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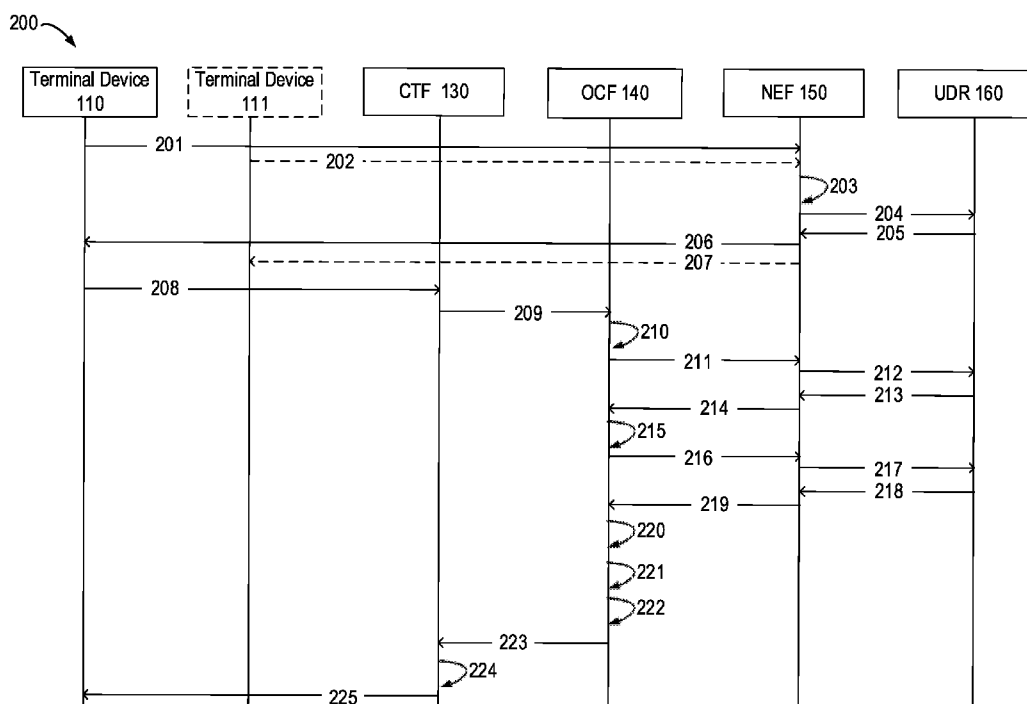


Fig. 2

(57) Abstract: Embodiments of the present disclosure provide method, device and computer readable medium for online charging. The method implemented at a terminal device comprises: transmitting, to a network device with a NEF, a request for setting a further terminal device as an ACP for the terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and receiving an acknowledgement for the request from the network device. The method implemented at a network device with a NEF comprises: receiving, from a first terminal device, a request for setting a second terminal device as an ACP for the first terminal device; and generating, based on the request, information of an ACP associated with the first terminal device. The method implemented at a network device with a CTF comprises: acquiring a request for a service from a terminal device; transmitting a request for online charging for the service to a further network device with an OCF; receiving, from the further

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network device, a response message to the request; and in response to the response message indicating that the service is charged by an ACP for the terminal device, transmitting to the terminal device a notification that a recharging is needed. The method implemented at a network device with an OCF comprises: receiving, from a first network device with a CTF, a request for online charging for a service requested by a terminal device; determining whether the terminal device is out of credit or not; in response to determining that the terminal device is out of credit, obtaining first information about an ACP associated with the terminal device from a second network device with a NEF; and determining, based on the first information, an ACP for charging for the service requested by the terminal device.

ONLINE CHARGING IN COMMUNICATION SYSTEMS

TECHNICAL FIELD

[0001] Embodiments of the present disclosure generally relate to the field of communications, and in particular, to a method, device and computer readable storage medium for online charging in communication systems.

