

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
6 December 2007 (06.12.2007)

PCT

(10) International Publication Number
WO 2007/139877 A1

(51) International Patent Classification:

H04L 12/14 (2006.01) *H04L 29/06* (2006.01)
H04M 15/00 (2006.01)

Beijing QuinNian Cheng No. 8, Hong Ying East Road, Chaoyang District, Beijing 100012 (CN). **ZHAO, Jay, Z.** [US/CN]; 1 Xiang Jiang Bei Road, Villa 159, Chaoyang District, Beijing 100103 (CN).

(21) International Application Number:

PCT/US2007/012377

(74) **Agent:** BORNSEN, Brett, L.; Lucent Technologies Inc., Docket Administrator-Room 2F-190, 600 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

(22) International Filing Date: 23 May 2007 (23.05.2007)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

200610084852.9 23 May 2006 (23.05.2006) CN
11/563,470 27 November 2006 (27.11.2006) US

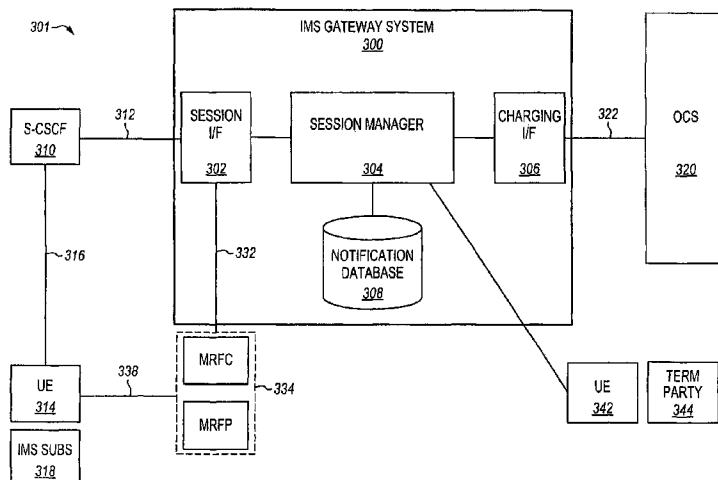
(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN,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

(71) **Applicant** (for all designated States except US): **LU-CENT TECHNOLOGIES INC.** [US/US]; 600 Mountain Avenue, Murray Hill, NJ 07974-0636 (US).

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TI, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: PROVIDING NOTIFICATION IN IMS NETWORKS



(57) **Abstract:** IMS gateway systems and methods are disclosed for providing notification to an IMS subscriber. An IMS gateway system (300) described herein includes a session manager (304) and a notification database (308). The notification database stores a plurality of notification definitions for pre-session, mid-session, and/or post-session notifications. The session manager identifies a triggering event for a session of an IMS subscriber (318). A triggering event may be the initialization of a session, the account balance of the IMS subscriber running low, the termination of a session, or any other event as defined for the session manager. The session manager identifies at least one notification definition for the triggering event from the notification database, and provides notification (e.g., a pre-session greeting, a mid-session warning of a low balance, a mid-session request to recharge the subscriber's account, a post-session goodbye message, etc) to the IMS subscriber based on the notification definitions identified for the triggering event.

WO 2007/139877 A1



Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PROVIDING NOTIFICATION IN IMS NETWORKS

Background of the Invention

5 *1. Field of the Invention*

The invention is related to the field of communications, and in particular, to providing notification (or announcements) to IMS subscribers of an IMS network.

2. *Statement of the Problem*

10 Traditional wireless and wireline networks have the capabilities of providing notification to a caller in a variety of circumstances. One common circumstance is for wireline prepaid calls (calling card calls) and wireless prepaid calls. For instance, a wireless subscriber may sign up for prepaid service where a particular amount of minutes are purchased in advance. When the subscriber places a call with a wireless device, the call is received by a Mobile Switching Center (MSC) in the wireless network. The MSC 15 recognizes the subscriber is a prepaid subscriber and queries a Service Control Point (SCP) for call routing information. The SCP then determines how to handle the prepaid call.

20 As part of call handling, the SCP may control an intelligent peripheral to provide pre-call notification to the subscriber. The pre-call notification may be a greeting along with a message indicating the status of the subscriber's account balance before the call. If the call is subsequently completed to the called party, then the SCP may further control the intelligent peripheral to provide mid-call notification. The mid-call notification may be a warning that the account balance is running low and a request that the subscriber replenish or recharge his/her account balance. If the call is subsequently terminated, then the SCP 25 may further control the intelligent peripheral to provide post-call notification. The post-call notification may be a message indicating the status of the subscriber's account balance after the call.

30 Another type of network gaining popularity is an IP Multimedia Subsystem (IMS) network. As set forth in the 3rd Generation Partnership Project (3GPP), IMS provides a common core network having access-agnostic network architecture for converged networks. Service providers are accepting this architecture in next generation network evolution. The IMS architecture is initially defined by the 3GPP to provide multimedia services to mobile subscribers over an Internet Protocol (IP) network. IP networks have become the most cost

savings bearer network to transmit video, voice, and data. IMS uses the advantage of IP networks to provide multimedia services for IMS subscribers on an IMS platform. The signaling used within IMS networks is Session Initiation Protocol (SIP). IMS defines the standard SIP interface between application servers, the IMS core network (CSCF), the IMS subscriber, the IMS database (HSS), and IMS billing elements. These standards can reduce the network integration costs and let the subscriber enjoy more stable services.

On the IMS platform, the traditional supplementary services, such as call forwarding, conferencing, and call waiting are available for IMS subscribers. Also, many new data services, such as instant messaging, video calls, video on wait, and web-based services, will also be available for the IMS subscribers. IMS subscribers may be prepaid that is controlled by online charging mechanisms in the IMS network, or may be postpaid that is controlled by offline charging mechanisms in the IMS network. One present problem with IMS networks is that the 3GPP standards do not define how to provide notification to IMS subscribers as is done in traditional wireless and wireline networks.

Notification is commonly, but not exclusively, used for prepaid calls, which are more accurately referred to as prepaid sessions in IMS networks. Online charging mechanisms are used in IMS networks to handle the prepaid sessions, and the following describes an online charging architecture for IMS networks.

FIG. 1 illustrates an IMS online charging architecture 100 as suggested by the 3GPP in the prior art. Online charging architecture 100 is described in the 3GPP TS 32.240 specification and the 3GPP TS 32.260 specification that are available at www.3gpp.org. Online charging architecture 100 includes IMS gateway function 102, an S-CSCF 104, and an OCS 106. OCS 106 includes a session-based charging function (SBCF) and an event-based charging function (EBCF). The session-based charging function is responsible for online charging of network/subscriber sessions, such as voice calls or IMS sessions. The event-based charging function performs event-based online charging (also referred to as “context charging”) in conjunction with any application servers.

