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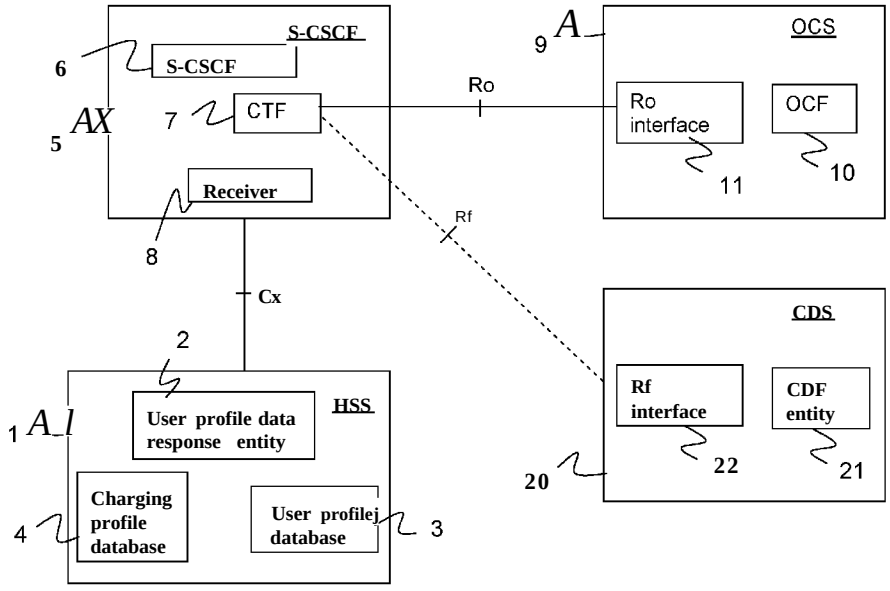


Figure 7

(57) Abstract: Apparatus for use within an IP Multimedia Subsystem network and comprising a receiver for receiving for a given user a charging type defining whether the user is a pre-paid user and or a post-paid user. The apparatus further comprises a Charging Triggering Function, CTF, entity for sending accounting information messages relating to said user to an Online Charging Function over an Ro interface or to a Charging Data Function over an Rf interface, and for including with the accounting information messages said charging type.

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Charging Decisions in an IP Multimedia Subsystem

Technical Field

The present invention relates to charging decisions in an IP Multimedia Subsystem and in particular to such decisions made in respect of how subscribers will be charged for making use of IP Multimedia Subsystem services.

Background

IP Multimedia (IPMM) services provide a combination of voice, video, messaging, data, etc, within the same session. As the number of basic applications and the media which it is possible to combine increases, the number of services offered to the end users will grow, and the potential for enriching inter-personal communication experience will be improved. This leads to a new generation of personalised, rich multimedia communication services, including so-called "combinational IP Multimedia" services.

IMS is the technology defined by the Third Generation Partnership Project (3GPP) to provide IP Multimedia services over mobile communication networks. IMS provides features to enhance the end-user person-to-person communication experience through the integration and interaction of services. IMS allows enhanced person-to-person (client-to-client) as well as person-to-content (client-to-server) communications over an IP-based network. 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 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. Other protocols are used for media transmission and control, such as Real-time Transport Protocol and Real-time Transport Control Protocol (RTP/RTCP).

Within an IMS network, Call Session Control Functions (CSCFs) perform processing and routing of signalling. CSCFs handle session establishment, modification and release of IP multimedia sessions using the SIP/SDP protocol suite. 3GPP TS23.228 describes the logical nodes P-CSCF, I-CSCF, S-CSCF, E-CSCF and BGCF. The S-CSCF conforms to 3GPP TS 24.229 and performs session control services for User Equipments (UEs). It maintains the session state to support the services, and performs

the following functions:

it acts as a registrar according to [RFC3261] at registration;

it notifies subscribers about registration changes;

it provides session control for the registered users' sessions;

it handles SIP requests, and either services these internally or forwards them on to a further node; and

it interacts with IMS Application Servers.

The S-CSCF performs SIP routing according to 3GPP routing procedures.

The S-CSCF may further act as a Charging Triggering Function (CTF), according to the principles outlined in the corresponding technical specifications, [TS 32.260] and [TS 32.299] and therefore supports charging for users making use of IMS infrastructure and services. Fulfilling the role of CTF in an IMS network requires a number of actions in the S-CSCF in order to identify the corresponding signalling event triggered by a UE activity. The S-CSCF, when performing the normal routing actions for the SIP signalling events it is handling, determines whether the SIP information represents a chargeable activity and, if so, which type of charging mechanism to apply. In a modification to this architecture, the CTF may implemented in an Application Server with which the S-CSCF communicates over the ISC interface.

The IMS architecture provides for two distinct charging models: offline charging, and online charging. Both online and offline charging involve the sending of accounting information to some centralised charging node for collection and processing.

In order to implement a pre-paid subscription model, online charging is required. Typically, a subscriber purchases a number of credits from an operator. If a SIP session is initiated by a SIP request sent from the subscriber's UE to the S-CSCF, the S-CSCF either makes use of an internal CTF module or contacts an Application Server implementing a CTF. The CTF node detects whether the requested session is subject to a charge or not. If the requested session is subject to a charge, the CTF node contacts an Online Charging Function (OCF) implemented within an Online Charging System (OCS) node in which the subscriber's current credit is stored. If the subscriber's account holds sufficient credit for the SIP request to be granted, the OCF replies accordingly to the CTF, which grants the request. Similarly, if insufficient credit is available, the SIP request may be turned down, or the session may be granted subject to a limited duration.

The CTF (either as a standalone node or as an internal module within the S-CSCF) and OCF implement the online charging functionalities for the IMS architecture. Communication between the CTF and OCF nodes takes place over the Ro interface described in 3GPP TS32.299, and is governed by the DIAMETER protocol. Specifically, the CTF sends DIAMETER Credit Control Request (CCR) messages, while the OCS replies in DIAMETER Credit Control Answer (CCA) messages. These messages are specified in RFC 4006. The OCF uses the accounting information received over the Ro interface to generate Call Data Records (CDRs) and sends these onwards to a centralised billing system.