BACKGROUND

[0002] Online charging functionality (OCF) in communication systems allows a communication service provider to charge in real time their customers based on their service usage. For a pre-paid service, when the customers run out of credit, an online recharge may be done in order to continue the service. However, the online recharge requires a network connection to pay online for the recharge fee. In this case, a dead loop occurs because the network connection also requires the prepaid credit.

SUMMARY

[0003] In general, example embodiments of the present disclosure provide a method, device and computer readable storage medium for online charging in communication systems.

[0004] In a first aspect, there is provided a terminal device. The terminal device comprises: a processor and a memory coupled to the processor. The memory stores instructions that when executed by the processor, cause the terminal device to perform actions. The actions comprise: transmitting, to a network device with a network exposure functionality, a request for setting a further terminal device as an alternative charging party (ACP) for the terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and receiving an acknowledgement for the request from the network device.

[0005] In a second aspect, there is provided a network device in a communication system. The network device comprises: a processor and a memory coupled to the processor. The memory stores instructions that when executed by the processor, cause the network device to perform actions. The actions comprise: receiving, from a first terminal device, a request for setting a second terminal device as an alternative charging party (ACP) for the

first terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and generating, based on the request, information of an ACP associated with the first terminal device.

[0006] In a third aspect, there is provided a network device in a communication system.

5 The network device comprises: a processor and a memory coupled to the processor. The memory stores instructions that when executed by the processor, cause the network device to perform actions. The actions comprise: acquiring a request for a service from a terminal device; in response to acquiring the request for the service, transmitting a request for online charging for the service to a further network device with an online charging
10 functionality; receiving, from the further network device, a response message to the request; and in response to the response message indicating that the service is charged by an alternative charging party (ACP) for the terminal device, transmitting to the terminal device a notification that a recharging is needed, the ACP being determined by the terminal device for charging for the service requested by the terminal device in case that the terminal device
15 is out of credit.

[0007] In a fourth aspect, there is provided a network device in a communication system.

The network device comprises: a processor and a memory coupled to the processor. The memory stores instructions that when executed by the processor, cause the network device to perform actions. The actions comprise: receiving, from a first network device with a
20 charging trigger functionality, a request for online charging for a service requested by a terminal device; in response to receiving the request for online charging, determining whether the terminal device is out of credit or not; in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a
25 network exposure functionality; and determining, based on the first information, an ACP for charging for the service requested by the terminal device.

[0008] In a fifth aspect, there is provided a method implemented at a terminal device. The method comprises: transmitting, to a network device with a network exposure functionality, a request for setting a further terminal device as an alternative charging party (ACP) for the
30 terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and receiving an acknowledgement for the request from the network device.

[0009] In a sixth aspect, there is provided a method implemented at a network device. The method comprises: receiving, from a first terminal device, a request for setting a second terminal device as an alternative charging party (ACP) for the first terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and generating, based on the request, information of an ACP associated with the first terminal device.

[0010] In a seventh aspect, there is provided a method implemented at a network device. The method comprises: acquiring a request for a service from a terminal device; in response to acquiring the request for the service, transmitting a request for online charging for the service to a further network device with an online charging functionality; receiving, from the further network device, a response message to the request; and in response to the response message indicating that the service is charged by an alternative charging party (ACP) for the terminal device, transmitting to the terminal device a notification that a recharging is needed, the ACP being determined by the terminal device for charging for the service requested by the terminal device in case that the terminal device is out of credit.

[0011] In an eighth aspect, there is provided a method implemented at a network device. The method comprises: receiving, from a first network device with a charging trigger functionality, a request for online charging for a service requested by a terminal device; in response to receiving the request for online charging, determining whether the terminal device is out of credit or not; in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a network exposure functionality; and determining, based on the first information, an ACP for charging for the service requested by the terminal device.

[0012] In a ninth aspect, there is provided a computer readable storage medium having instructions stored thereon. The instructions, when executed on at least one processor, cause the at least one processor to carry out the method according to the fifth aspect of the present disclosure.

