policy and charging rules node comprises a Policy and Charging Rules Function of the Universal Mobile Telecommunications System.

5.   A method as claimed in claim 2, 3 or 4, wherein the or each policy and charging rules enforcement node comprises a Gateway Node of the Universal Mobile Telecommunications System, such as a Gateway GPRS Support Node.

6.   A method as claimed in any one of claims 2 to 5, wherein the proxy node comprises an Application Function of the Universal Mobile Telecommunications System.

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7.   A method as claimed in any one of claims 2 to 6, wherein the proxy node comprises a Proxy Call Session Control Function of the Universal Mobile Telecommunications System.

8.   A method as claimed in any one of claims 2 to 7, wherein the subsystem is an IP Multimedia Subsystem.

9.   A method as claimed in any preceding claim, wherein the determining step comprises sending a validation request from the proxy node to the candidate policy and charging rules node comprising information for use by the candidate policy and charging rules node in determining whether it has already been selected by a policy and charging rules enforcement node to serve the mobile node, and basing the determination on a reply received from the candidate policy and charging rules node.

10.   A method as claimed in claim 9, wherein the validation request is sent as part of an Application Function session between the proxy node and the candidate policy and charging rules node.

11.   A method as claimed in claim 9 or 10, wherein the information comprises an IP address of the mobile node.

12.   A method as claimed in claim 11, comprising checking whether the IP address of the mobile node is already stored in the candidate policy and charging rules node.

13.   A method as claimed in any preceding claim, comprising, if it is determined that the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, continuing with steps to register the mobile node to the subsystem.

14.   A method as claimed in any preceding claim, comprising, if it is determined that the candidate policy and charging rules node has not already been selected by a policy and charging rules enforcement node to serve the mobile node, performing the selecting and determining steps again for one or more further candidate policy and charging rules

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node either until one is selected for which it is determined that it has already been selected by a policy and charging rules enforcement node to serve the mobile node or until there are no further candidates to select.

15.   A method as claimed in any preceding claim, comprising, if no candidate policy and charging rules node is selected for which it is determined that it has already been selected by a policy and charging rules enforcement node to serve the mobile node, rejecting the request to register the mobile node to the subsystem, at least in respect of the participating proxy node.

16.   A method as claimed in claim 15, comprising performing the steps again for a further proxy node.

17.   An apparatus for use in registering a mobile node of a telecommunications network to a subsystem of the network, the network having at least one node for maintaining or having access to policy and charging rules for users of the network and at least one node for enforcement of the policy and charging rules to traffic flows, the apparatus comprising means for receiving a registration request message from the mobile node, means for selecting a candidate policy and charging rules node for the mobile node, means for determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, and means for performing subsequent steps of the registration procedure in dependence on the determination.

18.   A method for use by an apparatus as part of a method of registering a mobile node of a telecommunications network to a subsystem of the network, the apparatus being one of at least one node of the network for maintaining or having access to policy and charging rules for users of the network and the network having at least one node for enforcement of the policy and charging rules to traffic flows, the method comprising, following receipt at a proxy node of the network of a registration request message from the mobile node and the selection of the apparatus as a candidate policy and charging rules node for the mobile node, determining whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to

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serve the mobile node, such that subsequent steps of the registration procedure can be performed in dependence on the determination.

19.   An apparatus for use in a method of registering a mobile node of a telecommunications network to a subsystem of the network, the apparatus being one of at least one node for maintaining or having access to policy and charging rules for users of the network and the network having at least one node for enforcement of the policy and charging rules to traffic flows, the apparatus comprising means for determining, following the receipt at a proxy node of the network of a registration request message from the mobile node and the selection of the apparatus as a candidate policy and charging rules node for the mobile node, whether the candidate policy and charging rules node has already been selected by a policy and charging rules enforcement node to serve the mobile node, such that subsequent steps of the registration procedure can be performed in dependence on the determination.

20.   An operating program which, when run on an apparatus, causes the apparatus to carry out a method as claimed in any one of claims 1 to 16 and 18.

21.   An operating program which, when loaded into an apparatus, causes the apparatus to become an apparatus as claimed in claim 17 or 19.