Figure 1 illustrates the online charging architecture for an IMS network in the case where the CTF is implemented within a standalone node (AS). As illustrated in the Figure, other nodes within the IMS network may also communicate with the OCF over the Ro interface.

In the case of offline charging within an IMS network, SIP network entities including the S-CSCF that are involved in a session use the Diameter Rf interface to send accounting information, generated by associated CTFs, to a Charging Data Function (CDF). The CDF uses the received accounting information to generate CDRs, and sends these to a Charging Gateway Function (CGF) over the GTP-based Ga interface. The CGF acts as a gateway between the IMS network and the billing domain, communicating with the billing domain over the Bi interface. This offline charging architecture is illustrated in Figure 2.

Figures 3 and 4 illustrate respectively signalling flows for the online and offline charging architectures, where in both cases the charging activity is associated with a call request initiated by a User Equipment (UE) sending a SIP INVITE to the IMS network. It will be appreciated that not all nodes involved in the process are shown. In the case of the online charging mechanism, the S-CSCF exchanges Credit Control Requests (CCRs) and Credit Control Answers (CCAs) with the OCF over the Ro interface, whilst in the case of the offline charging mechanism, the S-CSCF exchanges Accounting Requests (ACRs) and Accounting Answers (ACAs) with the CDF.

Many developing countries deploying IMS architectures rely exclusively on an online charging infrastructure, primarily because the technical infrastructure for setting up an online charging system for an IMS architecture is not as complex and costly as the technical infrastructure needed for setting up an offline charging system. Nonetheless,

even operators of online only charging network architectures may want to handle post-paid as well as pre-paid subscribers. In some cases, operators of an offline only charging network may want to handle pre-paid as well as post-paid subscribers.

Summary

According to a first aspect of the present invention there is provided apparatus for use within an IP Multimedia Subsystem network and comprising a receiver for receiving for a given user a charging type defining whether the user is a pre-paid user and or a post-paid user. The apparatus further comprises a Charging Triggering Function, CTF, entity for sending accounting information messages relating to said user to an Online Charging Function over an Ro interface or to a Charging Data Function over an Rf interface, and for including with the accounting information messages said charging type.

At least certain embodiments of the invention can improve the flexibility with which charging can be applied in a given operator's network. For example, an operator implementing only an online, Ro, interface, may be able to employ both pre-paid and post-paid charging in its network.

The receiver within the apparatus may be configured to receive said charging type at IMS registration of the user or at another user profile retrieval point.

The charging type may define the user as one of a pre-paid user, a post-paid user, or another category of user.

According to a second aspect of the present invention there is provided apparatus for use within an IP Multimedia Subsystem network and comprising an online charging function entity for generating Call Data Records and for sending these to a domain billing system. The apparatus further comprises an Ro interface for receiving from a Charging Triggering Function, CTF, accounting information messages containing a charging type defining whether the user is a pre-paid user and or a post-paid user, wherein the online charging function entity is configured to perform billing based upon the charging type contained within a received accounting message.

According to a third aspect of the present invention there is provided apparatus for use within an IP Multimedia Subsystem network and comprising a charging data function

entity for generating Call Data Records and for sending these to a domain billing system. The apparatus further comprises an Rf interface for receiving from a Charging Triggering Function, CTF, accounting information messages containing a charging type defining whether the user is a pre-paid user and or a post-paid user, wherein the charging data function entity is configured to perform billing based upon the charging type contained within a received accounting message.

According to a fourth aspect of the present invention there is provided apparatus for use within an IP Multimedia Subsystem network and comprising a charging profile database configured to contain one or more addresses for online charging systems within the IP Multimedia Subsystem network. The apparatus further comprises a user profile database configured to contain, for each of a set of users, user profile data including a pointer to an online charging address, and a charging type defining whether the user is a pre-paid user, a post-paid user, and or another category of user, and a user profile data response entity for sending to a requesting entity within the IMS network, over a Cx or Sh interface, the user profile data including said charging type.

This apparatus may be configured to operate as a Home Subscriber Server.

According to a fifth aspect of the present invention there is provided a method of handling charging for a user within an IP Multimedia Subsystem network. The method comprises maintaining within a Home subscriber Server, HSS, profile data for each of a set of IMS users, the profile data including for the associated user a charging type defining whether the user is a pre-paid user, a post-paid user, and or another category of user and, for a given user, sending the profile data from the HSS to a Charging Triggering Function, CTF. The method further comprises, at the CTF, including the charging type in accounting messages associated with the user sent to an online charging function over the Ro interface or to a charging data function over the Rf interface, and, at the online charging function or charging data function, handling charging for the user in dependence upon the charging type.

Brief Description of the Drawings

Figure 1 illustrates schematically an IMS online charging architecture;
Figure 2 illustrates schematically an IMS offline charging architecture;
Figure 3 is a partial signalling flow for a call set up procedure in the online charging architecture of Figure 1;

Figure 4 is a partial signalling flow for a call set up procedure in the offline charging architecture of Figure 2;

Figure 5 is a signalling flow for a user IMS registration process and which allows the HSS to provision to the CTF (co-located with an S-CSCF) a subscriber charging type;

Figure 6 is a partial signalling flow for a call set up procedure in the online charging architecture and according to which a CTF (in S-CSCF) sends a subscriber charging type to an OCS over the Rf interface;

Figure 7 illustrates schematically an IMS charging architecture comprising an OCS and, additionally or alternatively, a CDS; and

Figure 8 is a flow diagram illustrating a method of handling charging with an IMS charging architecture.

Detailed Description

Within an IP Multimedia Subsystem (IMS) network of a wireless network operator's domain, subscriber data for IMS subscribers is provisioned in the Home Subscriber Server (HSS). In particular, for each subscriber, the provisioned data includes a "pointer" or identity of a charging address profile maintained within the HSS. A charging address profile will include one or both of an Event Charging Function (ECF) parameter which is the address of the relevant OCS within the operator's domain and a CDF address (e.g. FQDN) for the relevant CDF within the operator's domain (possibly primary and secondary addresses for both ECF and CDF). Normally, post-paid subscribers are associated with offline charging and pre-paid subscribers with online charging, but online charging can also be used for post-paid subscribers, for example to achieve spending control.