[0013] In a tenth aspect, there is provided a computer readable storage medium having instructions stored thereon. The instructions, when executed on at least one processor, cause the at least one processor to carry out the method according to the sixth aspect of the present disclosure.

[0014] In an eleventh aspect, there is provided a computer readable storage medium having instructions stored thereon. The instructions, when executed on at least one processor, cause the at least one processor to carry out the method according to the seventh aspect of the present disclosure.

- 5 [0015] In a twelfth aspect, there is provided a computer readable storage medium having instructions stored thereon. The instructions, when executed on at least one processor, cause the at least one processor to carry out the method according to the eighth aspect of the present disclosure.

- 10 [0016] It is to be understood that the summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

- 15 [0017] Through the more detailed description of some embodiments of the present disclosure in the accompanying drawings, the above and other objects, features and advantages of the present disclosure will become more apparent, wherein:

[0018] Fig. 1 shows an example communication system in which embodiments of the present disclosure can be implemented;

- 20 [0019] Fig. 2 shows an example interaction among terminal devices and network devices in a communication system in accordance with some embodiments of the present disclosure;

[0020] Fig. 3 shows a flowchart of an example method implemented at a terminal device for online charging in accordance with some embodiments of the present disclosure;

- 25 [0021] Fig. 4 shows a flowchart of an example method implemented at a network device with a network exposure functionality (NEF) for online charging in accordance with some embodiments of the present disclosure;

- 30 [0022] Fig. 5 shows a flowchart of an example method implemented at a network device with a charging trigger functionality (CTF) for online charging in accordance with some embodiments of the present disclosure;

[0023] Fig. 6 shows a flowchart of an example method implemented at a network device

with an online charging functionality (OCF) for online charging in accordance with some embodiments of the present disclosure; and

[0024] Fig. 7 shows a simplified block diagram of a device that is suitable for implementing embodiments of the present disclosure.

5 [0025] Throughout the drawings, the same or similar reference numerals represent the same or similar element.

DETAILED DESCRIPTION

10 [0026] Principle of the present disclosure will now be described with reference to some example embodiments. It is to be understood that these embodiments are described only for the purpose of illustration and help those skilled in the art to understand and implement the present disclosure, without suggesting any limitations as to the scope of the disclosure. The disclosure described herein can be implemented in various manners other than the ones described below.

15 [0027] In the following description and claims, unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skills in the art to which this disclosure belongs.

[0028] As used herein, the term “communication system” herein refers to a system that follows any suitable communication standards or protocols such as long term evolution (LTE), LTE-Advanced (LTE-A) and 5G NR, and employs any suitable communication technologies, including, for example, Multiple-Input Multiple-Output (MIMO), OFDM, time division multiplexing (TDM), frequency division multiplexing (FDM), code division multiplexing (CDM), Bluetooth, ZigBee, machine type communication (MTC), eMBB, mMTC and uRLLC technologies. For the purpose of discussion, in some embodiments, 20 the LTE system, the LTE-A system, the 5G NR system or any combination thereof is taken as an example of the communication system.

[0029] As used herein, the term “network device” refers to any suitable device at a network side of a communication system. The network device may also include any suitable device in a core network, for example, including multi-standard radio (MSR) radio equipment such as MSR BSs, network controllers such as radio network controllers (RNCs) 30 or base station controllers (BSCs), Multi-cell/multicast Coordination Entities (MCEs), Mobile Switching Centers (MSCs) and MMEs, Operation and Management (O&M) nodes,

Operation Support System (OSS) nodes, Self-Organization Network (SON) nodes, positioning nodes, such as Enhanced Serving Mobile Location Centers (E-SMLCs), and/or Mobile Data Terminals (MDTs).