S-CSCF 104 serves user equipment (UE) of an IMS subscriber and communicates with the UE through SIP. IMS gateway function 102 communicates with S-CSCF 104 over the ISC interface 105 and communicates with OCS 106 over the Ro interface 107. For online charging communication between S-CSCF 104 and the session-based charging function in OCS 106, S-CSCF 104 does not trigger online charging events and thus does not include a Charging Trigger Function (CTF). Instead, the ISC interface 105 is employed by

the S-CSCF 104, implying that online charging is transparent to S-CSCF 104 and appears like any other service controlled by a SIP application server. Therefore, if support for Ro-based online charging is required, a special CTF is needed in order to mediate between the Ro-based session-based charging function and the SIP-based service control. This role is 5 taken by IMS gateway function 102, which translates between SIP session control towards S-CSCF 104 and the Ro credit control towards OCS 106.

The 3GPP specifications are vague as to the role of the IMS gateway function 102. For instance, the 3GPP specifications do not describe how to use the IMS gateway function 102 for online charging. The specifications also do not resolve how the ISC interface, the 10 Ro interface, and the S-CSCF 102 would function together, and how the IMS gateway function 102 would operate to provide budget control for online charging. The specifications also do not mention that the IMS gateway function 102 may provide notification to the UE for online charging functions or for any other triggering events that may happen before, during, or after an IMS session.

15 The 3GPP specifications do mention that a Media Resource Function (MRF) may be used to provide announcements to UE. FIG. 2 illustrates an MRF architecture 200 as suggested by the 3GPP in the prior art. MRF architecture 200 is described in the 3GPP TS 23.228 specification also available at www.3gpp.org. MRF architecture 200 illustrates an application server (AS) 202, an S-CSCF 204, a Media Resource Function Controller 20 206, and a Media Resource Function Processor (MRFP) 208. AS 202 communicates with S-CSCF 204 over an ISC interface. S-CSCF 204 communicates with the MRFC 206 over an Mr reference point. MRFC 206 communicates with the MRFP 208 over the Mp reference point. MRFP 208 communicates with other IP networks (not shown) over the Mb reference point.

25 MRFC 206 controls the media stream resources in the MRFP 208 and controls and interprets information coming from AS 202 or S-CSCF 204. MRFP 208 controls the bearer channel on the Mb reference point, provides resources to be controlled by the MRFC 206, and mixes the incoming media streams (e.g., for multiple parties) and media stream source (for multimedia announcements).

30 Unfortunately, the 3GPP specifications do not define how the MFR architecture 200 works with an IMS gateway system 102 to provide announcements to UE's, such as for online charging purposes. The 3GPP specifications mention that the MPFC 206 may be used for announcements, but do not described how to operate the MPFC 206 in conjunction

with an IMS gateway system 102 to provide notification. Also, the 3GPP specifications imply that the AS 202 and the S-CSCF 204 have the capability of providing announcements, but do not define the message flow over the Mr and Mp reference points to provide announcements.

5

Summary of the Solution

The invention solves the above and other related problems with systems and methods for providing for notification to IMS subscribers using an IMS gateway system. The IMS gateway system described herein allows for pre-session, mid-session, and post-session notification, such as providing online charging notifications to the IMS subscriber. IMS subscribers may thus be able to experience similar notifications and announcements from IMS networks much like they experience in traditional wireline and wireless networks.

One embodiment of the invention comprises an IMS gateway system of an IMS network that handles notification. The IMS gateway system includes a session manager and a notification database. The notification database is adapted to store a plurality of notification definitions for pre-session, mid-session, and/or post-session notifications. The notifications definitions may be defined by a service provider or another party to define when and what notifications are provided to IMS subscribers, such as online charging notifications provided to an IMS subscriber. The session manager is adapted to identify a triggering event for a session of an IMS subscriber. A triggering event may be the initialization of a session, the account balance of the IMS subscriber running low, the termination of a session, or any other event as defined for the session manager. The session manager is further adapted to identify one or more notification definitions for the triggering event from the notification database. The session manager is further adapted to provide notification to the IMS subscriber based on the notification definition identified for the triggering event. The notification specified by the notification definition may a pre-session greeting, a mid-session warning of a low balance, a mid-session request to recharge the subscriber's account, a post-session goodbye message, or a multitude of other pre-session, mid-session, or post-session notifications.

In some embodiments, the session manager may provide the notification to the IMS subscriber through a text message. In other embodiments, the session manager may transmit the notification to a Media Resource Function Controller (MRFC)/Media Resource Function Processor (MRFP). The MRFC/MRFP then sets up a notification session with the

IMS subscriber to provide the notification to the IMS subscriber through a multimedia message.

In another embodiment, if the notification definition for the triggering event requires online charging information, then the session manager identifies the required online

5 charging information. The session manager may internally store the online charging information that it is presently using for budget control for the session. The session manager may also access an online charging system (OCS) to obtain the online charging information. When the online charging information is identified either internally or by accessing the OCS, then the session manager includes the online charging information in

10 the notification to the IMS subscriber.

Another embodiment of the invention comprises an associated method of operating an IMS gateway system. The invention may include other exemplary embodiments described below.

15 **Description of the Drawings**

FIG. 1 illustrates the 3GPP online charging architecture including the IMS gateway function in the prior art.

FIG. 2 illustrates the 3GPP Media Resource Function (MRF) architecture in the prior art.

20 FIG. 3 illustrates an IMS gateway system in an exemplary embodiment of the invention.

FIG. 4 is a flow chart illustrating a method of operating an IMS gateway system in an exemplary embodiment of the invention.

25 FIG. 5 is a message diagram illustrating pre-session notification in an exemplary embodiment of the invention.

FIG. 6 is a message diagram illustrating mid-session notification in an exemplary embodiment of the invention.

Detailed Description of the Invention

30 FIGS. 3-6 and the following description depict specific exemplary embodiments of the invention to teach those skilled in the art how to make and use the invention. For the purpose of teaching inventive principles, some conventional aspects of the invention have been simplified or omitted. Those skilled in the art will appreciate variations from these

embodiments that fall within the scope of the invention. Those skilled in the art will appreciate that the features described below can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific embodiments described below, but only by the claims and their equivalents.