For operators that only have charging systems supporting online charging (i.e. where the network infrastructure provides an OCF accessed by the IMS over the Ro interface but not a CDF accessed over the Rf interface), it might be desirable to facilitate both pre-paid and post-paid services using online charging handled over the Ro-interface. However, in current deployments, this is problematic as there is no indication in the IMS user profile as to whether the subscriber is a pre-paid or a post-paid subscriber. Rather, if the subscriber's profile points to a charging address profile containing an ECF address, the subscriber is assumed to be a pre-paid subscriber and if his or her profile points to a charging profile containing a CDF address, the subscriber is assumed to be a post-paid subscriber.

To address this deficiency, it is proposed here to include within a subscriber's profile, as stored in the HSS, the logical meaning of the subscriber's charging type (pre-paid, post-paid) in addition to a pointer to the (online) charging address profile. When a user registers with the IMS, the user's profile data including the charging type will be downloaded from the HSS into the Serving Call Session Control Function (S-CSCF). At a charging event, the Charging Triggering Function (CTF), implemented within the S-CSCF or as a standalone Application Server coupled to the S-CSCF over the ISC interface, is able to send the charging type in a Credit Control Request (CCR) message sent to the OCF/OCS over the Ro interface. [NB. Use of the Rf interface for this purpose is discussed below.] Of course, the subscriber profile data may be downloaded to the S-CSCF at events other than IMS registration, e.g. a terminating call for an unregistered subscriber. Furthermore, the profile data may be obtained by nodes other than the S-CSCF, e.g. other CSCF, AS, or MRFC.

A node possessing the new subscriber charging type may be able to make decisions for a subscriber based upon the charging type. These decisions may relate, for example, to actions such as terminate (e.g. the Credit Control Request is regarded as failed and the SIP dialog or transaction is terminated), continue (e.g. the S-CSCF sees the service as granted and will continue without further request), retry and terminate or store for later processing etc, for the specific subscriber charging session.

Considering the proposal in more detail, the user profile for a subscriber stored in the HSS is extended with a subscriber charging type that defines whether the user is a pre-paid or post-paid subscriber. The charging type may further define, as a third type, a subscriber for which no charging is applied. The user profile is downloaded to the S-CSCF over the Cx interface during IMS registration of the user, or can be fetched via the Sh interface. This procedure is illustrated in Figure 5, for the case where the CTF is co-located with the S-CSCF. The subscriber charging type can be carried in the XML part of the user profile (Sh case) or as separate new Attribute Value Pair (AVP) (Cx case). The S-CSCF may also include the subscriber charging type in messages (e.g. a SIP INVITE) sent over the ISC interface in order to inform other nodes of the charging type.

Considering the XML part (Sh case), the Charging-Information is of type Grouped, and contains the addresses of the charging functions. This group is extended with the new user profile data described above, i.e.:

Charging-Information :: = < AVP Header : 618 10415 >

[Primary-Event-Charging-Function-Name]
[Secondary-Event-Charging-Function-Name]
[Primary-Charging-Collection-Function-Name]
[Secondary-Charging-Collection-Function-Name]
[Subscriber-Charging-Type]
*[AVP]

An operator may choose to include only a (primary and secondary) ECF name in the XML part, or only a (primary and secondary) CCF name, or both.

The Subscriber-Charging-Type AVP is of type Enumerated. This AVP contains the type of user charging category, for example:

POST_PAID (0)

This value is used to indicate that the user should be treated as a post-paid user only.

PRE_PAID (1)

This value is used to indicate that the user should be treated as a pre-paid user only.

POST_PAID-PRE_PAID (2)

This value is used to indicate that the user should be treated as both post-paid and pre-paid. [In practice, it might be included to allow the charging system to decide on post-paid or pre-paid charging.]

NO_CHARGING (3)

This value is used to indicate that the user should have no charging.

Considering now the Ro interface (Figure 1), the Subscriber-Charging-Type AVP will be included in the CCR(s) sent to the OCF/OCS, as illustrated in Figure 6. The OCS is provided with logic to interpret the Subscriber-Charging-Type AVP, and to act accordingly.

It will be readily appreciated that, by using this approach, it will be possible to treat users in a more flexible manner and as a result satisfy the demands of operators who have only implemented limited charging functionality in their networks.

Figure 7 illustrates schematically various nodes within an IMS network architecture configured to implement the processes described above. In particular it illustrates an HSS 1 comprising a User profile data response entity 2 which is configured to respond to user profile data requests received from an S-CSCF, e.g. at user IMS registration, by

returning that user profile data. The user profile data is maintained in the HSS within a user profile database 3. The HSS further comprises a charging profile database 4 (memory) which retains addresses pointing to available online and offline charging systems (OCS and CDF). The S-CSCF node 5 comprises the S-CSCF 6 itself, a co-located CTF 7, and a receiver 8 coupled to the Cx interface for receiving user profile data from the HSS.

For the case of online charging only, the architecture comprises an OCS node 9 comprising the OCF 10 and an Ro interface entity 11. This entity receives a charging type from the S-CSCF in respect of a user to be charged (for an IMS service).

Figure 8 is a flow diagram identifying a number of key steps in the process. Step S1 comprises maintaining within a Home subscriber Server, HSS, profile data for each of a set of IMS users, the profile data including for the associated user a charging type defining whether the user is a pre-paid user, a post-paid user, or another category of user. At step S2, for a given user, profile data is sent from the HSS to a Charging Triggering Function, CTF. Then, at step S3, the charging type is included in accounting messages associated with the user sent from the CTF to an online charging function over the Ro interface or to a charging data function over the Rf interface. At step S4, at the online charging function or charging data function, charging for the user is handled in dependence upon the charging type.

By way of background, the reader is referred to the following documents: IETF RFC4006; 3GPP TS 32.260; 3GPP TS 32.299; and 3GPP TS 29.229.

It will be appreciated by the person skilled in the art that various modifications may be made to the above described embodiments without departing from the scope of the present invention. For example, in the case of networks implementing only an Rf interface, i.e. an offline charging interface, or in cases where both an Rf and an Ro interface are provided but where the network prefers to use the Rf interface, a charging type (post-paid, pre-paid or other) may be included in Accounting Request (ACR) messages sent by the CTF to the CDF over the Rf interface. This allows charging for pre-paid subscribers to be handled using the offline charging mechanisms. Whilst not providing for exact real-time charging, only near real-time charging, it may be sufficient for some purposes. Figure 7 illustrates a CDS 20 associated with this alternative approach and which comprises a CDF entity 21 and an Rf interface entity 22 for receiving a charging type from the S-CSCF in respect of a user to be charged (for an

IMS service).