[0030] The network device may also include any suitable device in an access network of the communication system, for example, including a base station (BS), a transmission point (TRP), a relay, an access point (AP), a node B (NodeB or NB), an evolved NodeB (eNodeB or eNB), a gigabit NodeB (gNB), a Remote Radio Module (RRU), a radio header (RH), a remote radio head (RRH), a low power node such as a femto, a pico, and the like.

[0031] As used herein, the term “terminal device” refers to a device capable of, configured for, arranged for, and/or operable for communications with a network device or a further terminal device in a communication network. The communications may involve transmitting and/or receiving wireless signals using electromagnetic signals, radio waves, infrared signals, and/or other types of signals suitable for conveying information over air. In some embodiments, the terminal device may be configured to transmit and/or receive information without direct human interaction. For example, the terminal device may transmit information to the network device on predetermined schedules, when triggered by an internal or external event, or in response to requests from the network side.

[0032] Examples of the terminal device include, but are not limited to, user equipment (UE) such as smart phones, wireless-enabled tablet computers, laptop-embedded equipment (LEE), laptop-mounted equipment (LME), and/or wireless customer-premises equipment (CPE). For the purpose of discussion, in the following, some embodiments will be described with reference to UEs as examples of the terminal devices, and the terms “terminal device” and “user equipment” (UE) may be used interchangeably in the context of the present disclosure.

[0033] As used herein, the term “circuitry” may refer to one or more or all of the following:

(a) hardware-only circuit implementations (such as implementations in only analog and/or digital circuitry) and

(b) combinations of hardware circuits and software, such as (as applicable): (i) a combination of analog and/or digital hardware circuit(s) with software/firmware and (ii) any portions of hardware processor(s) with software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus, such as a mobile

phone or server, to perform various functions) and

(c) hardware circuit(s) and or processor(s), such as a microprocessor(s) or a portion of a microprocessor(s), that requires software (e.g., firmware) for operation, but the software may not be present when it is not needed for operation.

5 [0034] This definition of circuitry applies to all uses of this term in this application, including in any claims. As a further example, as used in this application, the term circuitry also covers an implementation of merely a hardware circuit or processor (or multiple processors) or portion of a hardware circuit or processor and its (or their) accompanying software and/or firmware. The term circuitry also covers, for example and
10 if applicable to the particular claim element, a baseband integrated circuit or processor integrated circuit for a mobile device or a similar integrated circuit in server, a cellular network device, or other computing or network device.

[0035] As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. The term “includes”
15 and its variants are to be read as open terms that mean “includes, but is not limited to.” The term “based on” is to be read as “at least in part based on.” The term “one embodiment” and “an embodiment” are to be read as “at least one embodiment.” The term “another embodiment” is to be read as “at least one other embodiment.” The terms “first,” “second,” and the like may refer to different or same objects. Other definitions,
20 explicit and implicit, may be included below.

[0036] In some examples, values, procedures, or apparatus are referred to as “best,” “lowest,” “highest,” “minimum,” “maximum,” or the like. It will be appreciated that such descriptions are intended to indicate that a selection among many used functional alternatives can be made, and such selections need not be better, smaller, higher, or
25 otherwise preferable to other selections.

[0037] As discussed above, a dead loop will occur when the customers run out of credit and need to online recharge but the network connection in turn requires the prepaid credit. This issue may cause a big trouble to the customers when they are doing outdoor activities and they are away from the free network access. In this case, the customers have to go to
30 the provider office/agency to recharge, which is in convenient to the customers. Thus, an improved online charging scheme is expected to address the above problem.

[0038] In view of the fact that a network exposure functionality (NEF) which allows an

external party to provision the expected UE behavioral information to network functions is introduced in 5G systems, embodiments of the present disclosure provide an improved solution for online charging utilizing the NEF to solve the problem above and one or more of other potential problems. In the present solution, an alternative charging party (ACP) for a terminal device is set or configured by the terminal device itself via the NEF, so that the ACP may charge a service requested by the terminal device in case that the terminal device is out of credit. In this way, the dead loop is avoided so that the service is continued, and then the user experience is enhanced. Principle and implementations of the present disclosure will be described in detail below with reference to Figs. 1-7.

