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(54) Title: METHOD AND SYSTEM FOR MANAGING CALL CHARGING IN A NETWORK

(57) Abstract: The present invention relates to a system (108) and a method (400) for managing call charging in a network (106) The method (400) enables service providers to configure and customize a charging mechanism, a call behavior, and Session Initiation Protocol (SIP) responses within the system (108). The system (108) facilitates the interaction between the user and the Online Charging System (OCS) (312) through the Diameter Routing Agent (DRA) (310) over a diameter interface. Service providers can configure parameters and rules within the system (108) to control the charging process and call behavior based on a service type, SIP methods, and the diameter responses. The system (108) evaluates the diameter responses from the OCS (312) to make decisions regarding call continuation or denial, allowing flexible call handling. Additionally, service providers map SIP error responses to specific diameter responses, ensuring consistent call-related event handling.

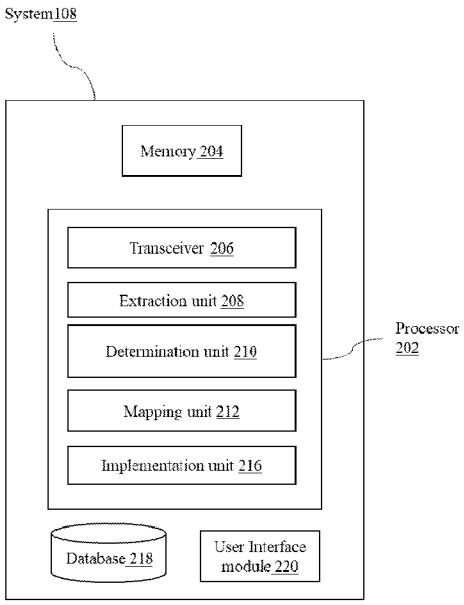

FIG. 2

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[Continued on next page]

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METHOD AND SYSTEM FOR MANAGING CALL CHARGING IN A NETWORK

FIELD OF THE INVENTION

[0001] The present invention relates to the field of wireless communication system, more particularly relates to a method and system for managing call charging in a network.

BACKGROUND OF THE INVENTION

[0002] The present disclosure pertains to the field of telephony systems and, more specifically, to the interaction between the Online Charging System (OCS) and the Business Telephony Application System (BTAS) through the Diameter Routing Agent (DRA). The Diameter interface plays a crucial role in the charging process within an IP Multimedia Subsystem (IMS) network, as it facilitates subscriber charging for various telephony services.

[0003] In a standard implementation, the BTAS receives service requests from subscribers, typically initiated through the Session Initiation Protocol (SIP) interface, and sends charging requests to the OCS via the Diameter interface. The OCS processes these requests and provides a response that determines the call's further execution. This represents the conventional charging mechanism used across networks.

[0004] However, there is a need for a customized charging support in the BTAS, considering its primary purpose as a business telephony application server catering to enterprise users. Different types of enterprise subscribers often require distinct charging schemes tailored to their specific needs. This customization adds value to the BTAS solution, enabling flexible and business-driven charging capabilities.

[0005] The customized charging support addresses several problems and offers unique features. Firstly, it allows for charging enterprise users in a manner that aligns

with their individual requirements. Instead of a one-size-fits-all approach, this customization enables differentiated charging based on subscriber types within the enterprise network.

[0006] Secondly, the behavior of the call can be governed based on the responses received via the Diameter interface. The BTAS can utilize the information in the Diameter responses to determine call handling and apply specific call policies accordingly. This flexibility enhances the overall user experience and service management within the BTAS environment.

[0007] Furthermore, the BTAS can map SIP response codes based on the Diameter responses received over the Ro interface. This mapping enables seamless interoperability between the Diameter and SIP protocols, ensuring accurate and consistent handling of call-related events and signaling.

[0008] The state of the art in telephony systems primarily focuses on standardized charging mechanisms and limited customization options. The customization provided by the BTAS allows for fine-tuning the charging process and call behaviour, thus improving the service delivery and meeting specific business requirements.

[0009] There is a need for offering a customized call charging support, to address the limitations of a standard charging mechanism and thereby, provide a more adaptable and business-centric solution. The subsequent sections of this patent specification will further describe the features, implementations, and advantages of the customized charging support within the BTAS, along with relevant technical details and embodiment.

SUMMARY OF THE INVENTION

[0010] One or more embodiments of the present disclosure provide a method and system for managing call charging in a network.

[0011] In one aspect of the present invention, a method of managing a call charging in a network is disclosed. The method includes the step of receiving a call request from at least one User Equipment via an interface. The method further includes the step of retrieving information pertaining to at least one of a call service type and a call service request from the received call request. The method further includes the step of determining if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) for charging the received call request. The method further includes the step of transmitting the CCR trigger to the OCS on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA). The method further includes the step of determining a Credit Control Answer (CCA) utilizing the information retrieved from the received call request to indicate a charging status and a valuation of the call request, thereby managing call charging in the network.

[0012] In one embodiment, the method further includes the step of determining a call behavior applicable to the received call request, wherein the call behavior is customizable based on a response received from the OCS and the call service type. The method further includes the step of applying the determined call behavior to the received call request.

[0013] In another embodiment, the call behavior pertains to an activity which includes one of continuing the call, deny the call, deny call with announcement and continue call with announcement.

[0014] In yet another embodiment, the call service type is one of an originating call and a terminating call.

[0015] In yet another embodiment, the call service request is one of at least a toll-free number dialing, Internet Protocol (IP) centrex services, and service for trunk users.

[0016] In yet another embodiment, the call request is received utilizing a Session Initiation Protocol (SIP) and the CCR trigger is transmitted to the OCS via the DRA utilizing a diameter interface.

[0017] In yet another embodiment, subsequent to checking a set of predefined conditions, the CCR trigger is transmitted to the OCS based on a satisfaction of a set of predefined conditions, wherein the set of pre-defined conditions are dependent on parameters such as service type, Closed User Group, and SIP method, wherein charging is customized by a service provider based on at least one of business requirements and the call service type.

[0018] In yet another embodiment, in response to transmission of the CCR trigger, the method further comprising the step of receiving a diameter response from the OCS. The method further includes the step of mapping the diameter response to a SIP response as customized by a service provider. The method further includes the step of implementing the call behavior at the at least one UE based on the mapping.

[0019] In yet another embodiment, the mapping of the diameter response to the SIP response is dependent on the call service type.

[0020] In yet another embodiment, the set of predefined conditions include at least one of a first condition to check information retrieved from the call received in order to identify which BTAS service type needs to be accessed and to determine whether the CCR trigger is required to be transmitted for the identified BTAS service type based on the customization, a second condition to determine a call type of an ongoing call, whether it is at least one of, a Closed User Group (CUG) class, an INTER call type, an INTRA call type or an Outside call type and to determine whether a Ro trigger is configured for the identified BTAS service type and a third condition to check which type of SIP invite is received, which includes at least one of, an invite request and update request in the call request and to determine the Ro trigger corresponding to the SIP invite received is enabled or disabled based on the customization.

[0021] In another aspect of the present invention, a system for managing call charging in a network is disclosed. The system includes a transceiver configured to receive a call request from an at least one User Equipment via an interface. The system further includes an extraction unit configured to retrieve information pertaining to at least one of a call service type and a call service request from the received call request. The system further includes a determination unit configured to determine if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) for charging the received call request. The system further includes the transceiver configured to transmit the CCR trigger to the OCS on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA). The system further includes the determination unit configured to determine a Credit Control Answer (CCA) utilizing the information retrieved to indicate a charging status and a valuation of the call request, thereby managing call charging in the network.

[0022] In another aspect of the present invention, a User Equipment (UE) is disclosed. One or more primary processors communicatively coupled to one or more processors. The one or more primary processors coupled with a memory. The memory stores instructions which when executed by the one or more primary processors causes the UE to transmit a call request to the one or more processors via an interface. Further, the one or more processors are configured to perform the method for managing call charging in a network.