CLAIMS

1. Apparatus for use within an IP Multimedia Subsystem network and comprising:
a receiver for receiving for a given user a charging type defining whether the user is a pre-paid user and or a post-paid user; and
a Charging Triggering Function, CTF, entity for sending accounting information messages relating to said user to an Online Charging Function over an Ro interface or to a Charging Data Function over an Rf interface, and for including with the accounting information messages said charging type.

2. Apparatus according to claim 1, the apparatus additionally comprising a Call Session Control Function entity.

3. Apparatus according to claim 2, wherein said Call Session Control Function entity is one of a Serving Call Session Control Function entity, a Proxy Call Session Control Function entity, and an Interrogating Call Session Control Function entity.

4. Apparatus according to claim 1, the apparatus being an Application Server and comprising an ISC interface for communicating with one or more Call Session Control Functions within the IP Multimedia Subsystem network.

5. Apparatus according to any one of the preceding claims, wherein said interface is an Ro interface and said accounting information messages are Credit Control Request, CCR, messages.

6. Apparatus according to any one of the preceding claims, wherein said interface is an Rf interface and said accounting information messages are Accounting Request, ACR, messages.

7. Apparatus according to any one of the preceding claims, said receiver being configured to receive said charging type at IMS registration of the user or at another user profile retrieval point.

8. Apparatus according to any one of the preceding claims, wherein said charging type may define the user as one of a pre-paid user, a post-paid user, and or another category of user.

9. Apparatus for use within an IP Multimedia Subsystem network and comprising:

an online charging function entity for generating Call Data Records and for sending these to a domain billing system;

an Ro interface for receiving from a Charging Triggering Function, CTF, accounting information messages containing a charging type defining whether the user is a pre-paid user and or a post-paid user,

wherein the online charging function entity is configured to perform billing based upon the charging type contained within a received accounting message.

10. Apparatus according to claim 9, wherein said accounting information messages are Credit Control Request, CCR, messages.

11. Apparatus for use within an IP Multimedia Subsystem network and comprising:

a charging data function entity for generating Call Data Records and for sending these to a domain billing system;

an Rf interface for receiving from a Charging Triggering Function, CTF, accounting information messages containing a charging type defining whether the user is a pre-paid user and or a post-paid user,

wherein the charging data function entity is configured to perform billing based upon the charging type contained within a received accounting message.

12. Apparatus according to claim 11, wherein said accounting information messages are Accounting Request, ACR, messages.

13. Apparatus for use within an IP Multimedia Subsystem network and comprising:

a charging profile database configured to contain one or more charging address profiles, the or each profile including an address of an online charging system within the IP Multimedia Subsystem network;

a user profile database configured to contain, for each of a set of users, user profile data including a pointer to a charging address profile, and a charging type defining whether the user is a pre-paid user, a post-paid user, and or another category of user; and

a user profile data response entity for sending to a requesting entity within the IMS network, over a Cx or Sh interface, the user profile data including said charging type.

14. Apparatus according to claim 13, the apparatus being configured to operate as

a Home Subscriber Server.

15. Apparatus according to claim 13 or 14, the user profile data response entity being configured to send said charging type as a Subscriber-Charging-Type Attribute Value Pair, AVP, within a Server- Assign-Answer, SAA, message over the Cx interface.

16. Apparatus according to claim 13 or 14, the user profile data response entity being configured to send said charging type as a Subscriber-Charging-Type Attribute Value Pair, AVP, within a User-Data-Answer, UDA, message over the Sh interface.

17. A method of handling charging for a user within an IP Multimedia Subsystem network and comprising:

maintaining within a Home subscriber Server, HSS, profile data for each of a set of IMS users, the profile data including for the associated user a charging type defining whether the user is a pre-paid user, a post-paid user, and or another category of user;

for a given user, sending the profile data from the HSS to a Charging Triggering Function, CTF;

at the CTF, including the charging type in accounting messages associated with the user sent to an online charging function over the Ro interface or to a charging data function over the Rf interface; and

at the online charging function or charging data function, handling charging for the user in dependence upon the charging type.

18. A method according to claim 17, wherein said CTF is implemented in one of a Call Session Control Function and an Application Server.