[0039] Fig. 1 illustrates an example communication system 100 in which embodiments of the present disclosure can be implemented. As shown in Fig. 1, the system 100 includes a terminal device 110, a CTF network device 130, an OCF network device 140, a NEF network device 150 and a UDR network device 160. The CTF network device 130 may refer to a network device with a charging trigger functionality and may be simply referred as CTF 130 hereinafter. The OCF network device 140 may refer to a network device with an online charging functionality and may be simply referred as OCF 140 hereinafter. The NEF network device 150 may refer to a network device with a network exposure functionality and may be simply referred as NEF 150 hereinafter. The UDR network device 160 may refer to a network device with a unified data repository functionality and may be simply referred as UDR 160 hereinafter. It should be understood that although the network devices 130-160 are shown as separate devices, one or more of them also may be implemented by the same physical device. Furthermore, any of the network devices 130-160 may also have any other suitable functionalities in addition to the above specified functionality. To avoid confusion, the other functionalities will not be detailed herein.

[0040] As shown in Fig. 1, the terminal device 110 may communicate with the CTF 130 via a wireless access network (RAN) 120 in a control plane. If the terminal device 110 initiates a request for a service, the CTF 130 may communicate with the OCF 140 so that the service is charged online. When the terminal device 110 is out of credit, the OCF 140 may communicate with the NEF 150 and UDR 160 so that the charging for the service may be done by an ACP for the terminal device 110. The terminal device 110 may also communicate with an application server (AS) 170 via a wireless access network (RAN) 120 and then communicate with the NEF 150 via the AS 170 in a user plane, so that settings for an ACP for the terminal device 110 may be done.

[0041] It should be understood that the number of network devices and terminal devices as shown in Fig. 1 is only for the purpose of illustration without suggesting any limitations. The system 100 may include any suitable number of devices adapted for implementing embodiments of the present disclosure. It should be also understood that the communication between the terminal devices and the network devices is not limited to the shown form but may be achieved by any other suitable forms. Further, it should be understood that the system 100 may include other network devices with other functionalities not shown herein, in addition to that shown in Fig. 1.

[0042] The communications in the system 100 may conform to any suitable standards including, but not limited to, Long Term Evolution (LTE), LTE-Evolution, LTE-Advanced (LTE-A), Wideband Code Division Multiple Access (WCDMA), Code Division Multiple Access (CDMA) and Global System for Mobile Communications (GSM) and the like. Furthermore, the communications may be performed according to any generation communication protocols either currently known or to be developed in the future. Examples of the communication protocols include, but not limited to, the first generation (1G), the second generation (2G), 2.5G, 2.75G, the third generation (3G), the fourth generation (4G), 4.5G, the fifth generation (5G) communication protocols.

[0043] Fig. 2 shows an example interaction 200 among terminal devices and network devices in a communication system in accordance with some embodiments of the present disclosure. The interaction 200 can be implemented at the terminal device 110 and the network devices 130-160 shown in Fig. 1. For the purpose of discussion, the interaction 200 will be described with reference to Fig. 1. It is to be understood that the interaction 200 may include additional acts not shown and/or may omit some shown acts, and the scope of the present disclosure is not limited in this regard.

[0044] The interaction 200 may be divided into two parts. One part is for the setting of an ACP, as shown in 201-207, and the other part is for the use of the ACP, as shown in 208-221. The details are explained below.

[0045] As shown in Fig. 2, the terminal device 110 may transmit 201 to the NEF 150 a request for setting a further terminal device, such as a terminal device 111, as an ACP for the terminal device 110. In some embodiments, the terminal device 110 may set one or more further terminal devices as its ACP(s). For example, the terminal device 110 may set members in a family or members in business groups as its ACPs. In some embodiments, a

common account can be used for members in a group, and as a member of the group, the terminal device 110 may set the common account as its ACP.