22.   An operating program as claimed in claim 20 or 21, carried on a carrier medium.

23.   An operating program as claimed in claim 22, wherein the carrier medium is a transmission medium.

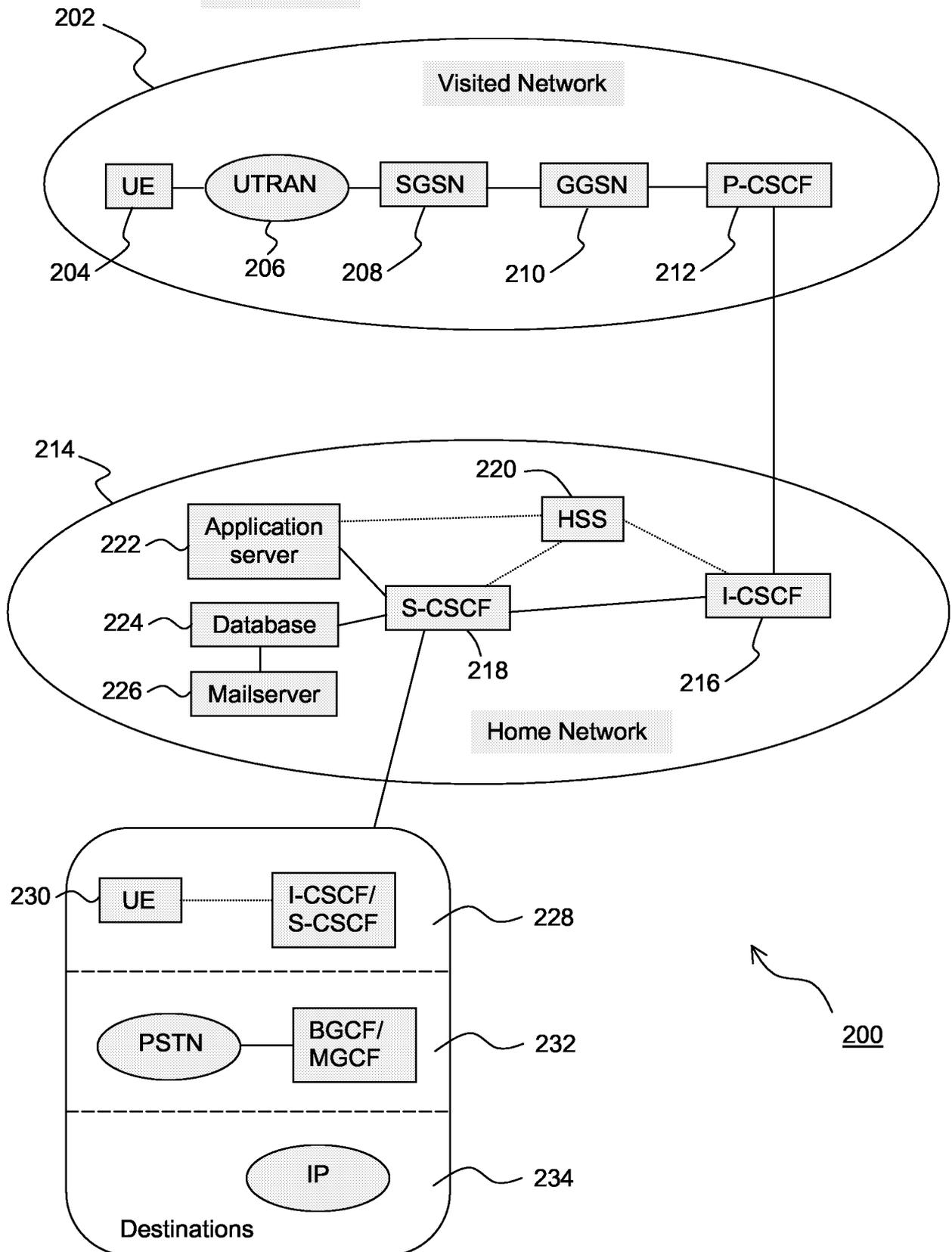24.   An operating program as claimed in claim 22, wherein the carrier medium is a storage medium.
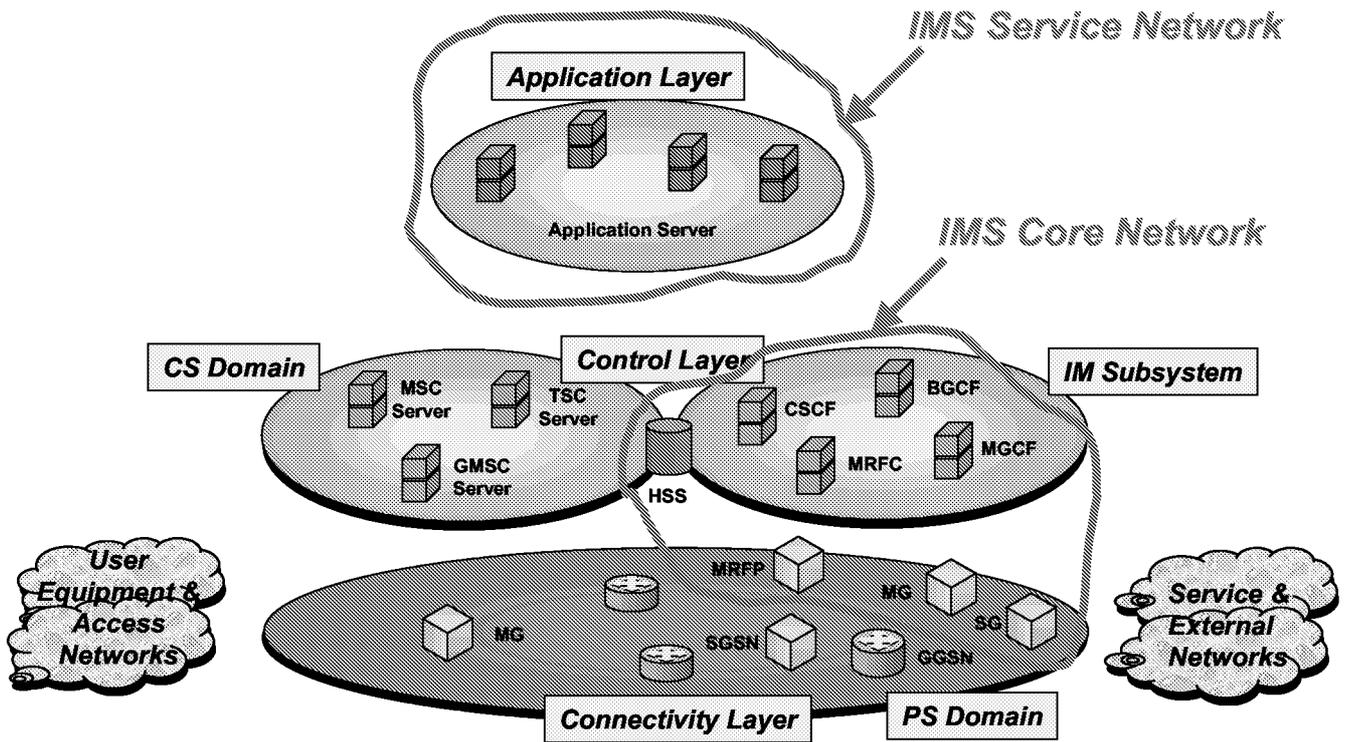
FIG. 1