[0023] In yet another aspect of the present invention, a non-transitory computer-readable medium having stored thereon computer-readable instructions that, when executed by a processor. The processor is configured to receive a call request from an at least one User Equipment via an interface. The processor is further configured to retrieve information pertaining to at least one of a call service type and a call service request from the received call request. The processor is further configured to determine if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) for charging the received call request. The processor is further configured to transmit the CCR trigger to the OCS on determination that the CCR

trigger is required to be transmitted via a Diameter Routing Agent (DRA). The processor is further configured to determine a Credit Control Answer (CCA) utilizing the information retrieved to indicate a charging status and a valuation of the call request, thereby managing call charging in the network.

[0024] Other features and aspects of this invention will be apparent from the following description and the accompanying drawings. The features and advantages described in this summary and in the following detailed description are not all-inclusive, and particularly, many additional features and advantages will be apparent to one of ordinary skill in the relevant art, in view of the drawings, specification, and claims hereof. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes and may not have been selected to delineate or circumscribe the inventive subject matter, resort to the claims being necessary to determine such inventive subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated herein, and constitute a part of this disclosure, illustrate exemplary embodiments of the disclosed methods and systems in which like reference numerals refer to the same parts throughout the different drawings. Components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Some drawings may indicate the components using block diagrams and may not represent the internal circuitry of each component. It will be appreciated by those skilled in the art that disclosure of such drawings includes disclosure of electrical components, electronic components or circuitry commonly used to implement such components.

[0026] **FIG. 1** is an exemplary block diagram of an environment for managing call charging in a network, according to one or more embodiments of the present invention;

[0027] **FIG. 2** is an exemplary block diagram of the system for managing call charging in a network, according to one or more embodiments of the present invention;

[0028] **FIG. 3** is an exemplary flow diagram of the system of **FIG. 2**, according to one or more embodiments of the present invention; and

[0029] **FIG. 4** is a flow diagram of a method for managing call charging in a network, according to one or more embodiments of the present invention.

[0030] **FIG. 5** is a signal flow diagram illustrating the system for managing call charging in a network, according to one or more embodiments of the present disclosure.

[0031] The foregoing shall be more apparent from the following detailed description of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0032] Some embodiments of the present disclosure, illustrating all its features, will now be discussed in detail. It must also be noted that as used herein and in the appended claims, the singular forms "a", "an" and "the" include plural references unless the context clearly dictates otherwise.

[0033] Various modifications to the embodiment will be readily apparent to those skilled in the art and the generic principles herein may be applied to other embodiments. However, one of ordinary skill in the art will readily recognize that the present disclosure including the definitions listed here below are not intended to be limited to the embodiments illustrated but is to be accorded the widest scope consistent with the principles and features described herein.

[0034] A person of ordinary skill in the art will readily ascertain that the illustrated steps detailed in the figures and here below are set out to explain the exemplary embodiments shown, and it should be anticipated that ongoing technological development will change the manner in which particular functions are performed.

These examples are presented herein for purposes of illustration, and not limitation. Further, the boundaries of the functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternative boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope and spirit of the disclosed embodiments.

[0035] The present invention provides a flexible and a customizable call charging support system in a network. The system allows service providers to configure charging triggers, call behavior, and SIP responses based on diameter responses received from the Online Charging System (OCS) over the Ro interface. By leveraging system configurations, service providers have full control over the charging mechanism and call handling. The present invention eliminates the need for any backend changes or code level changes. The present invention offers advantages such as tailored charging for different service types, configurable call behavior based on diameter responses, and easy mapping of SIP responses to the diameter responses.

[0036] Referring to **FIG. 1**, **FIG. 1** illustrates an exemplary block diagram of an environment **100** for managing call charging in a network **106**, according to one or more embodiments of the present invention. The environment **100 i**ncludes, a User Equipment (UE) **102**, a server **104**, a network **106** and a system **108**. The UE **102** aids a user to interact with the system **108** to transmit a call request in order to establish a call within a network **106**.

[0037] For the purpose of description and explanation, the description will be explained with respect to one or more user equipment's (UEs) **102**, or to be more specific will be explained with respect to a first UE **102a**, a second UE **102b**, and a third UE **102c**, and should nowhere be construed as limiting the scope of the present disclosure. Each of the at least one UE **102** namely the first UE **102a**, the second UE

102b, and the third UE **102c** is configured to connect to the server **104** via the network **106**.

[0038] In an embodiment, each of the first UE **102a**, the second UE **102b**, and the third UE **102c** is one of, but not limited to, any electrical, electronic, electro-mechanical or an equipment and a combination of one or more of the above devices such as virtual reality (VR) devices, augmented reality (AR) devices, laptop, a general-purpose computer, desktop, personal digital assistant, tablet computer, mainframe computer, or any other computing device.

[0039] The network **106** includes, by way of example but not limitation, one or more of a wireless network, a wired network, an internet, an intranet, a public network, a private network, a packet-switched network, a circuit-switched network, an ad hoc network, an infrastructure network, a Public-Switched Telephone Network (PSTN), a cable network, a cellular network, a satellite network, a fiber optic network, or some combination thereof. The network **106** may include, but is not limited to, a Third Generation (3G), a Fourth Generation (4G), a Fifth Generation (5G), a Sixth Generation (6G), a New Radio (NR), a Narrow Band Internet of Things (NB-IoT), an Open Radio Access Network (O-RAN), and the like.

[0040] The network **106** may also include, by way of example but not limitation, at least a portion of one or more networks having one or more nodes that transmit, receive, forward, generate, buffer, store, route, switch, process, or a combination thereof, etc. one or more messages, packets, signals, waves, voltage or current levels, some combination thereof, or so forth. The network **106** may also include, by way of example but not limitation, one or more of a wireless network, a wired network, an internet, an intranet, a public network, a private network, a packet-switched network, a circuit-switched network, an ad hoc network, an infrastructure network, a Public-Switched Telephone Network (PSTN), a cable network, a cellular network, a satellite network, a fiber optic network, a VOIP or some combination thereof.

[0041] The environment **100** includes the server **104** accessible via the network **106**. The server **115** may include by way of example but not limitation, one or more of a standalone server, a server blade, a server rack, a bank of servers, a server farm, hardware supporting a part of a cloud service or system, a home server, hardware running a virtualized server, a processor executing code to function as a server, one or more machines performing server-side functionality as described herein, at least a portion of any of the above, some combination thereof. In an embodiment, the entity may include, but is not limited to, a vendor, a network operator, a company, an organization, a university, a lab facility, a business enterprise side, a defence facility side, or any other facility that provides service.

[0042] The environment **100** further includes a system **108** communicably coupled to the server **104** and each of the first UE **102a**, the second UE **102b**, and the third UE **102c** via the network **106**. The system **108** is adapted to be embedded within the server **104** or is embedded as the individual entity. However, for the purpose of description, the system **108** is described as an integral part of the server **104**, without deviating from the scope of the present disclosure. The system **108** is configured to manipulate message in the network **106**.

[0043] Operational and construction features of the system **108** will be explained in detail with respect to the following figures.

[0044] **FIG. 2** is an exemplary block diagram of the system **108** for managing call charging in a network **106**, according to one or more embodiments of the present invention.

[0045] As per the illustrated and preferred embodiment, the system **108** to manage call charging in the network **106** is a Business Telephony Application Server (BTAS). The BTAS provides a full-featured telephony and multimedia application system. The BTAS helps to rapidly develop and deliver services for enterprise and residential customers. The BTAS contains the service logic that provides the basic call-processing

services, including digit analysis, routing, call setup, call waiting, call forwarding, conferencing, etc. The BTAS also provides the service logic for invoking the media servers to provide the appropriate call progress tones and announcements.

[0046] The system **108** is a central component that handles various telephony services. The system **108** operates based on industry-standard protocols and leverages configuration capabilities to customize a charging process and a call behavior. In order for the system **108** to manage call charging in the network **106**, the system **108** includes one or more processors **202**, a memory **204**, a database **218** and a User Interface module **220.** The one or more processors **202** includes a transceiver **206,** an extraction unit **208,** a determination unit **210,** a mapping unit **212,** and an implementation unit **214**. The one or more processors **202**, hereinafter referred to as the processor **202**, may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors, central processing units, state machines, logic circuitries, single board computers, and/or any devices that manipulate signals based on operational instructions. However, it is to be noted that the system **108** may include multiple processors as per the requirement and without deviating from the scope of the present disclosure. Among other capabilities, the processor **202** is configured to fetch and execute computer-readable instructions stored in the memory **204**.