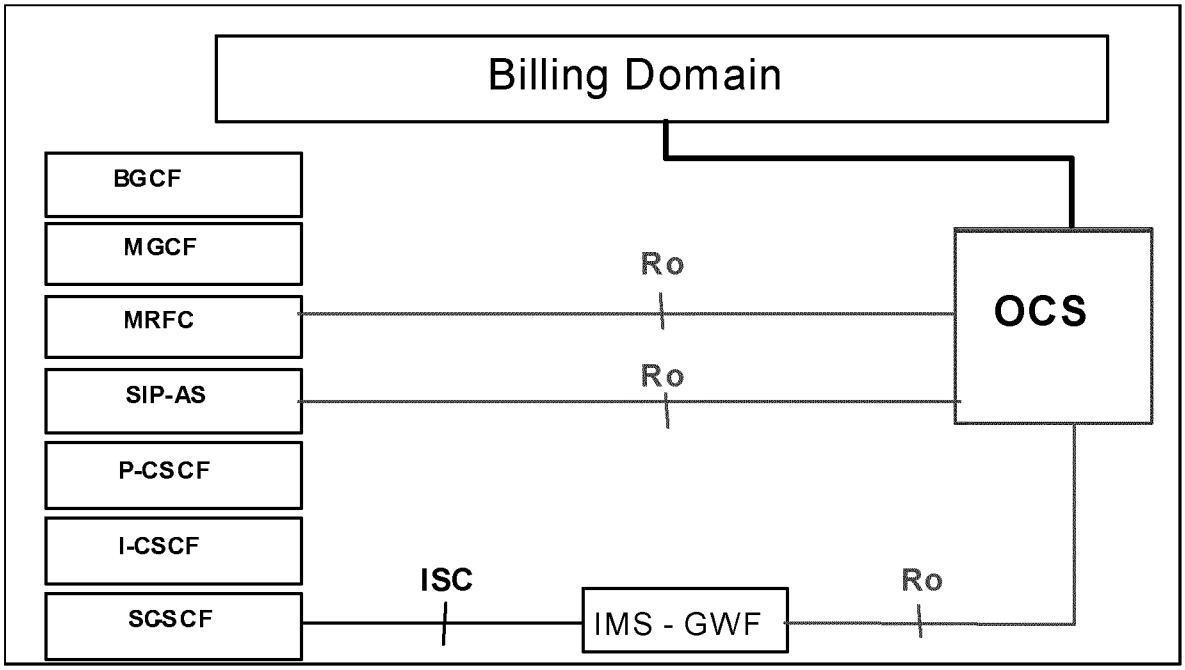


Figure 1

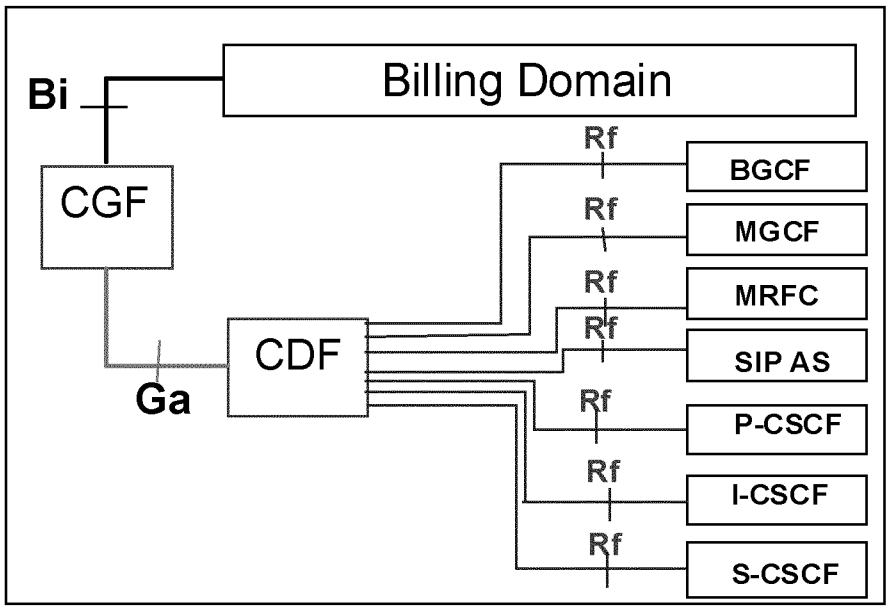


Figure 2

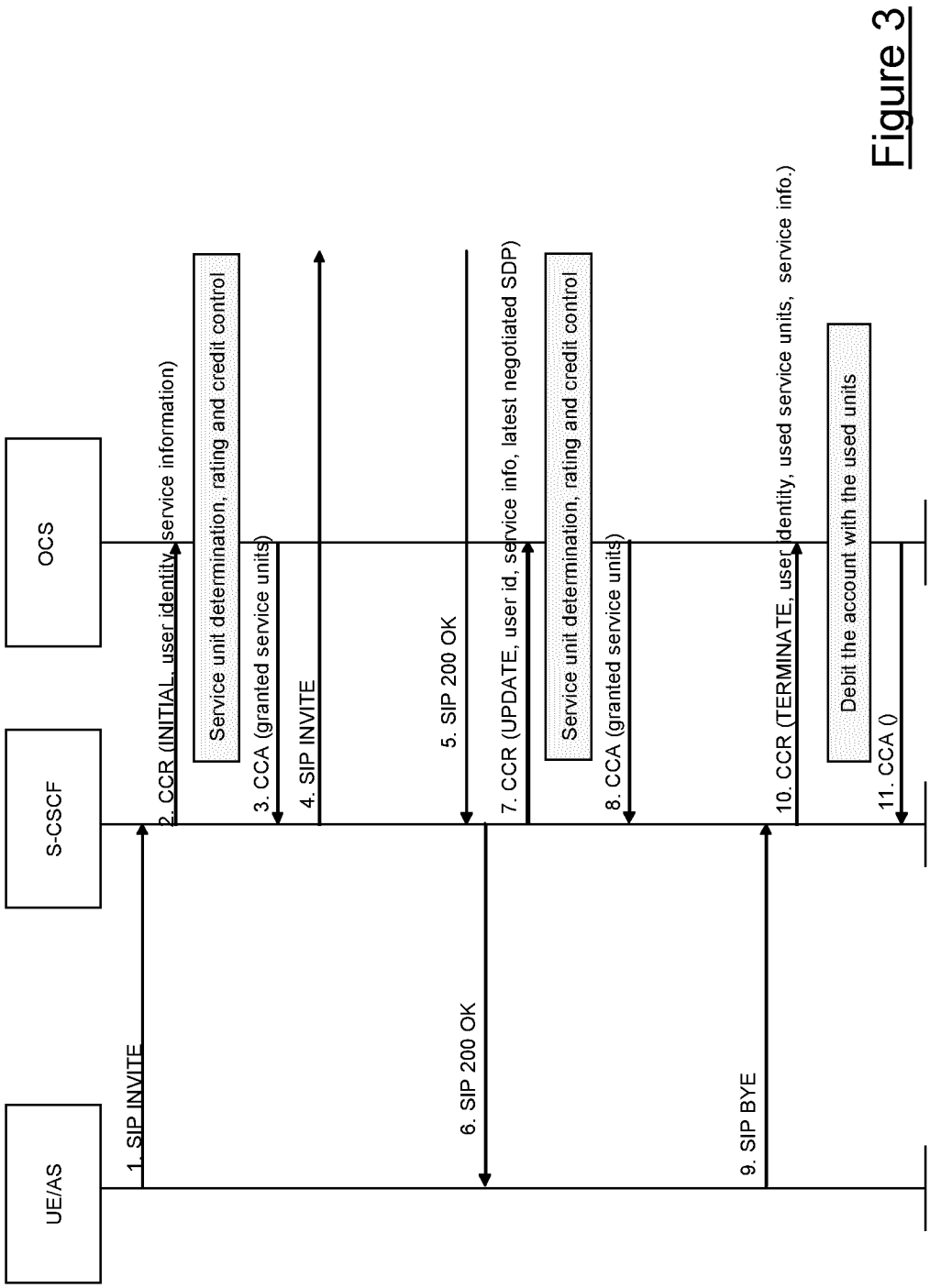

UE/AS
S-CSCF
OCS
1. SIP INVITE
2. CCR (INITIAL, user identity, service information)
Service unit determination, rating and credit control
3. CCA (granted service units)
4. SIP INVITE
5. SIP 200 OK
6. SIP 200 OK
7. CCR (UPDATE, user id, service info, latest negotiated SDP)
Service unit determination, rating and credit control
8. CCA (granted service units)
9. SIP BYE
10. CCR (TERMINATE, user identity, used service units, service info.)
Debit the account with the used units
11. CCA ()