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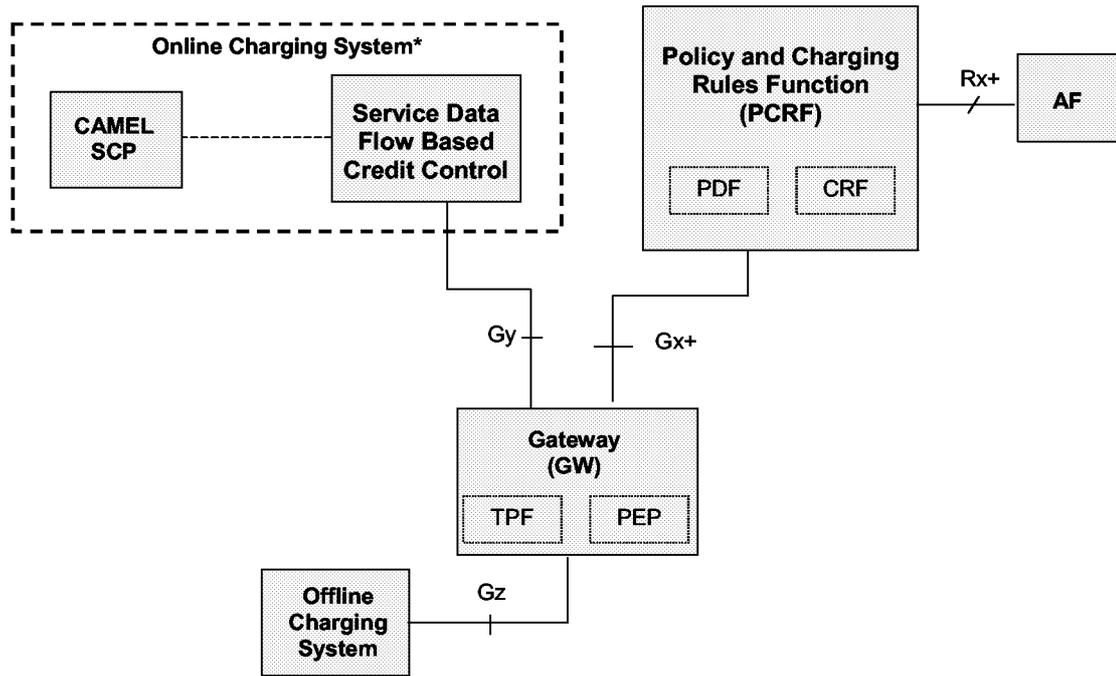Visited Network