[0047] As per the illustrated embodiment, the processor **202** is configured to fetch and execute computer-readable instructions stored in the memory **204** as the memory **204** is communicably connected to the processor **202**. The memory **204** is configured to store one or more computer-readable instructions or routines in a non-transitory computer-readable storage medium, which may be fetched and executed to create or share data packets over a network service. The memory **204** may include any non-transitory storage device including, for example, volatile memory such as RAM, or non-volatile memory such as disk memory, EPROMs, FLASH memory, unalterable memory, and the like.

[0048] In an embodiment, the transceiver **206** of the processor **202** is communicably connected to each of the at least first UE **102a**, the second UE **102b**, and the third UE **102c** via the network **106**. Initially, the UE **102** transmits a call request to the processor **202** via an interface. Further the processor **202** is configured to perform the method for managing call charging in a network **106**. Accordingly, the transceiver **206** is configured to receive a call request from the UE **102** via an interface. In one embodiment, the interface includes at least one of, but not limited to, an Application Programming Interface (API). The transceiver **206** is further configured to transmit, the Charging Control Request (CCR) trigger to the OCS **312** (shown in FIG. 3) subsequent to determination of the CCR trigger is required to be transmitted to the OCS **312.**

[0049] In an embodiment, the extraction unit **208** of the processor **202** is configured to retrieve information pertaining to at least one of a call service type and a call service request from the call request received from the UE **102.** In an embodiment, the call service type is one of an originating call and a terminating call. In an embodiment, the call service request is one of at least a toll-free number dialing, Internet Protocol (IP) centrex services, and service for trunk users. The IP Centrex service is a cloud-based telephony service. Businesses use it for Voice over Internet Protocol (VoIP) based communication to avoid having all the necessary equipment on-site. The IP Centrex centralizes telecommunication services, allowing enterprises to manage multiple locations and services through a single network provider.

[0050] In an embodiment, the determination unit **210** of the processor **202** is configured to determine whether a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) **312** for charging the call request received from the UE **102**. The determination unit **210** checks a set of pre-defined conditions, based on which the transceiver **206** transmits the Charging Control Request (CCR) trigger to the OCS **312.** The determination unit **210** is further configured to determine a Diameter Credit Control Answer (CCA) response utilizing the information retrieved pertaining to at least one of a call service type and a call

service request to indicate a charging status and a valuation of the call request. In an embodiment, the valuation of the call request is performed by the OCS **312.** The valuation of the call request pertains to ascertaining the charges for the call initiated by user**.** In another embodiment, the valuation of the call request corresponds to monetary charges incurred to the user for one or more of, initiating the call, using the calling service, call duration, making the call. The determination unit **210** is further configured to determine a call behavior based on the Diameter CCA response received from the OCS **102.** In an embodiment, the call behavior pertains to an activity which includes at least one of, continuing the call, denying the call, denying call with an announcement and continuing the call with an announcement. Based on the determination of the call behavior, the determination unit **210** applies the determined call behavior to the call request. In other words, the ongoing call will be continued or denied by the determination unit **210**.

[0051] In an embodiment, in order to support Credit Control via the diameter protocol, there are two diameter messages, the CCR (Credit Control Request) and the CCA (Credit Control Answer) response. The diameter protocol is related to the mobile communication networks, such as 4G LTE networks. The diameter protocol provides authentication, authorization, and accounting (AAA) messaging services for network access and data mobility applications in 3G, IP Multimedia Systems (IMS), and LTE/4G networks. The CCR represents a Diameter Credit-Control-Request message, which is transmitted to the OCS **102** by the processors **202**. The CCA represents the Diameter CCA response which is transmitted by the OCS **102** to the processor **202**. In general, the corresponding Diameter Credit-Control application messages for a Debit /Reserve Unit Request operation is a Credit-Control-Request (CCR) and for a Debit /Reserve Unit Response operation is Credit-Control-Answer (CCA).

[0052] In an embodiment, the mapping unit **212** of the processor **202** is configured to map the diameter responses to Session Initiation Protocol (SIP) responses as customized by the service provider. The mapping of the diameter responses to the SIP responses is dependent on the call service type. The mapping unit **212** enables service

providers to map SIP responses to specific diameter responses which ensures consistent and appropriate handling of call-related events. Service providers customize the SIP responses using a user interface module **220** according to their preferences and requirements. In one embodiment, the diameter responses are received by the system **108** from the OCS **312** and the SIP responses are stored in a database **218.**

[0053] In one embodiment, the Session Initiation Protocol (SIP) is a signaling protocol that enables the Voice Over Internet Protocol (VoIP) by defining the messages sent between endpoints and managing the actual elements of a call. SIP is used for initiating, maintaining, modifying and terminating real-time communications sessions between Internet Protocol (IP) devices. SIP enables voice, messaging, video and other communications applications and services between two or more endpoints on IP networks. The SIP response provides information about the status of the call.

[0054] The database **218** is one of, but not limited to, a centralized database, a cloud-based database, a commercial database, an open-source database, a distributed database, an end-user database, a graphical database, a No-Structured Query Language (NoSQL) database, an object-oriented database, a personal database, an in-memory database, a document-based database, a time series database, a wide column database, a key value database, a search database, a cache databases, and so forth. The foregoing examples of database **212** types are non-limiting and may not be mutually exclusive e.g., a database can be both commercial and cloud-based, or both relational and open-source, etc.

[0055] In an embodiment, the user interface module **220** of the system **108** includes a variety of interfaces, for example, a graphical user interface, a web user interface, a Command Line Interface (CLI), and the like. The user interface module **220** allows service providers to configure and customize a charging mechanism, a call behavior, and Session Initiation Protocol (SIP) responses.

[0056] In an embodiment, the implementation unit **214** of the processor **202** is configured to implement the call behavior at the at least one UE **102** based on the mapping of the diameter responses with the SIP responses configured by the service providers. The call behavior pertains to an activity which includes one of continuing the call, denying the call, denying the call with an announcement and continuing the call with an announcement. For example, when the diameter response is received from the OCS **312,** the implementation unit **214** of the system **108** decides whether to continue the ongoing call or deny the ongoing call based on the mapping of the diameter responses to the SIP responses.

[0057] The transceiver **206,** the extraction unit **208,** the determination unit **210,** the mapping unit **212,** and the implementation unit **214** in an exemplary embodiment, are implemented as a combination of hardware and programming (for example, programmable instructions) to implement one or more functionalities of the processor **202**. In the examples described herein, such combinations of hardware and programming may be implemented in several different ways. For example, the programming for the processor **202** may be processor-executable instructions stored on a non-transitory machine-readable storage medium and the hardware for the processor may comprise a processing resource (for example, one or more processors), to execute such instructions. In the present examples, the memory **204** may store instructions that, when executed by the processing resource, implement the processor **202**. In such examples, the system **108** may comprise the memory **204** storing the instructions and the processing resource to execute the instructions, or the memory **204** may be separate but accessible to the system **108** and the processing resource. In other examples, the processor **202** may be implemented by electronic circuitry.

[0058] **FIG. 3** illustrates an exemplary block diagram of an architecture for the system **108** of **FIG. 2,** according to one or more embodiments of the present invention. More specifically, **FIG. 3** illustrates the system **108** configured for managing call charging in a network **106**. It is to be noted that the embodiment with respect to **FIG. 3** will be explained with respect to the UE **102** for the purpose of description and

illustration and should nowhere be construed as limited to the scope of the present disclosure. The **FIG. 3** includes a UE **102**, the system **108**, a Diameter Routing Agent (DRA) **310** and an Online Charging System (OCS) **312**.

[0059] The Diameter Routing Agent (DRA) **310** is a functional element in a 3G or 4G (such as LTE) network that provides real-time routing capabilities to ensure that request/messages/calls are routed among the correct network elements in the network. The Online charging system (OCS) **312** is a system allowing a communications service provider to charge their customers, in real time, based on service usage. The diameter interface connects the DRA **310** with the OCS **312** in a diameter protocol based mobile communication networks, such as 4G LTE networks. The diameter protocol provides authentication, authorization, and accounting (AAA) messaging services for network access and data mobility applications in 3G, IP Multimedia Systems (IMS), and LTE/4G networks.