[0046] In some embodiments, the request may comprise an identification (ID) of the further terminal device such as the terminal device 111. In some embodiments, the ID may be at least one of a phone number, a subscriber identification module (SIM) card or an international mobile equipment identity (IMEI). It is to be understood that any other suitable ID information may also be used.

[0047] In some embodiments, the terminal device 110 may transmit the request to the NEF 150 via the AS 170. It is to be understood that any other suitable ways also can be used to communicate with the NEF 150 in a user plane. In this way, the terminal device 110 may autonomously set or modify one or more ACPs for itself, thereby facilitating the flexibility and convenience of the end-user usage.

[0048] Similarly, as shown in Fig.2, the terminal device 111 may also transmit 202 to the NEF 150 a request for setting a further terminal device, such as the terminal device 110, as an ACP for the terminal device 111. In some embodiments, the terminal device 111 may set one or more further terminal devices as its ACP(s).

[0049] Upon receiving the request for setting an ACP from the terminal device 110 or 111, the NEF 150 generates 203 information of an ACP associated with the respective terminal device based on the request. In some embodiments, the information of an ACP may include a list of ID information of one or more ACPs. It is to be understood that any other suitable information also can be used to indicate terminal devices as ACPs. The NEF 150 only allows the terminal device 110 or 111 to set or modify the information of an ACP associated with it per se. This makes sure that malicious users are not able to set or configure others to pay for their services.

[0050] In some embodiments, the NEF 150 may store the information of an ACP locally. In some embodiments, the NEF 150 may store the information of an ACP externally in the UDR 160. In this case, UDR 160 may transmit 205 to the NEF 150 an acknowledgement for the storage of the information of an ACP. Thereby, when the terminal device is out of credit, a service requested by the terminal device may be charged utilizing the stored information of an ACP and then the service is to be continued, instead of being failed.

[0051] Then the NEF 150 may transmit 206 an acknowledge for the request to the terminal device 110. Similarly, the NEF 150 may transmit 207 an acknowledge for the

request to the terminal device 111.

[0052] So far, the setting for an ACP is completed. It is to be understood that the setting may be carried out in real time or in advance as needed. As the setting for an ACP is carried out at a terminal device, the flexibility and convenience of the end-user usage is facilitated and the end-user experience is enhanced. Below the use of the ACP will be further explained with reference to Fig.2.

[0053] As known, the terminal device 110 may transmit to a network side a request for a service such as an instant message service (IMS) session request, a session request related to an AS or the like. In this case, the CTF 130 may acquire 208 the request for the service from the terminal device 110. In some embodiments, the CTF 130 may detect the request for the service from the terminal device 110 periodically. In an alternative embodiment, the CTF 130 may carry out the detection in any other suitable way.

[0054] Upon acquiring 208 the request for the service from the terminal device 110, the CTF 130 may transmit 209 a request for online charging for the service to a further network device with an online charging functionality, such as the OCF 140. Upon receiving the request for online charging, the OCF 140 may determine 210 whether the terminal device 110 is out of credit or not.

[0055] If the terminal device 110 has enough billing credit, the OCF 140 may charge the service on the terminal device 110 and transmit a response message indicating that the service is charged. Upon receiving the response message, the CTF 130 may deliver the service to the terminal device 110.

[0056] If the terminal device 110 is out of credit, the OCF 140 may transmit 211 to the NEF 150 a request for obtaining the information of an ACP associated with the terminal device 110, also referred to as “first information” hereafter. Upon receiving the request from the OCF 140, the NEF 150 may acquire the first information associated with the terminal device 110. In some embodiments, if the information of an ACP is stored in the UDR 160, the NEF 150 may transmit 212 to the UDR 160 a request for acquiring the first information associated with the terminal device 110, and the UDR 160 transmit 213 the stored first information to the NEF 150. Then the NEF 150 may transmit 214 the first information to the OCF 140. In some embodiments, if the information of an ACP is stored locally, the NEF 150 may acquire the first information associated with the terminal device 110 locally, without accessing the UDR 160.