Figure 3

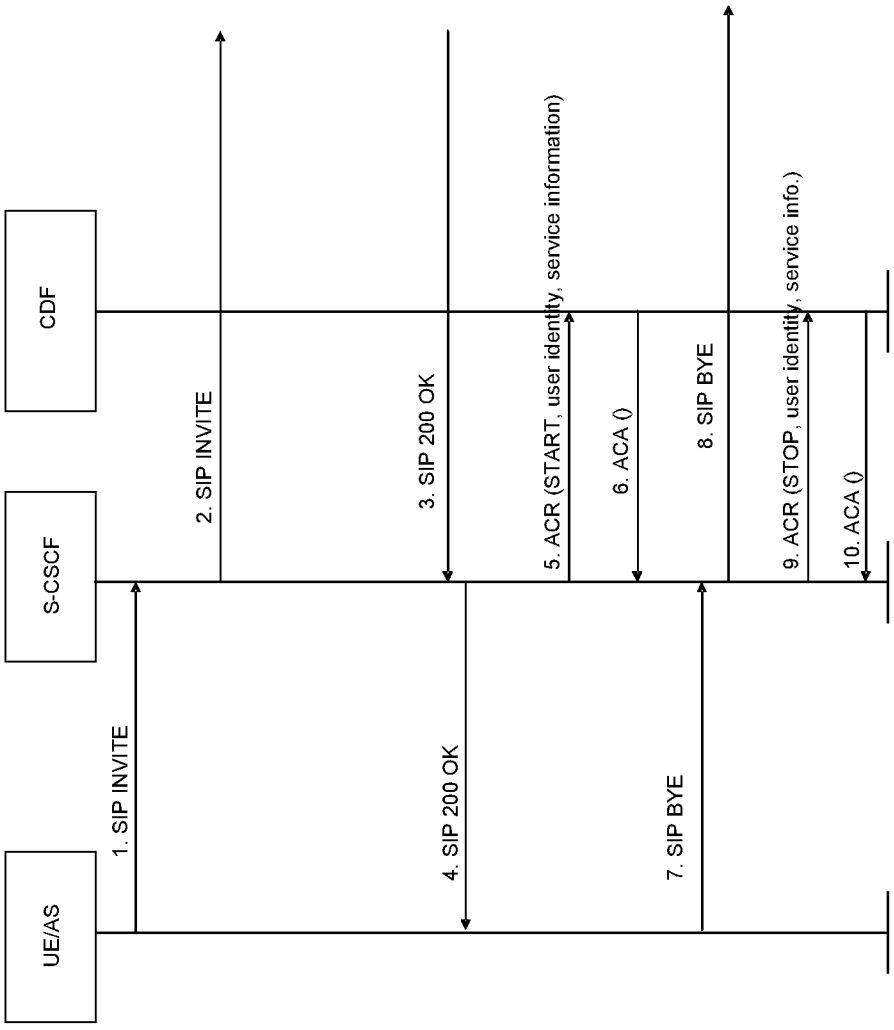

CDF
S-CSCF
UE/AS
1. SIP INVITE
2. SIP INVITE
3. SIP 200 OK
4. SIP 200 OK
5. ACR (START, user identity, service information)
6. ACA ()
7. SIP BYE
8. SIP BYE
9. ACR (STOP, user identity, service info.)
10. ACA ()