[0060] For the purpose of description of the exemplary embodiment as illustrated in **FIG. 3**, the User Equipment (UE) **102** uses network protocol connection to communicate with the system **108**. Accordingly, the UE **102** is configured to transmit a call request to the system **108** via an interface.

[0061] In an embodiment, the network protocol connection is the establishment and management of communication between the UE **102** and the system **108** over the network **106** using a specific protocol or set of protocols. The network protocol connection includes, but not limited to, Session Initiation Protocol (SIP), System Information Block (SIB) protocol, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), Simple Network Management Protocol (SNMP), Internet Control Message Protocol (ICMP), Hypertext Transfer Protocol Secure (HTTPS) and Terminal Network (TELNET).

[0062] In an embodiment, the UE **102** includes a primary processor **302**, a memory **304,** and a user interface **306**. In alternate embodiments, the UE **102** may include more than one primary processor **302** as per the requirement of the network **106**. The primary processor **302**, may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors, central processing units, state machines, logic circuitries, single board computers, and/or any devices that manipulate signals based on operational instructions.

[0063] In an embodiment, the primary processor **302** is configured to fetch and execute computer-readable instructions stored in the memory **304**. The memory **304** may be configured to store one or more computer-readable instructions or routines in a non-transitory computer-readable storage medium, which may be fetched and executed to create or share data packets over a network service. The memory **304** may include any non-transitory storage device including, for example, volatile memory such as RAM, or non-volatile memory such as disk memory, EPROMs, FLASH memory, unalterable memory, and the like.

[0064] In an embodiment, the user interface **306** of the UE **102** includes a variety of interfaces, for example, a graphical user interface, a web user interface, a Command Line Interface (CLI), and the like. The user interface module **306** is configured to allow a user to transmit a call request to the processor **202**. The user interface module **306** facilitates communication with the system **108**.

[0065] In an embodiment, Diameter Routing Agent (DRA) **310** provides a real-time routing capability to ensure that calls are routed among the correct elements in a network **106**. The DRA **310** connects the system **108** with the OCS **312** via at least one of, a diameter interface and a Ro interface. Diameter is a protocol used for authentication, authorization, and accounting (AAA) in IP networks. Diameter interface enables communication between the system **108** and the DRA **310**.

[0066] In an embodiment, the Ro interface is a 3rd Generation Partnership Project (3GPP) reference point that describes the connection to the OCS **312** from another functional component. The Ro interface supports Ro protocol which allows a Charging Trigger Function (CTF) to issue charging events to the OCS **312**. The charging events can be immediate, event-based, or session-based. The Ro interface is the interface between the system and the OCS **312**. The Ro trigger is configured to trigger the online charging via the Ro interface based on the identified call service type.

[0067] In an embodiment, the Online charging system (OCS) **312** performs charging calculations based on the information received retrieved pertaining to at least one of a call service type and a call service request and provides a Diameter Credit Control Answer (CCA) response indicating the charging status and valuation of the call. The system **108** connects to the OCS **312** through a DRA **310** over at least one of, the diameter interface and the Ro interface. Diameter interface and Ro interface enables communication between the system **108** and the OCS **312**, ensuring secure and reliable exchange of charging-related information.

[0068] For example, when a user initiates a call, the system **108** receives the call signaling through the Session Initiation Protocol (SIP). SIP is a protocol used for establishing, modifying, and terminating multimedia sessions over IP networks. The system **108** processes the SIP requests/messages and determines the call service type and specific call service request. Further based on the call service type and subsequent to checking the set of pre-defined conditions, the system **108** determines whether a Charging Control Request (CCR) trigger is required to be transmitted to the OCS **312** for charging the call. This configuration is customizable by the service provider utilizing the user interface module **220**, allowing service providers to define charging triggers according to their business requirements. For example, different charging triggers can be set for toll-free number calls, IP Centrex services, or specific user categories.

[0069] Once the decision is made to charge the call, the system **108** transmits the CCR trigger to the OCS **312** over the Diameter interface and the OCS **312** performs charging calculations based on the received information pertaining to at least one of a call service type and a call service request and provides a Diameter Credit Control Answer (CCA) response indicating the charging status and valuation of the call. Based on the diameter CCR response received from the OCS **312**, the system **108** determines the call behavior. This call behavior is configurable by the service provider and can be tailored to specific diameter response codes. The system **108** includes rules which allows service providers to define actions such as call continuation, call denial, call denial with announcement, or call continuation with announcement. These actions are associated with different diameter response codes, ensuring flexible control over call handling. For example, let us consider that the system **108** receives a Diameter error response with code 5030. The service provider configures different actions based on the diameter error response with code 5030. If service provider configures system **108** utilizing the user interface module **220** to ignore the error, the system **108** will disregard the error and continue the call. Alternatively, if service provider configures system **108** to reject the call, the system **108** will terminate the call.

[0070] The system **108** includes rules which are configured at run time by the service providers. These rules facilitate service providers to control the charging process and the call behavior. For example, the service provider configures the system **108** to transmit the Charging Control Request (CCR) triggers for a particular service type such as society centrex calls. In other words, the system **108** will only charge for a particular service type requested by the user based on the configuration performed by the service provider utilizing the user interface module **220**.

[0071] **FIG. 4** is a flow diagram of a method **400** for managing call charging in a network **106**, according to one or more embodiments of the present invention. For the purpose of description, the method is described with the embodiments as illustrated in **FIG. 2** and should nowhere be construed as limiting the scope of the present disclosure.

[0072] At step **402**, the method **400** includes the step of receiving a call request from an at least one User Equipment **102** via an interface. In one embodiment, transceiver **206** of the processor **202** is configured to receive a call transmitted from the UE **102**. The call request is received utilizing a Session Initiation Protocol (SIP).

[0073] At step **404**, the method **400** includes the step of retrieving information pertaining to at least one of a call service type and a call service request from the received call request. In one embodiment, the extraction unit **208** of the processor **202** is configured to retrieve information from the received call request. The call service type is one of an originating call and a terminating call. The call service request is one of at least a toll-free number dialing, Internet Protocol (IP) centrex services, and service for trunk users.

[0074] At **406**, the method **400** includes the step of determining if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) for charging the received call request. The determination unit **210** determines if CCR trigger is required to be transmitted to an OCS **312** subsequent to checking the set of predefined conditions which are dependent on parameters such as service type, Closed User Group, and SIP method.

[0075] The set of predefined conditions include a first condition to check information retrieved from the call received in order to identify which service types are required for the user and to determine whether the CCR trigger is required to be transmitted for the identified service type based on the customization done by the service provider. For example, if the user requires a specific type of service, the determination unit **210** identifies the required service type and checks whether the service provider had provided customization utilizing the user interface module **220** related to charging for that specific service type based on which the determination unit **210** determines if there is a need to transmit a CCR for the required service type .The set of predefined conditions further include a second condition in order to determine a call type of an ongoing call, whether it is at least one of, a Closed User Group (CUG)

class, an INTER call type, an INTRA call type or an Outside call type and to determine whether a Ro trigger is configured for the identified service type. The set of predefined conditions further include a third condition to check which type of SIP invite is received at the system **108**, which includes at least one of, an invite request and update request in the call request and to determine the Ro trigger corresponding to the SIP invite received is enabled or disabled based on the customization done by the service provider.

[0076] In one embodiment, the Closed User group (CUG) is a supplementary service provided by the service providers to mobile subscribers/users who can make and receive calls from any member associated within the group. The INTRA call is a type of an ongoing call which is considered as the local call while INTER call is a type of an ongoing call which is considered as the long-distance call.

[0077] At **408**, the method **400** includes the step of transmitting the CCR trigger to the OCS on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA). Subsequent to checking the set of predefined conditions by the determination unit **210,** the transceiver **206** transmits the CCR trigger to the OCS **312** via a Diameter Routing Agent (DRA) utilizing a diameter interface for charging the call.