[0057] Based on the first information, the OCF 140 may determine 215 an ACP for charging for the service requested by the terminal device 110. As stated above, the first information may include a list of one or more ACPs set by the terminal device 110. In some embodiments, the OCF 140 may select one of the ACPs available for charging for the service as a candidate ACP. In some embodiments, the OCF 140 may perform the selection in a predefined order, for example, based on a priority, a time sequence or the like. In some embodiments, the OCF 140 may perform the selection at random. For convenience, the terminal device 111 is assumed as the candidate ACP for the terminal device 110.

[0058] To further ensure the safety, an authentication mechanism may be adopted to confirm whether the service can be charged on the candidate ACP. In some embodiments, it may be achieved by verifying whether the candidate ACP also sets the terminal device as its ACP, that is, whether a mutual agreement for alternative charging is done between the candidate ACP and the terminal device. It will be explained below with reference to Fig. 2.

[0059] Upon determining 215 the candidate ACP, the OCF 140 may transmit 216 to the NEF 150 a request for obtaining information of an ACP associated with the candidate ACP (in this example, the terminal device 111), also referred to as second information hereafter. In some embodiments, if the information of an ACP is stored in the UDR 160, the NEF 150 may transmit 217 to the UDR 160 a request for acquiring the second information associated with the terminal device 111, and the UDR 160 transmit 218 the stored second information to the NEF 150. Then the NEF 150 may transmit 219 the second information to the OCF 140. In some embodiments, if the information of an ACP is stored locally, the NEF 150 may acquire the second information associated with the terminal device 111 locally, without accessing the UDR 160. It is to be understood that the processes in 216-219 are similar with that in 211-214, and thus its details are omitted here.

[0060] Through the processes in 216-219, the OCF 140 obtains the second information about an ACP associated with the terminal device 111 from the NEF 150. It is to be understood that the second information is similar with the first information, and thus its details are omitted here.

[0061] Upon obtaining the second information, the OCF 140 may determine 220 whether the terminal device 110 is indicated in the second information. In some embodiments, the

OCF 140 may match the ID of the terminal device 110 with each of IDs in the second information so as to perform the determination 220.

[0062] If it is matched successfully, the OCF 140 may determine that the terminal device 110 is indicated in the second information. It means that the terminal device 111 also set the terminal device 110 as its ACP. In this case, the OCF 140 may determine 221 the candidate ACP as the ACP for charging for the service. Then the OCF 140 may charge 222 the service from the determined ACP, and transmit 223 to the CTF 130 a response message indicating that the service is charged by the determined ACP.

[0063] If it is unmatched, the OCF 140 may determine that the terminal device 110 is not indicated in the second information. That is, the terminal device 111 does not set the terminal device 110 as its ACP. In this case, the OCF 140 may repeat the processes in 215-221 for another one of the ACPs in the first information, until determining the ACP available for charging the service. If all of the ACPs in the first information are unavailable, the OCF 140 may transmit to the terminal device 110 a response message indicating that the service cannot be charged. Upon receiving the response message, the CTF 130 may deny the service from the terminal device 110.

[0064] The authentication mechanism implemented by the processes in 216-221 merely is an example. It is to be understood that any other suitable authentication mechanisms may also be used, and the present disclosure is not limited to this example. The authentication mechanism enhances the safety in communication systems.

[0065] Upon receiving the response message indicating that the service is charged by the determined ACP, the CTF 130 may generate 224 a notification that a recharging is needed and transmit 225 it to the terminal device 110. Meanwhile, the CTF 130 may allow the service to be delivered to the terminal device 110. In this way, the service continuity may be secured even in case that the terminal device 110 is out of credit and the terminal device 110 is informed that it is time to do the recharge.