5 FIG. 3 illustrates an IMS gateway system 300 of an IMS network 301 in an exemplary embodiment of the invention. IMS gateway system 300 may be included in the IMS charging architecture 100 of FIG. 1 in a similar manner to IMS gateway function 102, but IMS gateway system 300 may also be implemented in other IMS charging architectures. 10 IMS gateway system 300 includes a session interface 302, a session manager 304, a charging interface 306, and a notification database 308. Charging interface 306 is coupled to an online charging system (OCS) 320 over a link 322. Session interface 302 is coupled to a serving-call session control function (S-CSCF) 310 over a link 312. S-CSCF 310 is coupled to user equipment (UE) 314 over a link 316, where user equipment (UE) 314 is being operated by an IMS subscriber 318. Session interface 302 is also coupled to an 15 MRFC/MRFP 334 over a link 332. MRFC/MRFP 334 is adapted to set up a link 338 with UE 314. Links 312, 316, 322, 336, and 338 may be wireline or wireless. IMS gateway system 300 is also illustrated as being coupled to UE 342 of a terminating party 344. IMS gateway system 300 may be coupled to UE 342 through S-CSCF 310 or another system or server that is known to those skilled in the art. IMS gateway system 300 may include other 20 components, devices, or systems not shown in FIG. 3 for the sake of brevity.

Session manager 304 comprises any system, device, or server adapted to identify when notifications are needed, and to provide the notifications to IMS subscriber 318. Notifications comprise any text or multimedia announcements provided to IMS subscriber 318 through UE 314 or another device being operated by IMS subscriber 318. Session 25 manager 304 may be implemented as software, hardware, or a combination of hardware and software. In a software implementation, session manager 304 may be comprised of instructions that are stored on storage media. The instructions may be retrieved and executed by a processing system. Some examples of instructions are software, program code, and firmware. Some examples of storage media are memory devices, tape, disks, 30 integrated circuits, and servers. The instructions are operational when executed by the processing system to direct the processing system to operate in accordance with the invention. The term "processing system" refers to a single processing device or a group of inter-operational processing devices. Some examples of processors are computers,

integrated circuits, and logic circuitry. Those skilled in the art are familiar with instructions, processors, and storage media.

Notification database 308 comprises any database, server, or system adapted to store a plurality of notification definitions for sessions in an IMS network. A notification definition comprises any information, data, criteria, etc, that define how to handle notifications to be provided in IMS network 301. The notification definitions may be defined by a service provider operating IMS network 301 or another party.

Session interface 302 comprises any interface adapted to exchange session control messages with S-CSCF 310 or another system or application. Session control messages comprise any messages used for session start-up, session management or maintenance, or session tear-down. Session interface 302 also comprises any interface adapted to communicate with MRFC/MRFP 334. Session interface 302 may comprise a SIP adaptor, an IMS service control (ISC) interface, and/or another interface.

Charging interface 306 comprises any interface adapted to exchange charging messages with OCS 320. Charging messages comprise any messages used for online charging of sessions in IMS network 301. Charging interface 306 may comprise a Diameter Ro interface as suggested by the 3GPP, but may comprise another interface in other embodiments.

FIG. 4 is a flow chart illustrating a method 400 of operating IMS gateway system 300 in an exemplary embodiment of the invention. Method 400 describes some basic steps of operating IMS gateway system 300, but other steps may also be performed as needed or desired.

In step 402, session manager 304 identifies a triggering event for a session for IMS subscriber 318. A triggering event comprises any event where notification to IMS subscriber 318 may be needed or desired. The triggering events for notification may be defined in notification database 308, in session manager 304, or in another system. A triggering event for a session may be a pre-session triggering event, a mid-session triggering event, or a post-session triggering event. As an example of a pre-session triggering event, session manager 304 (through session interface 302) may receive a session start up message from UE 314 through S-CSCF 310, such as a SIP INVITE message to initiate a session. Session manager 304 may identify the session start up message as a triggering event requiring notification, such as a greeting or a beginning account balance. As an example of a mid-session triggering event, session manager 304 may determine that a prepaid account

balance for IMS subscriber 318 is running low or running out during a session. Session manager 304 may identify the low balance as a triggering event requiring notification, such as a low balance warning or a request to recharge the account. As an example of a post-session triggering event, session manager 304 (through session interface 302) may receive a

5 session termination message from UE 314 through S-CSCF 310, such as a SIP INVITE message to terminate a presently pending session. Session manager 304 may identify the session termination message as a triggering event requiring notification, such as a goodbye message or an ending account balance.

In step 404, session manager 304 identifies at least one notification definition for the triggering event from notification database 308. When the triggering event has been identified, there may be one or more notification definitions specifying the notifications that are required for this triggering event. Session manager 304 may query notification database 308 with an event name, an event number, or some other identifier of the triggering event. Notification database 308 would then respond with the notification definition(s) for the present triggering event.

In step 406, session manager 304 then provides notification to UE 314 of IMS subscriber 318 based on the one or more notification definitions identified for the triggering event. The notification may be a pre-session notification, a mid-session notification, or a post-session notification depending on the triggering event. Session manager 304 may provide the notification to UE 314 in multiple ways. For instance, session manager 304 may provide the notification to UE 314 in a text message. To provide the text message, session manager 304 may transmit a SIP INFO message to UE 314 through S-CSCF 310 that includes the text message. Alternatively, session manager 304 may provide the notification to UE 314 in a multimedia message. To provide the multimedia message, session manager 304 may transmit the multimedia message to MRFC/MRFP 334, such as through a SIP INVITE message. Responsive to receiving the multimedia message, MRFC/MRFP 334 would set up link 338 with UE 314 and transmit or play the multimedia message to UE 314 over link 338, such as through Real-time Transport Protocol (RTP).

In providing one or more of the notifications to IMS subscriber 318, session manager 304 may need online charging information for the notification (as specified in the notification definition for the triggering event). If session manager 304 is providing budget control for the session, then session manager 304 may internally store online charging information for the notification. For instance, for budget control the session manager 304

may request a quota for a session from OCS 320 through charging interface 306. To do so, session manager 304 transmits a Diameter Credit Control Request (CCR) message or similar message to OCS 320 for credit authorization. Responsive to the CCR message, OCS 320 grants quota units that are allocated based on the charge rating, which could be 5 based on media type, bandwidth, encode mechanism, QoS, etc. OCS 320 then generates a Diameter Credit Control Answer (CCA) message or similar message that includes the granted quota, and transmits the CCA message to session manager 304. Session manager 304 then monitors the granted quota during the session and requests new quotas if needed. Session manager 304 may thus be able to identify online charging information internally if 10 needed for a notification.

Session manager 304 may also query OCS 320 for the desired online charging information. For example, OCS 320 may query OCS 320 for a pre-session account balance of IMS subscriber 318. Session manager 304 transmits a CCR message or similar message to OCS 320 through charging interface 306 requesting the desired information. OCS 320 15 would respond with a CCA message or similar message that includes the desired online charging information. Session manager 304 may then be able to include the online charging information in the notification.