[0078] At **410**, the method **400** includes the step of determining a Credit Control Answer (CCA) utilizing the information retrieved from the received call request to indicate a charging status and a valuation of the call request, thereby managing call charging in the network. In one embodiment, the OCS **312** performs charging calculations based on the received information from the received call request and provides a Diameter Credit Control Answer (CCA) response indicating the charging status and valuation of the call. The system **108** evaluates the diameter responses received from the OCS **312** to make decisions regarding call continuation or denial. For example, the system 108 receives a diameter error response with code 5030. The service provider configures different actions utilizing the user interface module **220**

based on the diameter error response. If service provider configures to ignore the error, the system **108** will disregard the error and continue the call. Alternatively, if service provider configures to reject the call, the system **108** will terminate the call and may play an announcement to the calling party such as UE **102**.

[0079] The described method provides service providers with the ability to customize and configure the charging mechanism, call behavior, and SIP responses within the system **108**. This customization offers tailored and flexible call charging support based on the call service types, the SIP methods, and the diameter responses. The system **108** ensures secure and reliable communication with the OCS **312**, facilitating efficient charging control and call handling. The runtime control and flexibility empower service providers, eliminating the need for extensive backend development or coding.

[0080] **FIG. 5** is a signal flow diagram illustrating the system for managing call charging in a network, according to one or more embodiments of the present disclosure.

[0081] At step **502**, the user initiates a call request via the UE **102**.

[0082] At step **504**, the transceiver **206** of the processor **205** receives the call request initiated by the user and forwards the call request to the extraction unit **208**.

[0083] At step **506**, the extraction unit **208** retrieves information pertaining to at least one of a call service type and a call service request from the received call request and transmits a determination request to the determination unit **210.**

[0084] At step **508**, the determination unit **210,** determines a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) **312** for charging the received call request and transmits a response to the transceiver 206.

[0085] At step **510**, based on the response from the determination unit **210,** the transceiver **206** transmits the CCR trigger to the OCS **312** via a Diameter Routing Agent (DRA) **310**.

[0086] At step **512**, the OCS **312** transmits a response to the determination unit **206.** The response is a diameter response related to the call request. The response indicates a charging status and a valuation of the call request.

[0087] At step **514**, the determination unit **210** receives the response from the OCS **312** and transmits a response to the transceiver **206** subsequent to determining a call behavior applicable to the received call request. The call behavior is customizable by a service provider based on a response received from the OCS **312** and the call service type. Further, the determination unit **210** applies the determined call behavior on the received call request.

[0088] At step **516**, the transceiver **206** transmits the applied call behavior on the received call request which is related to call continuation of the call or the denial of the call.

[0089] The present invention further discloses a non-transitory computer-readable medium having stored thereon computer-readable instructions. The computer-readable instructions are executed by the processor **202**. The processor **202** is configured to receive a call request from an at least one User Equipment via an interface. The processor **202** is further configured to retrieve information pertaining to at least one of a call service type and a call service request from the received call request. The processor **202** is further configured to determine if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) **312** for charging the received call request. The processor **202** is further configured to transmit the CCR trigger to the OCS **312** on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA) **310**. The processor **202** is further configured to determine a Credit Control Answer (CCA)

utilizing the information retrieved to indicate a charging status and a valuation of the call request, thereby managing call charging in the network.

[0090] A person of ordinary skill in the art will readily ascertain that the illustrated embodiments and steps in description and drawings (FIG.1-5) are set out to explain the exemplary embodiments shown, and it should be anticipated that ongoing technological development will change the manner in which particular functions are performed. These examples are presented herein for purposes of illustration, and not limitation. Further, the boundaries of the functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternative boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope and spirit of the disclosed embodiments.

[0091] The present disclosure provides technical advancement. For example, the invention provides customized call charging support tailored to the specific business needs of enterprise users. Further, different types of subscribers can be charged differently, allowing service providers to offer flexible charging options based on service types and user categories. Further, this customization capability ensures that each enterprise user receives charging treatment appropriate for their requirements. Further, the invention enables service providers to govern call behavior based on diameter responses received from the Online Charging System (OCS). By configuring the system, service providers can define actions such as call continuation, call denial, call denial with announcement, or call continuation with announcement. This kind of flexibility empowers service providers to handle calls in a manner that aligns with their specific business policies and requirements. Further, service providers can map Session Initiation Protocol (SIP) error responses to specific diameter responses, ensuring consistent and appropriate handling of call-related events. This mapping capability of the invention allows service providers to customize SIP error responses

according to their preferences and requirements. By mapping the appropriate SIP error response based on the Diameter response received, service providers can ensure seamless call handling and enhance the overall user experience. The invention eliminates the need for extensive backend development or coding. Further, the service providers can dynamically configure the system parameters and rules, providing runtime control and flexibility over the charging process, call behavior, and SIP responses. This streamlines the customization process and empowers service providers to adapt their charging mechanisms and call handling in real-time, without requiring significant system modifications. With the ability to charge different services in distinct ways, service providers can offer enhanced service differentiation to their enterprise users. By tailoring the charging process based on service types, service providers can provide unique pricing structures, packages, or features for each service category, further strengthening their value proposition and meeting the diverse needs of their customers.

[0092] The present invention offers multiple advantages over the prior art and the above listed are a few examples to emphasize on some of the advantageous features. The listed advantages are to be read in a non-limiting manner.

REFERENCE NUMERALS

[0093] Environment - 100;

[0094] User Equipment (UE) - 102;

[0095] Server - 104;

[0096] Network- 106;

[0097] System -108;

[0098] Processor - 202;

[0099] Memory - 204;

[00100] Transceiver – 206;

[00101] Extraction unit – 208;

[00102] Determination unit – 210;

[00103] Mapping unit – 212;

[00104] Implementation unit – 214;

[00105] Database – 218;

[00106] User Interface module – 220;

[00107] Primary processor- 302;

[00108] Memory- 304;

[00109] User Interface – 306;

[00110] DRA – 310;

[00111] OCS – 312.

We Claim:

1. A method (400) of managing call charging in a network (106), the method (400) comprises the steps of:

receiving, by one or more processors (202), a call request from an at least one User Equipment (102) via an interface;

retrieving, by the one or more processors (202), information pertaining to at least one of a call service type and a call service request from the received call request;

determining, by the one or more processors (202), if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) (312) for charging the received call request;

transmitting, by the one or more processors (202), the CCR trigger to the OCS (312) on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA) (310); and

determining, by the one or more processors (202), a Credit Control Answer (CCA) utilizing the information retrieved from the received call request to indicate a charging status and a valuation of the call request, thereby managing call charging in the network (106).

2. The method (400) as claimed in claim 1, further comprising the steps of:

determining, by the one or more processors (202), a call behaviour applicable to the received call request, wherein the call behaviour is customizable based on a response received from the OCS (312) and the call service type; and

applying, by the one or more processors (202), the determined call behaviour to the received call request.

3. The method (400) as claimed in claim 2, wherein the call behaviour pertains to an activity which includes one of continuing the call, deny the call, deny call with announcement and continue call with announcement.

4. The method (400) as claimed in claim 1, wherein the call service type is one of an originating call and a terminating call.

5. The method (400) as claimed in claim 1, wherein the call service request is one of at least a toll-free number dialling, Internet Protocol (IP) centrex services, and service for trunk users.

6. The method (400) as claimed in claim 1, wherein the call request is received utilizing a Session Initiation Protocol (SIP) and the CCR trigger is transmitted to the OCS (312) via the DRA (310) utilizing a diameter interface.

7. The method (400) as claimed in claim 1, wherein subsequent to checking a set of predefined conditions, the CCR trigger is transmitted to the OCS (312), wherein the set of pre-defined conditions are dependent on parameters such as service type, Closed User Group, and SIP method, wherein charging is customized by a service provider based on at least one of business requirements and the call service type.

8. The method (400) as claimed in claim 1, wherein in response to transmission of the CCR trigger, the method (400) further comprising the steps of:

receiving, by the one or more processors (202), a diameter response from the OCS (312);

mapping, by the one or more processors (202), the diameter response to a SIP response as customized by a service provider;

implementing, by the one or more processors (202), the call behaviour at the at least one UE (102) based on the mapping.

9. The method (400) as claimed in claim 8, wherein the mapping of the diameter response to the SIP response is dependent on the call service type.