| UE | — UTRAN — | SGSN | — | GGSN | — | P-CSCF |

204   206   208   210   212

214

220

222   Application server   HSS

224   Database   S-CSCF   I-CSCF

226   Mailserver   218   216

Home Network

228

230   UE · · · · · I-CSCF/ S-CSCF

232   PSTN — BGCF/ MGCF

234   IP

Destinations

200

FIG. 2

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FIG. 3

FIG. 4

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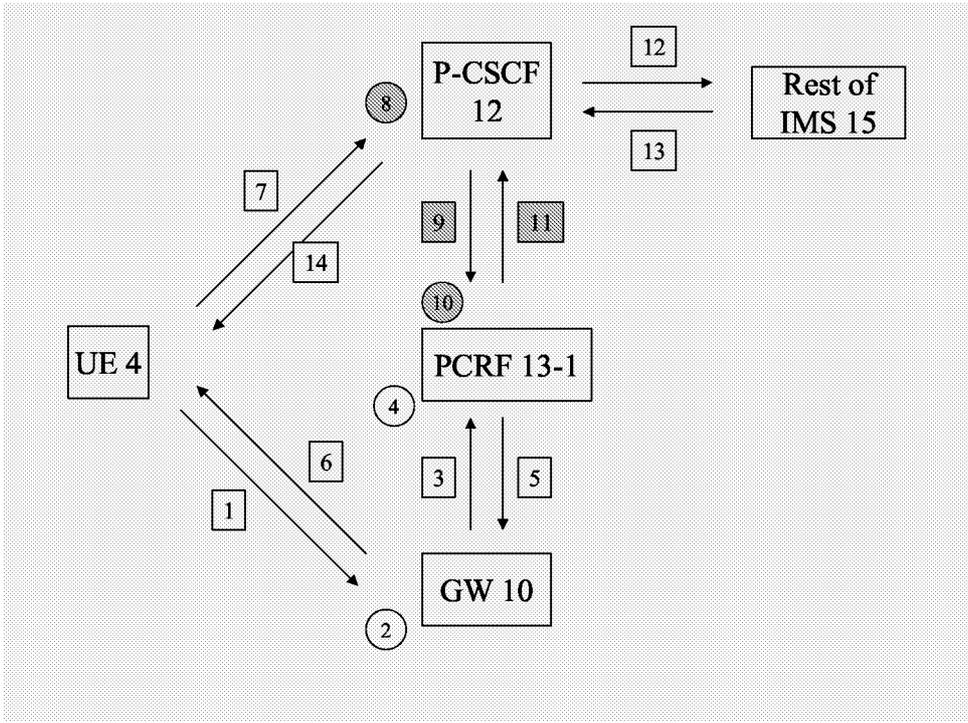
FIG. 5

INTERNATIONAL SEARCH REPORT

A CLASSIFICATION OF SUBJECT MATTER
INV . H04Q7/38

According b International Patent Classification (IPC) or to both national classif cation and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04Q H04L

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

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

EPO-Internal , WPI Data

C DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication where appropriate of the relevant passages	Relevant to claim No
A	THIRD GENERATION PARTNERSHIP PROJECT, 3GPP: "TS 23.203, Policy and charging control architecture, Release 7"[Onl me] January 2006 (2006-01), XP002408127 Retrieved from the Internet: L)RL: www.3gpp.org> [retrieved on 2006-11-17] paragraph [4.2.1] - paragraph [6.1.0] paragraph [6.2.1] - paragraph [7.3.2] ———— -/-	1-24

X	Further documents are listed in the continuation of Box C	**D** See patent family annex

* Special categories of cited documents

'A document defining the general state of the art which is not considered b be of particular relevance

E earlier document but published on or after the international filing date

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

O[1] document referring to an oral disclosure, use, exhibition or other means

P document published pnor 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 trie 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 εtθp when the document is combined with one or more other such docu¬ ments such combination being obvious to a person skilled in the art

[1]& document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international ssarch raport
20 November 2006	04/12/2006

Name and mailing address of the ISA/ European Patent Office, P B 5B18 Patentlaan 2 NL - 2280 HV Rijεwijk Tel (+31-70) 340-20-40 Tx 31 651 epo nl Fax (+31-70) 340-3016	Authorized officer Lombardi , Giuseppe

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"Digital cellular telecommunications system (Phase 2+)" ETSI STANDARDS, EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE, SOPHIA-ANTIPO, FR, vol. 3-CN1, no. V5150, December 2005 (2005-12), XP014032498 ISSN: 0000-0001 paragraph [5.1.1] - paragraph [5.8.5] paragraph [9.2.1] - paragraph [9.2.5]	1-24
A	THIRD GENERATION PARTNERSHIP PROJECT, 3GPP: "TR 23.803, evolution of policy control and charging, Release 7"[Online] September 2005 (2005-09), XP002408128 Retrieved from the Internet: URL:www.3gpp.org> [retrieved on 2006-11-17] paragraph [4.1.1] - paragraph [6.1.5]	1-24