Figure 4

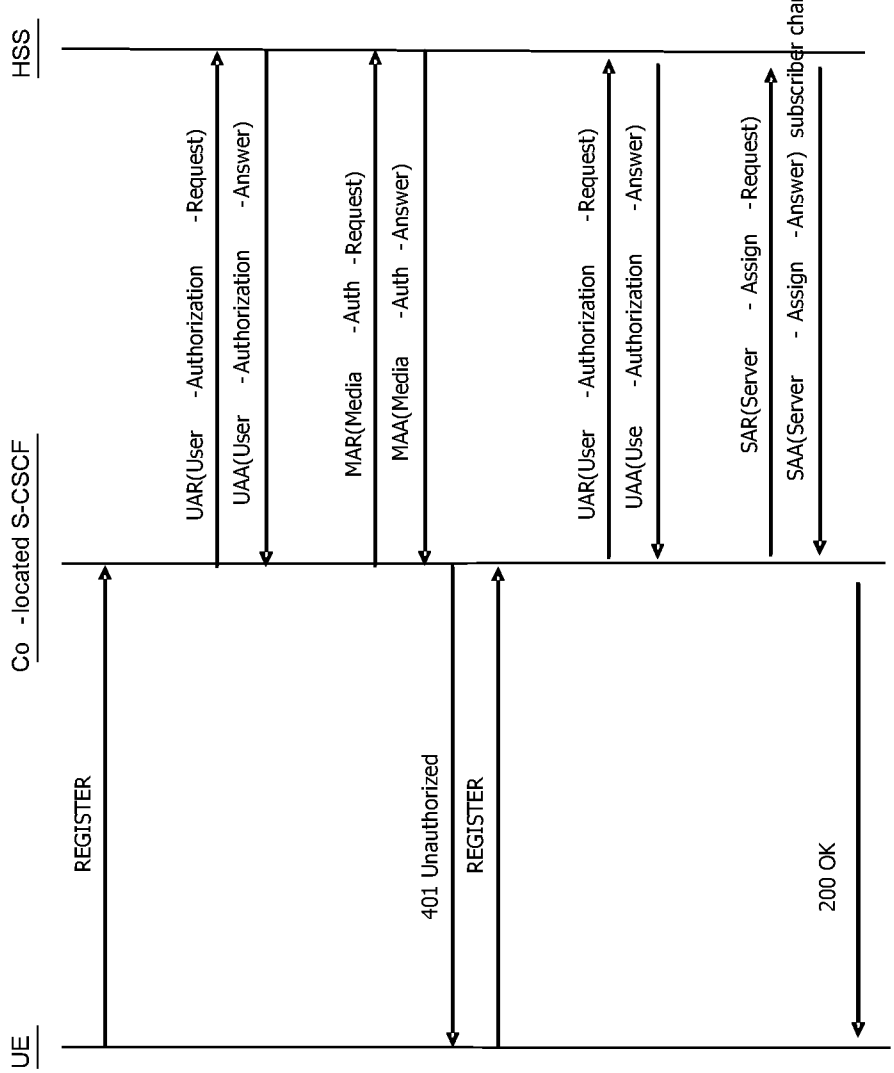

UE
Co -located S-CSCF
HSS
REGISTER
UAR(User -Authorization -Request)
UAA(User -Authorization -Answer)
MAR(Media -Auth -Request)
MAA(Media -Auth -Answer)
401 Unauthorized
REGISTER
UAR(User -Authorization -Request)
UAA(Use -Authorization -Answer)
SAR(Server - Assign -Request)
SAA(Server - Assign -Answer) subscriber charging type,
200 OK

Figure 5

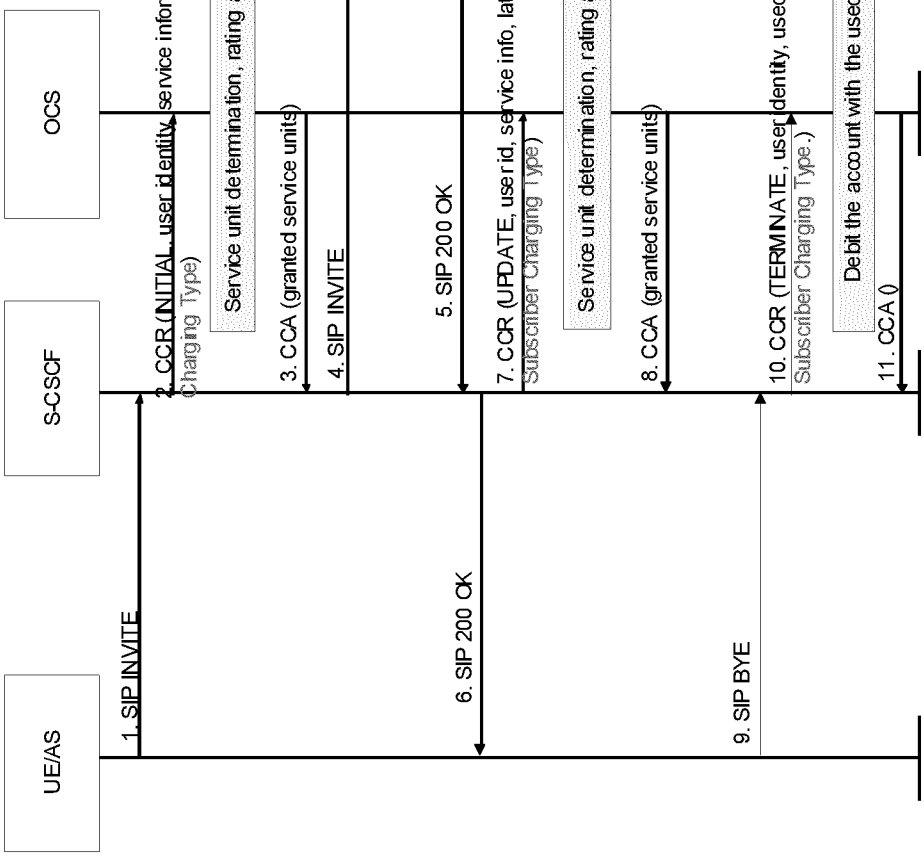

UE/AS
S-CSCF
OCS
1. SIP INVITE
2. CCR (INITIAL, user identity, service information, Subscriber Charging Type)
Service unit determination, rating and credit control
3. CCA (granted service units)
4. SIP INVITE
5. SIP 200 OK
6. SIP 200 OK
7. CCR (UPDATE, user id, service info, latest negotiated SDP, Subscriber Charging Type)
Service unit determination, rating and credit control
8. CCA (granted service units)
9. SIP BYE
10. CCR (TERMINATE, user identity, used service units, service info, Subscriber Charging Type.)
Debit the account with the used units
11. CCA ()