10. The method (400) as claimed in claim 7, wherein the set of predefined conditions include at least one of:

a first condition, to check information retrieved from the call received in order to identify which BTAS service type needs to be accessed and to determine whether the CCR trigger is required to be transmitted for the identified BTAS service type based on the customization;

a second condition, to determine a call type of an ongoing call, whether it is at least one of, a Closed User Group (CUG) class, an INTER call type, an INTRA call type or an Outside call type and to determine whether a Ro trigger is configured for the identified BTAS service type; and

a third condition, to check which type of SIP invite is received, which includes at least one of, an invite request and update request in the call request and to determine the Ro trigger corresponding to the SIP invite received is enabled or disabled based on the customization.

11. A User Equipment (UE) (102), comprising:

one or more primary processors (302) communicatively coupled to one or more processors (202), the one or more primary processors (302) coupled with a memory (304), wherein said memory (304) stores instructions which when executed by the one or more primary processors (302) causes the UE (102) to:

transmit a call request to the one or more processors (202) via an interface, wherein the one or more processors (202) are configured to perform the method (400) as claimed in claim 1.

12. A system (108) of managing call charging in a network (106), the system (108) comprising:

a transceiver (206) configured to receive, a call request from an at least one User Equipment (102) via an interface;

an extraction unit (208) configured to retrieve, information pertaining to at least one of a call service type and a call service request from the received call request;

a determination unit (210) configured to determine, if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) (312) for charging the received call request;

the transceiver (206) configured to transmit, the CCR trigger to the OCS (312) on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA) (310); and

the determination unit (210) configured to determine, a Credit Control Answer (CCA) utilizing the information retrieved to indicate a charging status and a valuation of the call request, thereby managing call charging in the network (106).

13. The system (108) as claimed in claim 12, wherein the determination unit (210) is further configured to:

determine, a call behaviour applicable to the received call request, wherein the call behaviour is customizable based on a response received from the OCS (312) and the call service type; and

apply, the determined call behaviour on the received call request.

14. The system (108) as claimed in claim 13, wherein the call behaviour pertains to an activity which includes one of continue the call, deny the call, deny call with announcement and continue call with announcement.

15. The system (108) as claimed in claim 12, wherein the call service type is one of an originating call and a terminating call.

16. The system (108) as claimed in claim 12, wherein the call service request is one of at least a toll-free number dialling, Internet Protocol (IP) centrex services, and service for trunk users.

17. The system (108) as claimed in claim 12, wherein the call request is received utilizing a Session Initiation Protocol (SIP) and the CCR trigger is transmitted to the OCS (312) via the DRA (310) utilizing a diameter interface.

18. The system (108) as claimed in claim 12, wherein subsequent to checking a set of predefined conditions, the CCR trigger is transmitted to the OCS (312) ,wherein the set of pre-defined conditions are dependent on parameters including at least one of, service type, Closed User Group, and SIP method, wherein charging is customized by a service provider based on at least one of business requirements and the call service type.

19. The system (108) as claimed in claim 12, wherein in response to transmission of the CCR trigger:

the transceiver (206) is configured to, receive, a diameter response from the OCS (312);

a mapping unit (212) is configured to map, the diameter response to a SIP response as customized by a service provider;

an implementation unit (214) is configured to, implement, the call behaviour at the at least one UE (102) based on the mapping.

20. The system (108) as claimed in claim 19, wherein the mapping of the diameter response to the SIP response is dependent on the call service type.

21. The system (108) as claimed in claim 18, wherein the set of predefined conditions include at least one of:

a first condition, to check information retrieved from the call received in order to identify which BTAS service type needs to be accessed and to determine whether the CCR trigger is required to be transmitted for the identified BTAS service type based on the customization;

a second condition, to determine a call type of an ongoing call, whether it is at least one of, a Closed User Group (CUG) class, an INTER call type, an INTRA call type or an Outside call type and to determine whether a Ro trigger is configured for the identified BTAS service type; and

a third condition, to check which type of SIP invite is received, which includes at least one of, an invite request and update request in the call request and to determine the Ro trigger corresponding to the SIP invite received is enabled or disabled based on the customization.

22. A non-transitory computer-readable medium having stored thereon computer-readable instructions that, when executed by a processor (202), causes the processor (202) to:

receive, a call request from an at least one User Equipment (102) via an interface;

retrieve, information pertaining to at least one of a call service type and a call service request from the received call request;

determine, if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) (312) for charging the received call request;

transmit, the CCR trigger to the OCS (312) on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA) (310); and

determine, a Credit Control Answer (CCA) utilizing the information retrieved to indicate a charging status and a valuation of the call request, thereby managing call charging in the network (106).

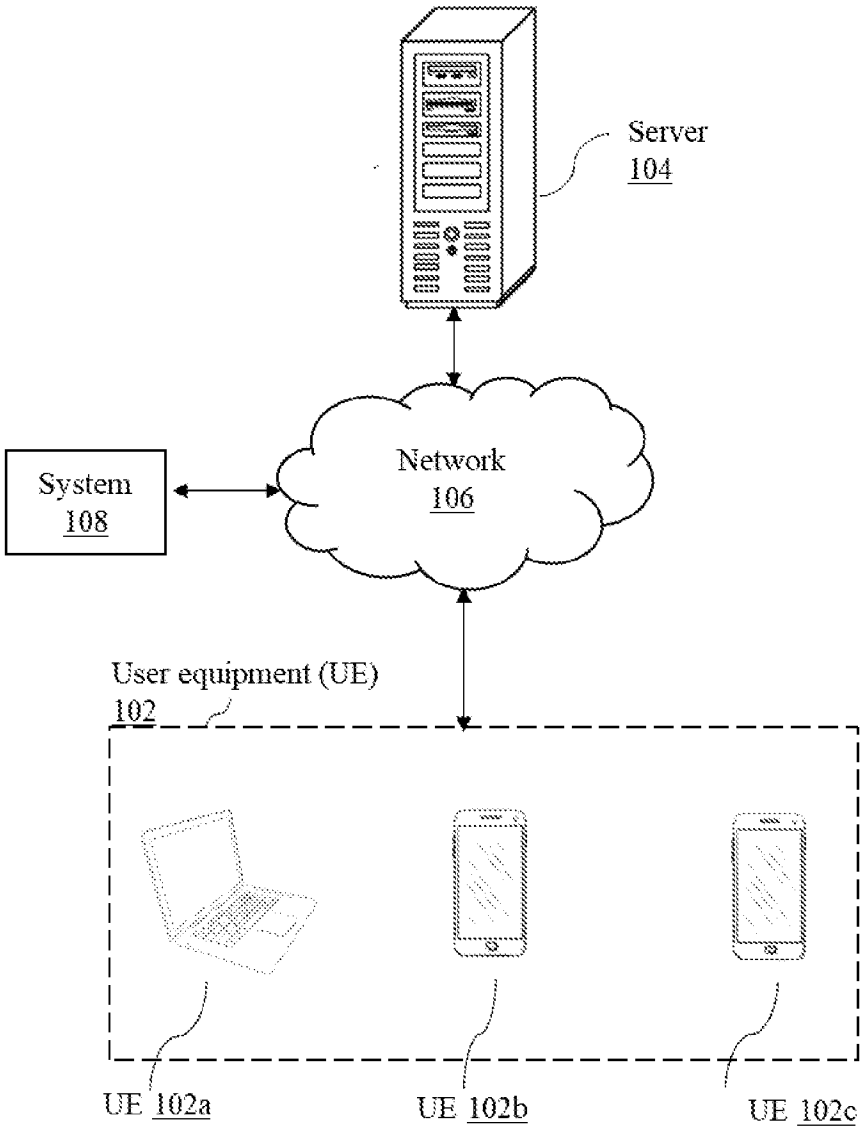
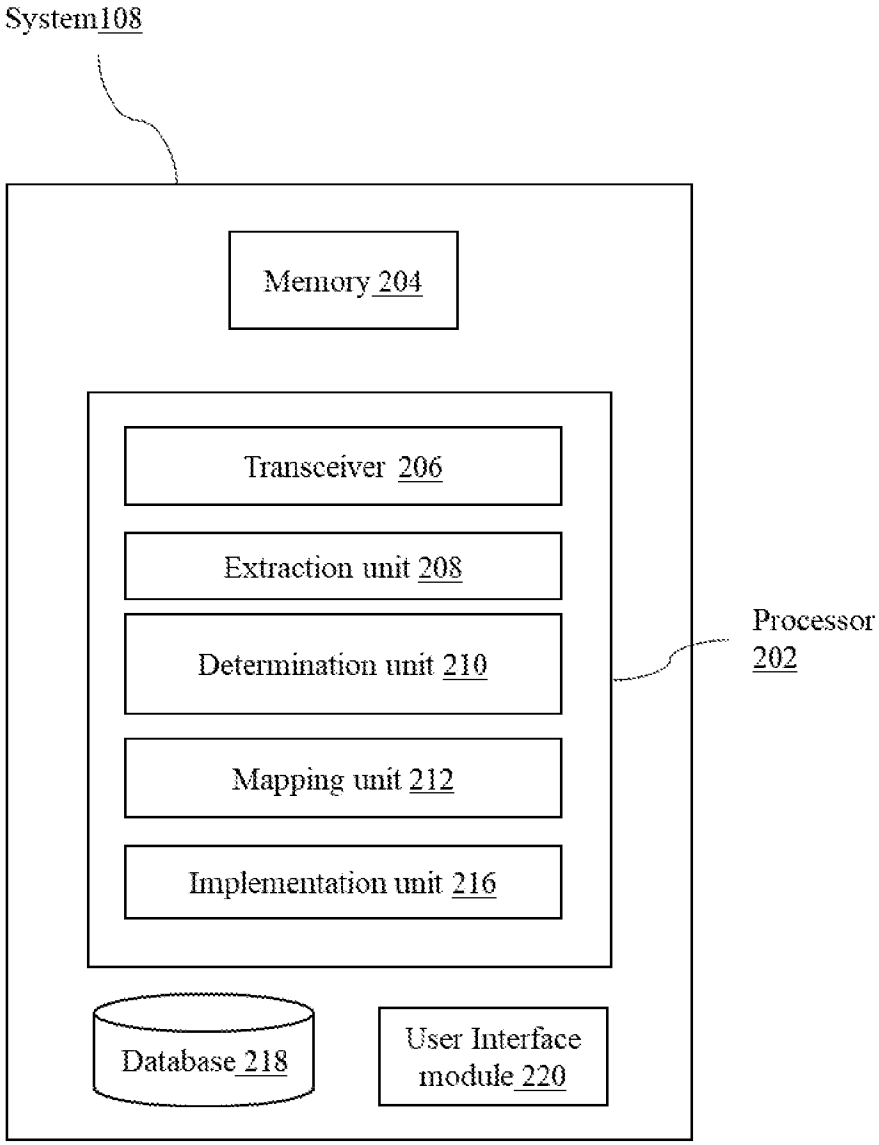