The notification definitions may have different formats as desired. The following provides one exemplary format. A notification definition may include a “Notification 20 Category” field that identifies a class of service, such as prepaid or postpaid. The notification definition may further include a “Notification Session Status” field that identifies the status of the session, such as pre-session, mid-session, or post-session. The notification definition may further include a “Notification Event” field that identifies the type of triggering event requiring notification, such as session initiation, a low balance 25 during a session, session termination, etc. The notification definition may further include a “Notification Method” field that identifies the method used to provide the notification for a triggering event, such as a text message, a multimedia message, etc. The notification definition may further include a “Notification Information” field that includes or describes the content of the notification to be provided for the triggering event, such as a pre-session 30 greeting, a pre-session account balance status (e.g., present balance, low balance warning, no balance warning, request to recharge the account balance, etc), a free charge notification, a mid-session credit expiry notification, a service blocked notification, a multiple simultaneous sessions exceeded notification, a new quota applied notification, a mid-session

low balance notification, a mid-session price plan changed notification, a recharge required for low balance notification, a post-session balance exhausted notification, a goodbye or thank you notification, etc.

FIGS. 5-6 are message diagrams illustrating notification by IMS gateway system

5 300 in an exemplary embodiment of the invention. In this embodiment, session interface 302 comprises an ISC interface using SIP, and charging interface 306 comprises a Diameter Ro interface. These examples focus on notification functionality, and other messages may be used for an actual session.

FIG. 5 is a message diagram illustrating pre-session notification in an exemplary

10 embodiment of the invention. To begin, assume that IMS subscriber 318 wants to initiate a session with terminating party 344. UE 314 transmits a SIP INVITE message to S-CSCF 310 to which S-CSCF 310 responds with a SIP 100 TRYING message. S-CSCF 310 also forwards the INVITE message to IMS gateway system 300, which IMS gateway system 300 responds with a 100 TRYING message. Session manager 304 is continually monitoring for 15 triggering events that require notification. Assume for this embodiment that receiving an initial INVITE message from UE 314 comprises a triggering event. Session manager 304 then accesses notification database 308 to identify one or more notification definitions for this triggering event. Once identified, assume that the notification definition specifies that a notification is required that provides IMS subscriber 318 with the present pre-session 20 account balance.

Session manager 304 generates a Diameter Credit Control Request (CCR) [INITIAL] message to transmit to OCS 320. The CCR[INITIAL] message may be for credit authorization for the session, but session manager 304 also requests that OCS 320 provide information required for pre-session notification via extended Ro. The information 25 in this embodiment would be the present account balance of IMS subscriber 318. Session manager 304 then transmits the CCR[INITIAL] message to OCS 320.

OCS 320 grants quota units responsive to the CCR[INITIAL] message and generates a Diameter Credit Control Answer (CCA)[INITIAL] message. OCS 320 sets the granted quota to the relevant granted Quota AVP in the CCA[INITIAL] message, and also 30 populates the extra information for pre-session notification in the CCA[INITIAL] message. OCS 320 then transmits the CCA[INITIAL] message to IMS gateway system 300.

Responsive to receiving the CCA[INITIAL] message, session manager 304 extracts the desired information from the CCA[INITIAL] message needed for the notification.

Session manager 304 may also identify other content that may be included in the notification. Session manager 304 then transmits a SIP INVITE message with information for IMS subscriber 318 and the notification information to MRFC/MRFP 334.

MRFC/MRFP 334 responds with a SIP 200 OK message to IMS gateway system 300. IMS 5 gateway system 300 transmits the 200 OK message to S-CSCF 310 that includes information on MRFC/MRFP 334. S-CSCF 310 forwards the 200 OK message to UE 314. UE 314 responds to the 200 OK message with a SIP ACK message to S-CSCF 310. S-CSCF 310 transmits the ACK message to IMS gateway system 300. IMS gateway system 300 transmits the ACK message to MRFC/MRFP 334. The media session between UE 314 10 and MFRP 334 is thus established. MRFC/MRFP 334 then plays the desired notification to UE 314 that includes the pre-session account balance.

15 After the notification is completed, MRFC/MRFP 334 transmits a SIP INFO message to IMS gateway system 300. IMS gateway system 300 responds with a SIP 200 OK message to MRFC/MRFP 334 and with a SIP BYE message to terminate the notification session between MRFC/MRFP 334 and UE 314. MRFC/MRFP 334 then transmits a SIP 200 OK message to IMS gateway system 300 and the notification session ends.

20 IMS gateway system 300 then transmits a SIP INVITE message to UE 342 of terminating party 344 to set up the session with terminating party 344. UE 342 responds with a SIP 200 OK message to IMS gateway system 300. IMS gateway system 300 then transmits a SIP (RE)INVITE message to UE 314 through S-CSCF 310. UE 314 responds 25 with a 200 OK message to IMS gateway system 300 through S-CSCF 310. IMS gateway system 300 then responds with a SIP ACK message to UE 314 through S-CSCF 310. IMS gateway system 300 also transmits an ACK message to UE 342. The media session between IMS subscriber 318 and terminating party 344 is thus established.

30 FIG. 6 is a message diagram illustrating mid-session notification in an exemplary embodiment of the invention. During the session, session manager 304 is monitoring the granted quota for the session. Assume that the granted quota presently allocated by OCS 320 has been used up. Also assume for this embodiment that a quota being used up comprises a triggering event. Session manager 304 then accesses notification database 308 to identify one or more notification definitions for this triggering event. Once identified, assume that the notification definition specifies that a notification is required if the account balance of IMS subscriber 318 is below a threshold amount.

To obtain a new quota from OCS 320, session manager 304 generates a CCR [UPDATE] message to transmit to OCS 320. The CCR [UPDATE] message is to obtain a new quota for the session, and also requests that OCS 320 provide information required for mid-session notification via extended Ro. The information in this embodiment would be 5 the present account balance of IMS subscriber 318. Session manager 304 then transmits the CCR[UPDATE] message to OCS 320.

OCS 320 grants quota units (if available) responsive to the CCR[UPDATE] message and generates a CCA[UPDATE] message. OCS 320 sets the granted quota to the relevant granted Quota AVP in the CCA[UPDATE] message, and also populates the extra 10 information for mid-session notification in the CCA[UPDATE] message. OCS 320 then transmits the CCA[UPDATE] message to IMS gateway system 300.

Responsive to receiving the CCA[UPDATE] message, session manager 304 extracts the desired information from CCA[UPDATE] message needed for the notification. Session manager 304 may also identify other content that may be included in the notification. If the 15 account balance of IMS subscriber 318 is below a threshold, then session manager 304 transmits a SIP (RE)INVITE message to UE 342 to hold the terminating party 344. UE 342 responds with a 200 OK message to IMS gateway system 300. IMS gateway system 300 transmits an ACK message to UE 342.