Figure 6

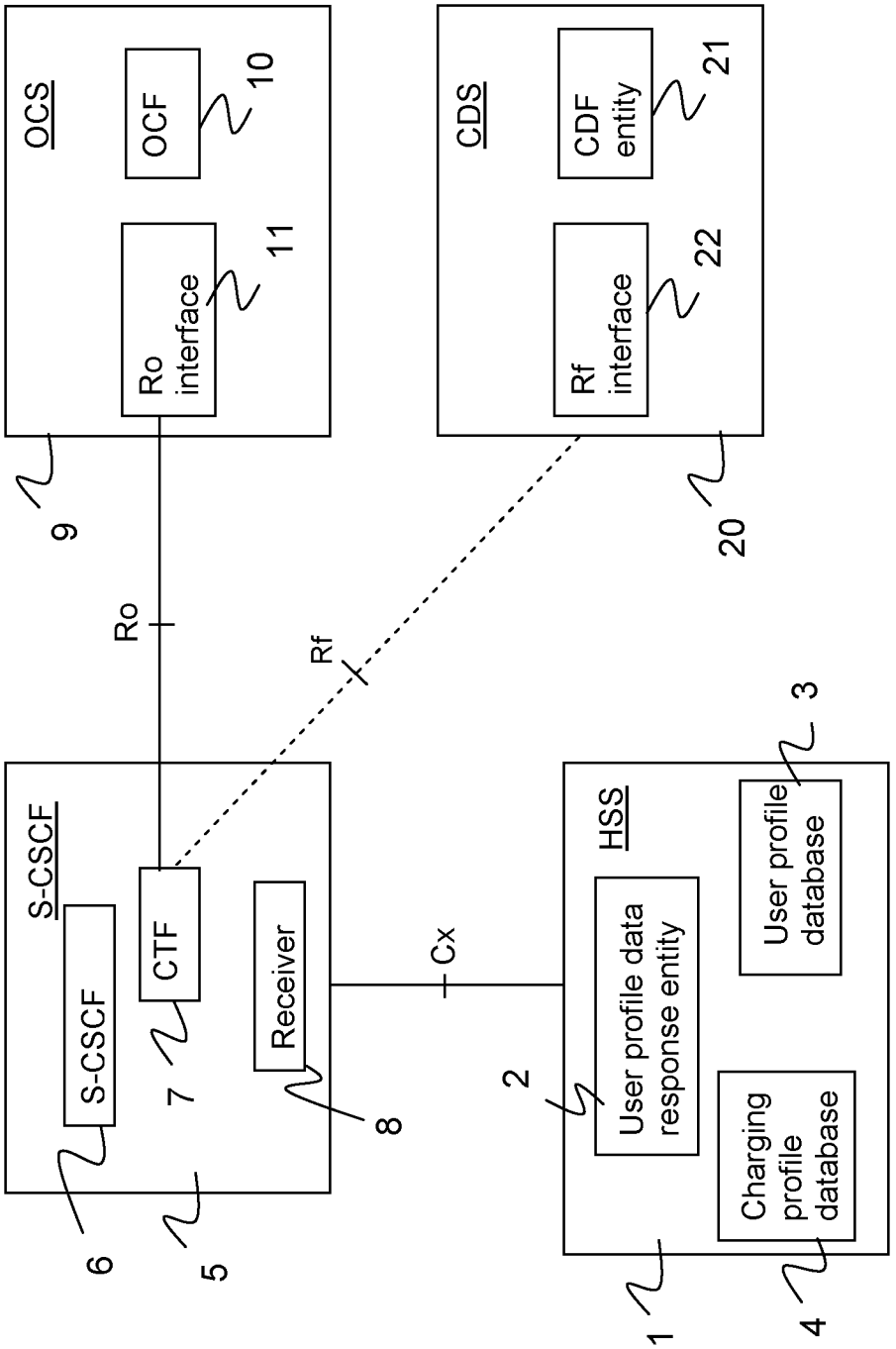

OCS
OCF
10
Ro interface
11
9
Ro
CDS
CDF entity
21
Rf interface
22
20
Rf
S-CSCF
S-CSCF
CTF
7
Receiver
8
6
5
Cx
HSS
User profile data response entity
2
User profile database
3
Charging profile database
4
1

Figure 7

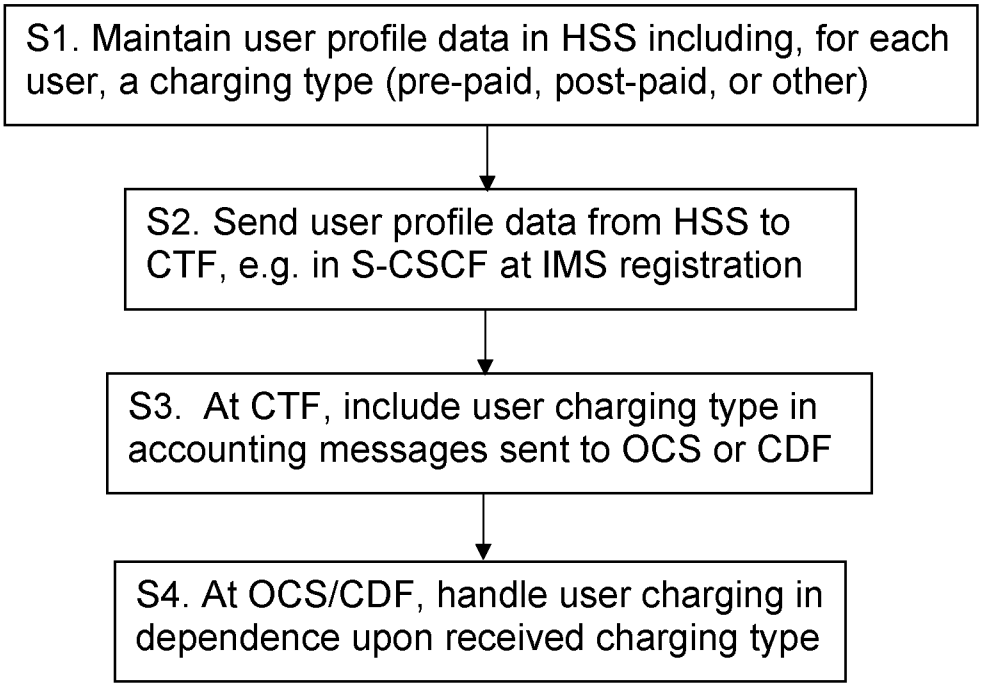

S1. Maintain user profile data in HSS including, for each user, a charging type (pre-paid, post-paid, or other)
S2. Send user profile data from HSS to CTF, e.g. in S-CSCF at IMS registration
S3. At CTF, include user charging type in accounting messages sent to OCS or CDF
S4. At OCS/CDF, handle user charging in dependence upon received charging type

Figure 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/074000

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/14 H04L29/06
ADD.

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

B. FIELDS SEARCHED

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

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 , WPI Data, COMPENDEX, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2007/120598 A2 (LUCENT TECHNOLOGIES INC [US]; CAI YIGANG [US]; LI XIANG YANG [CN]; LV) 25 October 2007 (2007-10-25) abstract page 1, line 10 - page 3, line 25 page 7, line 1 - page 9, line 32 claim 1 figures 2,4	1-18
A	VITALIS G 0ZIANYI ET AL: "Design and implementation of scalable IMS charging systems" , LOCAL COMPUTER NETWORKS, 2009. LCN 2009. IEEE 34TH CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, 20 October 2009 (2009-10-20) , pages 800-806, XP031581378, ISBN: 978-1-4244-4488-5 the whole document	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"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
7 September 2012	02/10/2012

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/074000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007120598 A2	25-10-2007	NON E	