Server
104
Network
106
System
108
User equipment (UE)
102
UE 102a
UE 102b
UE 102c

FIG. 1


System 108
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Transceiver 206
Extraction unit 208
Determination unit 210
Mapping unit 212
Implementation unit 216
Processor 202
Database 218
User Interface module 220

FIG. 2

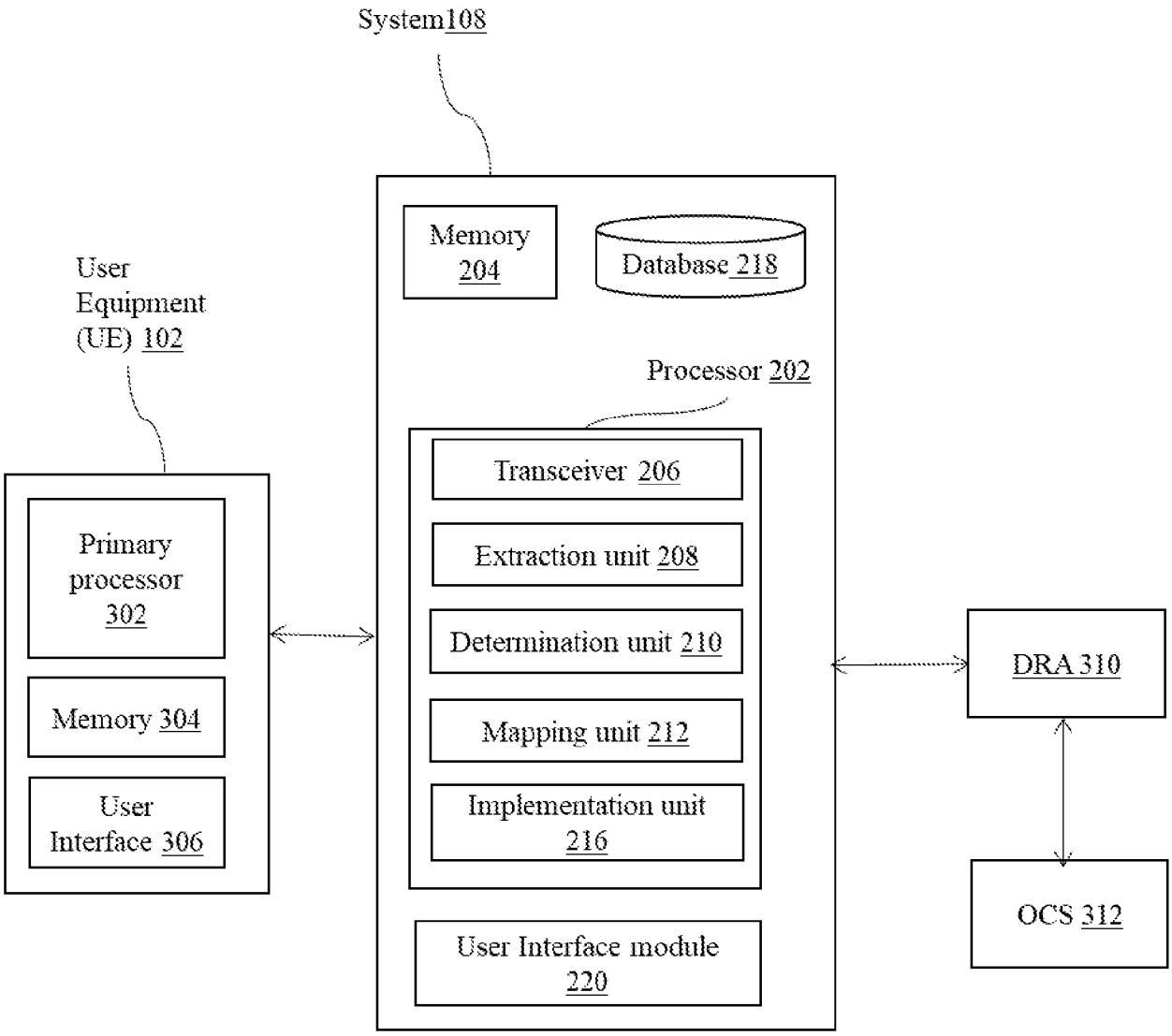
System108
Memory 204
Database 218
User Equipment (UE) 102
Processor 202
Transceiver 206
Extraction unit 208
Determination unit 210
Mapping unit 212
Implementation unit 216
User Interface module 220
Primary processor 302
Memory 304
User Interface 306
DRA 310
OCS 312