Session manager 304 then transmits a SIP INVITE message with information for 20 IMS subscriber 318 and the notification information to MRFC/MRFP 334. MRFC/MRFP 334 responds with a SIP 200 OK message to IMS gateway system 300. IMS gateway system 300 transmits a SIP (RE)INVITE message to UE 314 through S-CSCF 310 that includes information on MRFC/MRFP 334. UE 314 responds with a 200 OK message to 25 IMS gateway system 300 through S-CSCF 310. UE 314 also responds with a SIP ACK message to IMS gateway system 300 through S-CSCF 310. IMS gateway system 300 transmits the ACK message to MRFC/MRFP 334. The media session between UE 314 and MRFC/MRFP 334 is thus established. MRFC/MRFP 334 then plays the desired notification to UE 314 that includes a warning of a low balance.

After the notification is completed, MRFC/MRFP 334 transmits a SIP INFO 30 message to IMS gateway system 300. IMS gateway system 300 responds with a SIP 200 OK message to MRFC/MRFP 334 and with a SIP BYE message to terminate the notification session between MRFC/MRFP 334 and UE 314. MRFC/MRFP 334 then

transmits a SIP 200 OK message to IMS gateway system 300 and the notification session ends.

IMS gateway system 300 then transmits a SIP (RE)INVITE message with information for IMS subscriber 318 to UE 342 to resume the connection between IMS 5 subscriber 318 and terminating party 344. UE 342 responds with a SIP 200 OK message to IMS gateway system 300. IMS gateway system 300 then transmits a SIP (RE)INVITE message to UE 314 through S-CSCF 310. UE 314 responds with a 200 OK message to IMS gateway system 300 through S-CSCF 310. IMS gateway system 300 then responds with a SIP ACK message to UE 314 through S-CSCF 310. IMS gateway system 300 also 10 transmits an ACK message to UE 342. The media session between IMS subscriber 318 and terminating party 344 is thus reestablished.

As described in the above embodiments, IMS gateway system 300 advantageously provides for notification at different times during a session. IMS subscribers may thus be able to experience similar notifications and announcements from IMS networks much like 15 they experience in traditional wireline and wireless networks.

Although specific embodiments were described herein, the scope of the invention is not limited to those specific embodiments. The scope of the invention is defined by the following claims and any equivalents thereof.

20 CLAIMS:

We claim:

1. An IMS gateway system (300), characterized by:

5 a notification database (308) adapted to store a plurality of notification definitions that define notifications to be provided in an IMS network (301); and a session manager (304) adapted to identify a triggering event for a session of an IMS subscriber (318), identify at least one notification definition for the triggering event from the notification database, and provide notification to the IMS subscriber based on the at least one notification definition identified for the triggering event.

10

2. The IMS gateway system (300) of claim 1 wherein if the notification definition for the triggering event requires online charging information, then the session manager (304) is further adapted to:

15 transmit a request to an online charging system (OCS) (320) for the online charging information; receive a response from the OCS that includes the online charging information; and provide the notification to the IMS subscriber (318) that includes the online charging information.

20 3. The IMS gateway system (300) of claim 1 wherein the session manager (304) is further adapted to:

provide the notification by transmitting a text message to the IMS subscriber (318) through an S-CSCF (310) serving the IMS subscriber.

25 4. The IMS gateway system (300) of claim 1 wherein the session manager (304) is further adapted to:

provide the notification by transmitting a multimedia message to a Media Resource Function Controller (MRFC)/Media Resource Function Processor (MRFP) (334) adapted to transmit the multimedia message to the IMS subscriber (318).

30

5. The IMS gateway system (300) of claim 1 wherein the triggering event comprises one of a pre-session triggering event, a mid-session triggering event, or a post-session triggering event.

6. A method of operating an IMS gateway system, the method characterized by the steps of:

storing a plurality of notification definitions that define notifications to be provided

5 in an IMS network;

identifying a triggering event for a session of an IMS subscriber;

identifying at least one notification definition for the triggering event; and

providing notification to the IMS subscriber based on the at least one notification definition identified for the triggering event.

10

7. The method of claim 6 wherein if the notification definition for the triggering event requires online charging information, then the method further comprises:

transmitting a request to an online charging system (OCS) for the online charging information;

15

receiving a response from the OCS that includes the online charging information; and

providing the notification to the IMS subscriber that includes the online charging information.

20

8. The method of claim 6 wherein providing the notification comprises:

providing the notification by transmitting a text message to the IMS subscriber through an S-CSCF serving the IMS subscriber.

9. The method of claim 6 wherein providing the notification comprises:

25

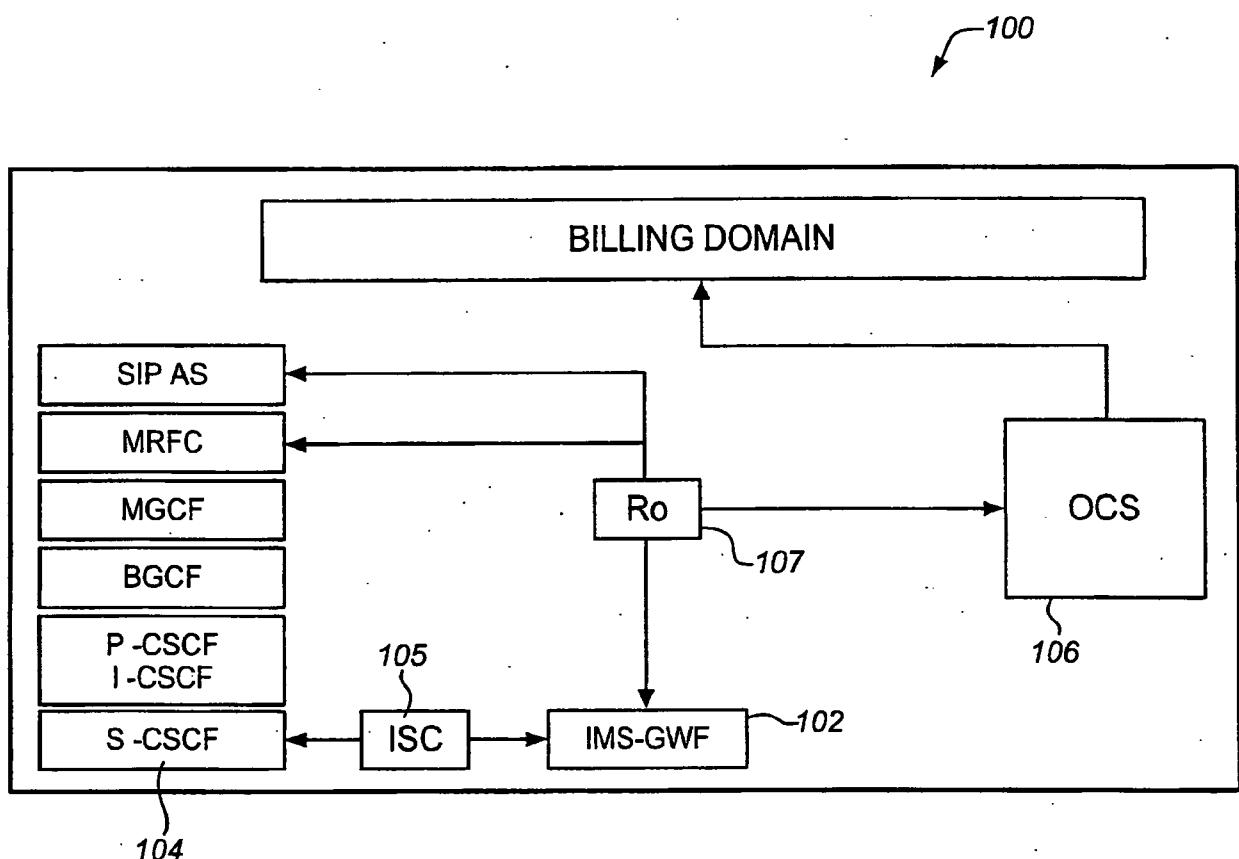
providing the notification by transmitting a multimedia message to a Media Resource Function Controller (MRFC)/Media Resource Function Processor (MRFP) adapted to transmit the multimedia message to the IMS subscriber.