FIG. 3

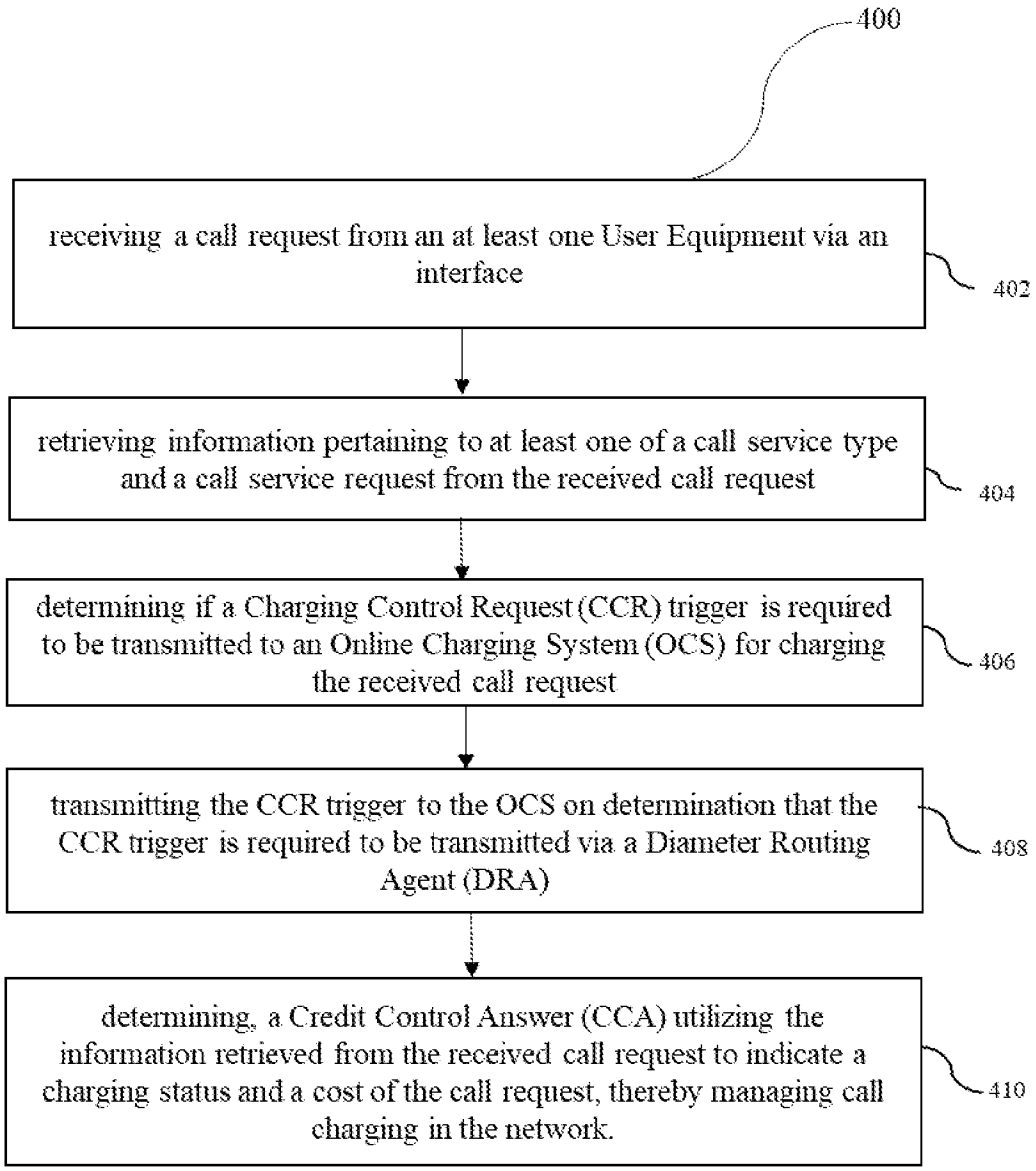
400
receiving a call request from an at least one User Equipment via an interface
402
retrieving information pertaining to at least one of a call service type and a call service request from the received call request
404
determining if a Charging Control Request (CCR) trigger is required to be transmitted to an Online Charging System (OCS) for charging the received call request
406
transmitting the CCR trigger to the OCS on determination that the CCR trigger is required to be transmitted via a Diameter Routing Agent (DRA)
408
determining, a Credit Control Answer (CCA) utilizing the information retrieved from the received call request to indicate a charging status and a cost of the call request, thereby managing call charging in the network.
410

FIG. 4

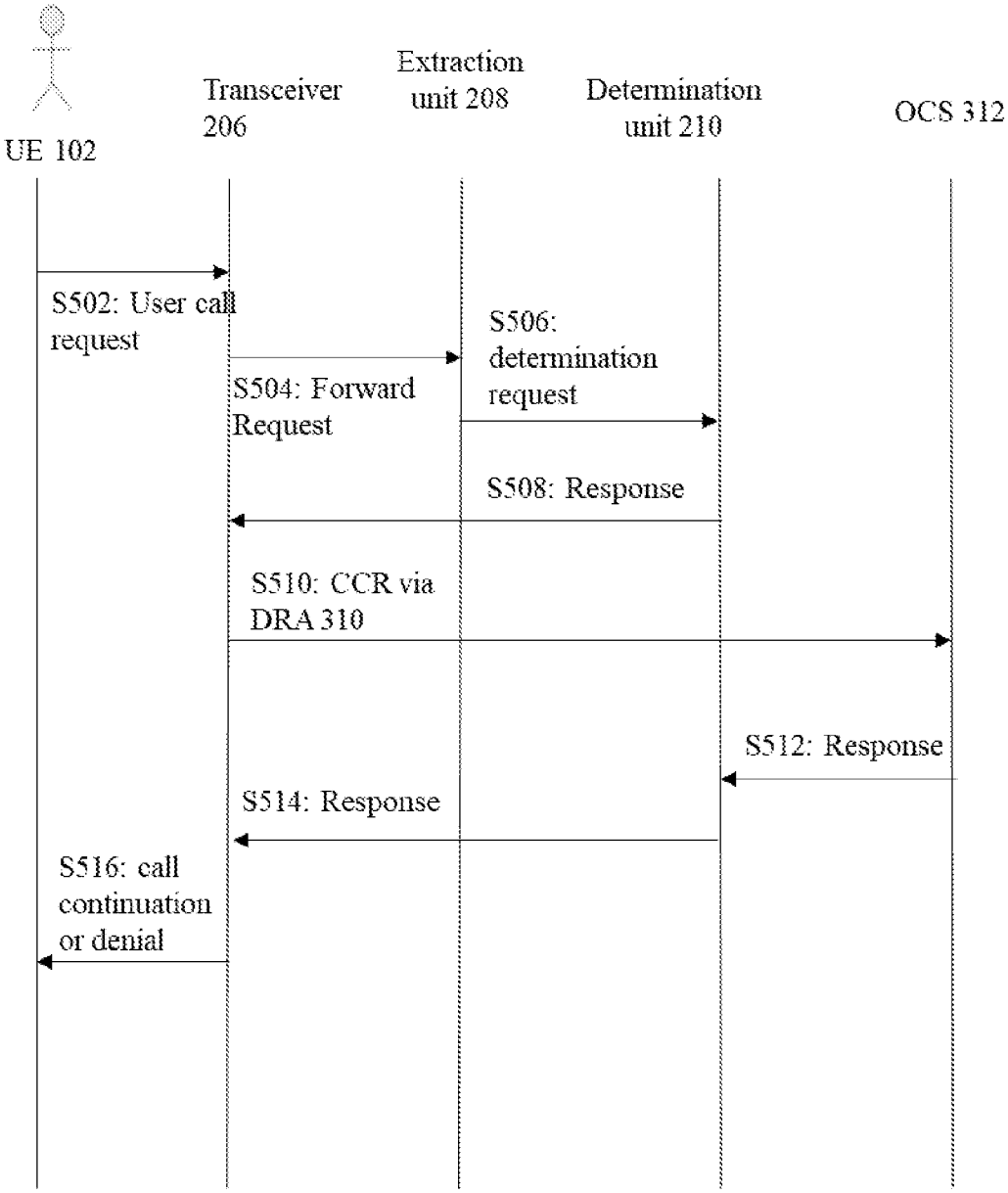
UE 102
Transceiver 206
Extraction unit 208
Determination unit 210
OCS 312
S502: User call request
S504: Forward Request
S506: determination request
S508: Response
S510: CCR via DRA 310
S512: Response
S514: Response
S516: call continuation or denial

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2024/050974

A. CLASSIFICATION OF SUBJECT MATTER
H04W4/24,H04L12/14,H04M15/00 Version=2024.01

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W, H04L, H04M

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP2086164 A1 (HUAWEI TECHNOLOGIES CO., LTD. [CN]) 05 August 2009 (05-08-2009) Abstract; Para [0022], Para [0039], Para [0042], Para [0050]; Claim 7	1-22
Y	US8620263 B2 (TEKELEC INC. [US]) 31 December 2013 (31-12-2013) Fig. 1	1-22

☐ 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
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30-10-2024	30-10-2024
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Amit Kumar Gupta Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2024/050974

Citation	Pub.Date	Family	Pub.Date
EP 2086164 A1	05-08-2009	CN 101499911 A	05-08-2009