30

10. The method of claim 6 wherein the triggering event comprises one of a pre-session triggering event, a mid-session triggering event, or a post-session triggering event.

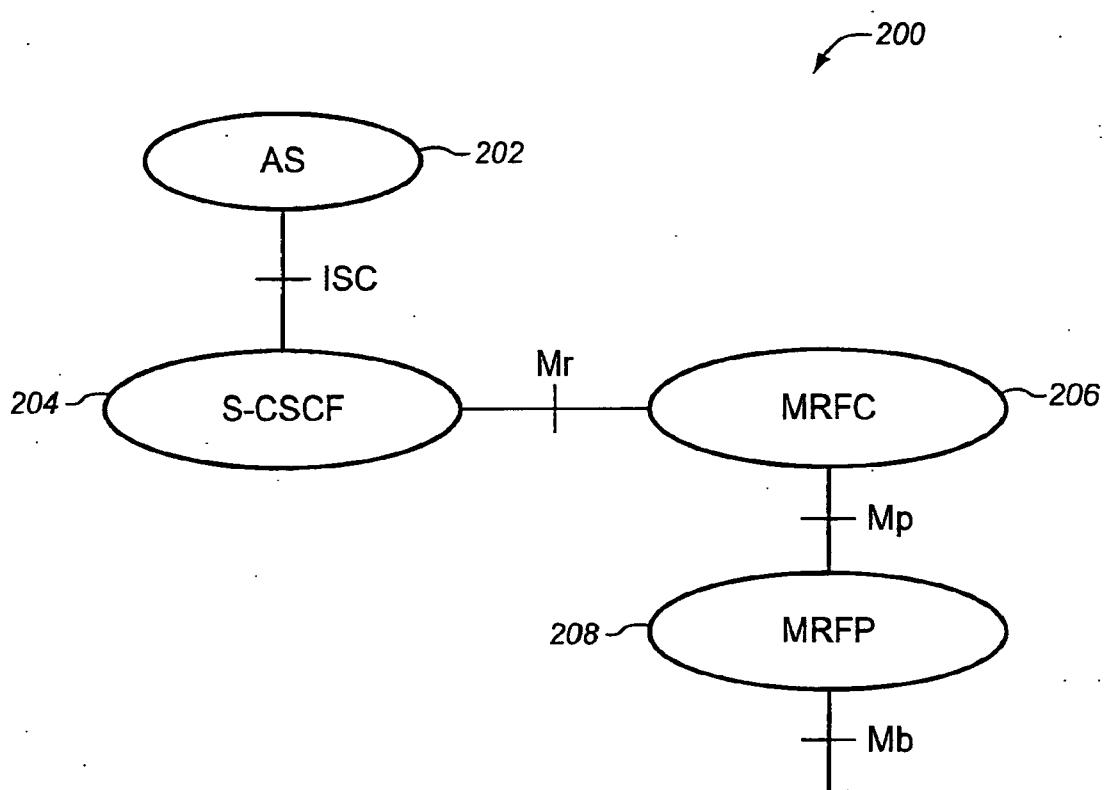
1/6

FIG. 1
PRIOR ART



2/6

FIG. 2
PRIOR ART



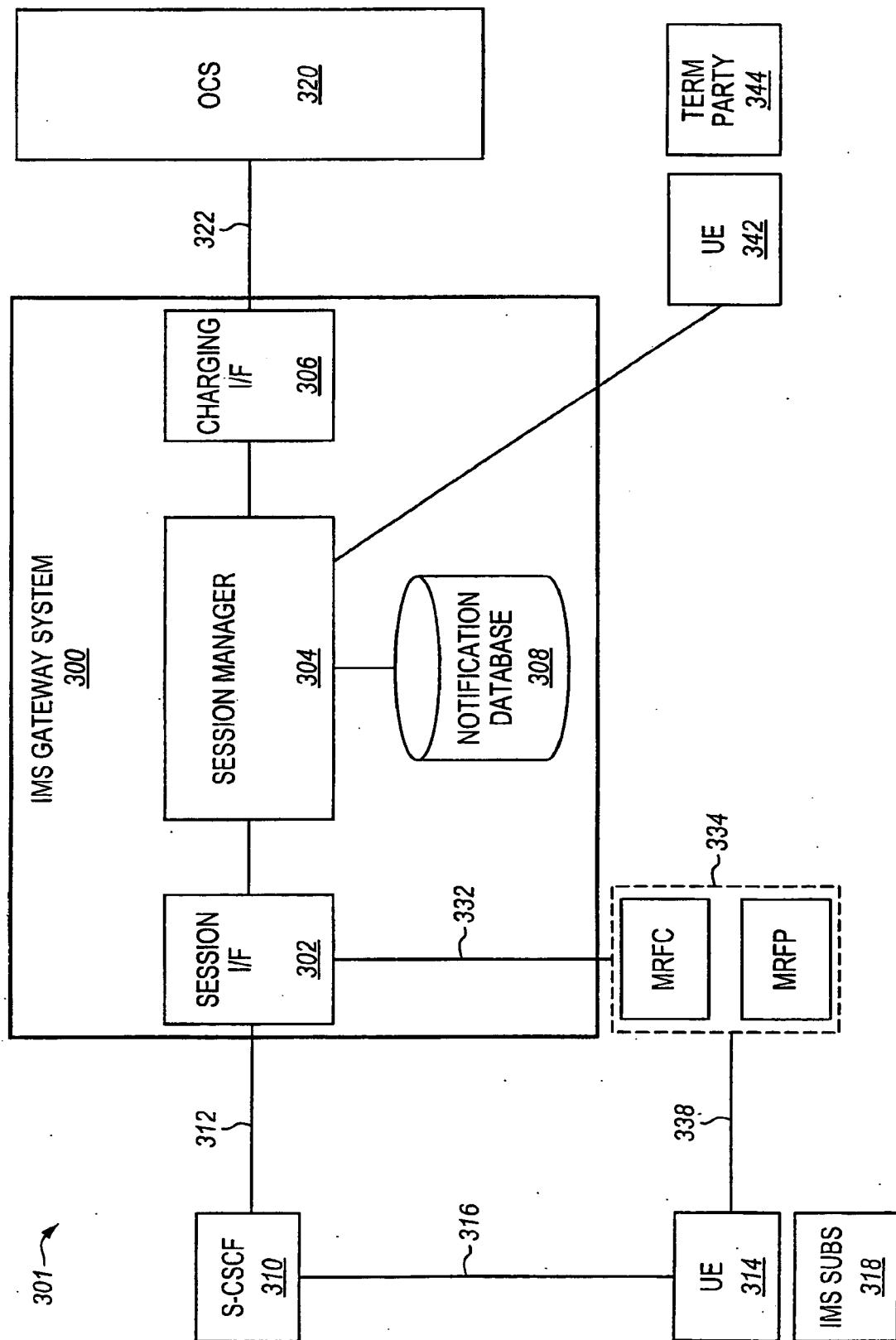
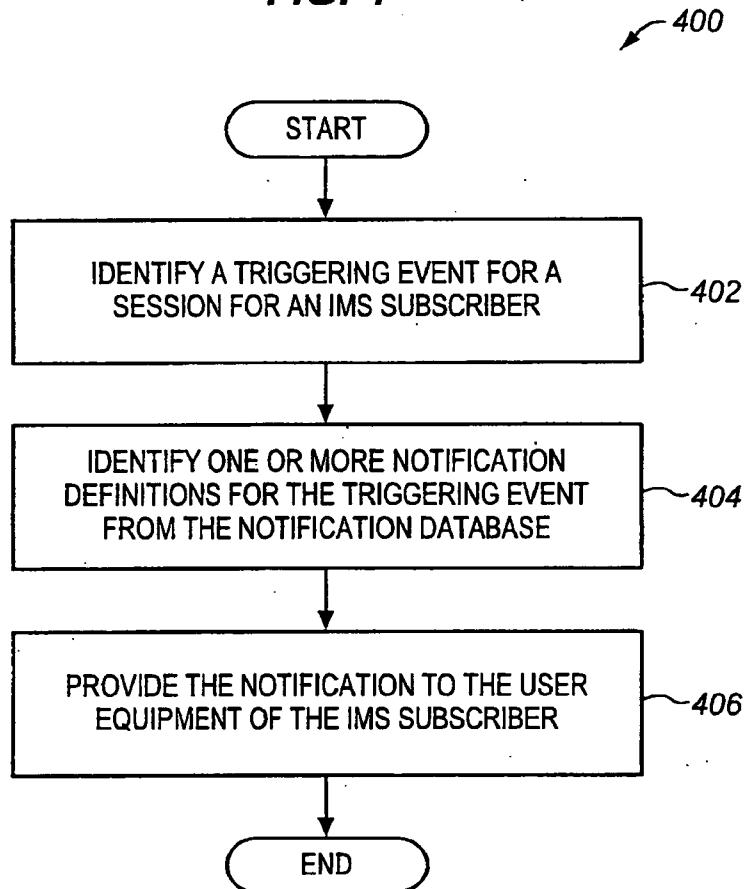


FIG. 3

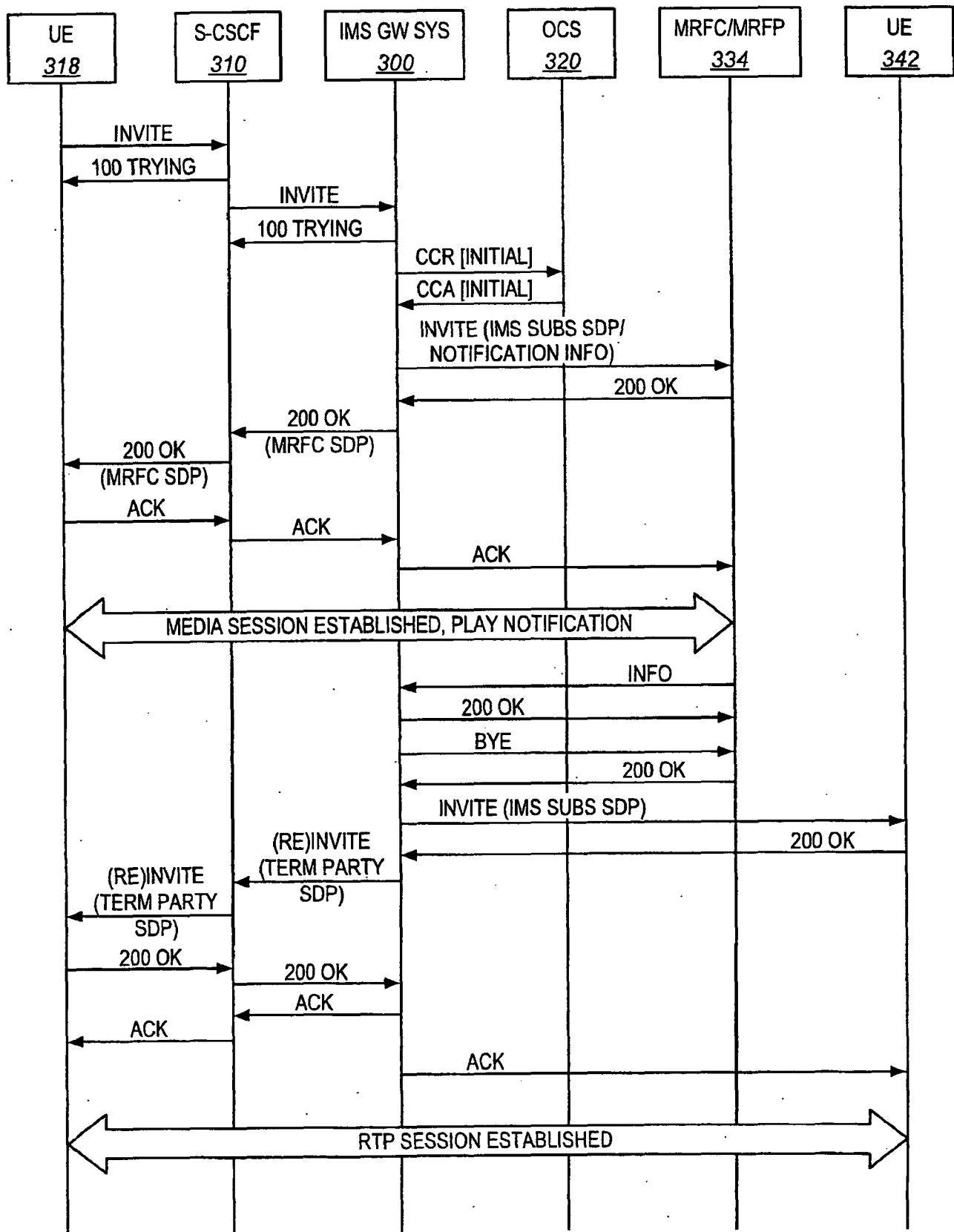
4/6

FIG. 4



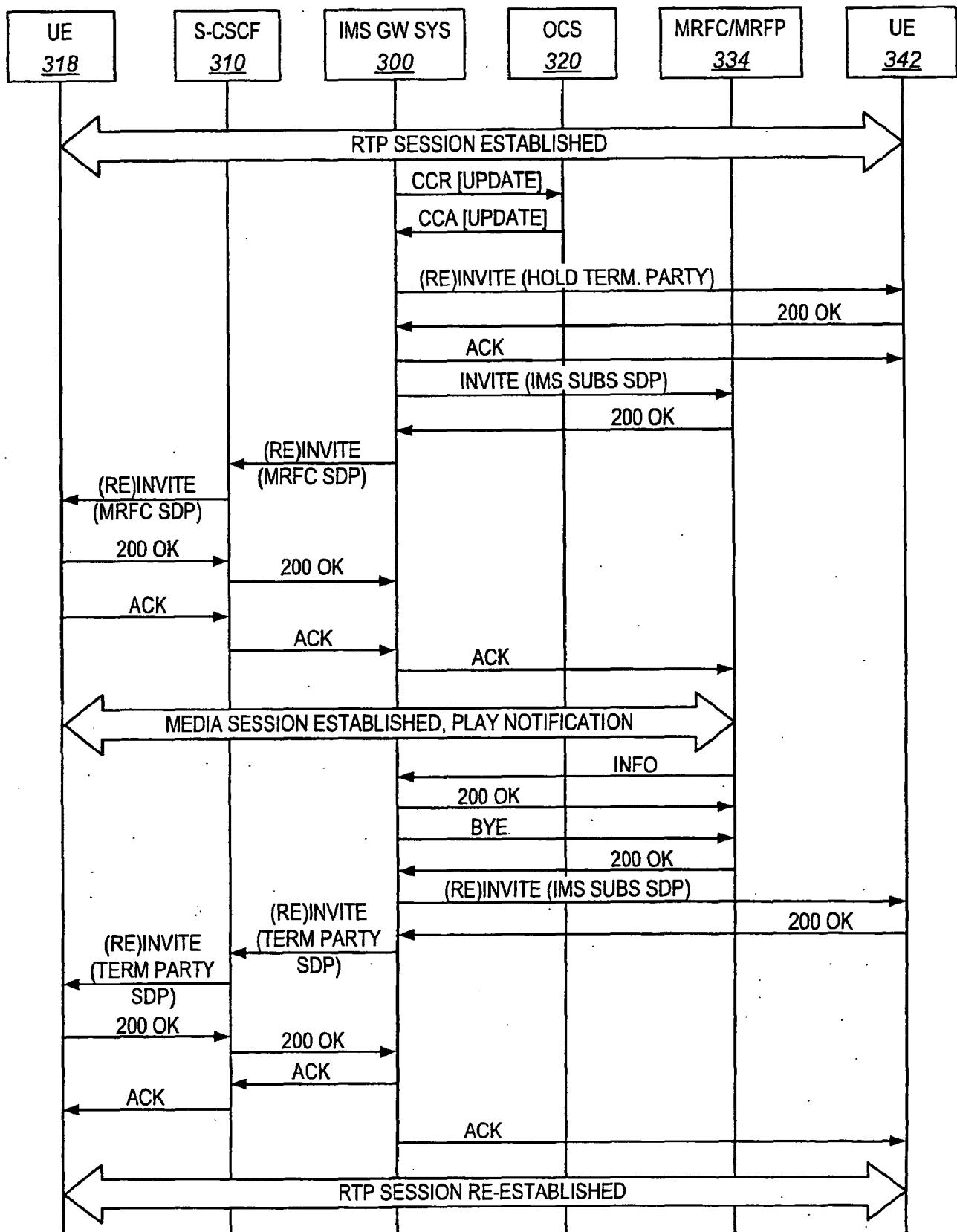
5/6

FIG. 5



6/6

FIG. 6



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/012377

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/14 H04M15/00 H04L29/06

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 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 practical, search terms used)

EPO-Internal, WPI Data, IBM-TDB, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>CAI Y ET AL: "IP MULTIMEDIA SUBSYSTEM ONLINE SESSION CHARGING CALL CONTROL" BELL LABS TECHNICAL JOURNAL, vol. 4, no. 10, 7 March 2006 (2006-03-07), pages 117-132, XP001239291 ISSN: 1089-7089 page 118, left-hand column, last paragraph - page 119, left-hand column, line 5 page 121, left-hand column, last paragraph - right-hand column; figures 2,4</p> <p style="text-align: center;">-/-</p>	1-10

Further documents are listed in the continuation of Box C.

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 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* 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

1 November 2007

Date of mailing of the international search report

09/11/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Vercauteren, Steven

INTERNATIONAL SEARCH REPORT

International application No	
PCT/US2007/012377	

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>"Universal Mobile Telecommunications System (UMTS); Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging (3GPP TS 32.260 version 6.5.0 Release 6)" ETSI TS 132 260 V6.5.0, March 2006 (2006-03), XP014033929 cited in the application page 11; figure 4.3</p> <p>-----</p> <p>"3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Charging management; Charging architecture and principles (Release 6)" 3GPP TS 32.240 V6.0.0, September 2004 (2004-09), XP014022018 cited in the application page 16, paragraph 4.1.2 page 20, paragraph 4.3.2 – page 22, paragraph 4.3.2.3</p> <p>-----</p>	1-10
A		1-10