[0066] With the solution of the present disclosure, as an ACP is set, service continuity is secured even when a terminal device is out of credit. Further, as the terminal device can set ACPs by itself and do the update of the ACPs anytime when it is needed, the configuration for ACPs at the terminal device is user-friendly. In addition, mutual agreement of ACPs avoids abuse of the charging by malicious users and ensures the safety.

[0067] Corresponding to the above concept described with reference to Figs. 1 and 2, the

present disclosure provides methods implemented at a terminal device and a network device respectively. Fig. 3 shows a flowchart of an example method 300 implemented at a terminal device for online charging in accordance with some embodiments of the present disclosure. The method 300 can be implemented at the terminal device 110 or 111 shown in Figs. 1 and 2. For the purpose of discussion, the method 300 will be described with reference to Figs. 1 and 2. It is to be understood that the method 300 may include additional acts not shown and/or may omit some shown acts, and the scope of the present disclosure is not limited in this regard.

[0068] At block 310, the terminal device 110 transmits, to the NEF 150, a request for setting a further terminal device as an ACP for the terminal device 110, the ACP provided for charging for a service requested by the terminal device 110 in case that the terminal device 110 is out of credit. In some embodiments, the terminal device 110 transmits the request to the NEF 150 via an AS such as the AS 170 as shown in Fig. 1. In some embodiments, the request comprises an ID of the further terminal device. The process in block 310 is similar with processes in 201 or 202 described in Fig. 2, and thus other details are omitted here.

[0069] At block 320, the terminal device 110 receives an acknowledgement for the request from the NEF 150. The process in block 320 is similar with processes in 206 or 207 described in Fig. 2, and thus omitted here.

[0070] With the solution of Fig. 3, the terminal device can set ACPs by itself and do the update of the ACPs anytime when it is needed, the configuration for ACPs at the terminal device is user-friendly, and the flexibility and convenience of the end-user usage is facilitated.

[0071] Fig. 4 shows a flowchart of an example method 400 implemented at a network device with a NEF for online charging in accordance with some embodiments of the present disclosure. The method 400 can be implemented at the NEF 150 shown in Figs. 1 and 2. For the purpose of discussion, the method 400 will be described with reference to Figs. 1 and 2. It is to be understood that the method 400 may include additional acts not shown and/or may omit some shown acts, and the scope of the present disclosure is not limited in this regard.

[0072] At block 410, the NEF 150 receives, from a first terminal device, a request for setting a second terminal device as an ACP for the first terminal device, the ACP provided

for charging for a service requested by the terminal device in case that the terminal device is out of credit. At block 420, the NEF 150 generates, based on the request, information of an ACP associated with the first terminal device.

[0073] In some embodiments, the NEF 150 stores the information of an ACP. In some
5 embodiments, the NEF 150 receives, from a further network device with an online charging functionality such as the OCF 140, a request for obtaining the information of an ACP, and transmits the information of an ACP to the further network device. The processes in blocks 410 and 420 are similar with processes in 203-205 described in Fig. 2, and thus its other details are omitted here.

10 [0074] With the solution of Fig. 4, the NEF device allows the terminal device to set ACPs by itself and generates and stores the ACPs for use in alternative charging for the service requested by the terminal device when the terminal device is out of credit. Thereby, it makes the configuration for ACPs very user-friendly, and the flexibility and convenience of the end-user usage is facilitated.

15 [0075] Fig. 5 shows a flowchart of an example method 500 implemented at a network device with a CTF for online charging in accordance with some embodiments of the present disclosure. The method 500 can be implemented at the CTF 130 shown in Figs. 1 and 2. For the purpose of discussion, the method 500 will be described with reference to Figs. 1 and 2. It is to be understood that the method 500 may include additional acts not shown
20 and/or may omit some shown acts, and the scope of the present disclosure is not limited in this regard.

[0076] At block 510, the CTF 130 acquires a request for a service from a terminal device, for example the terminal device 110. The process in block 510 is similar with process in 208 described in Fig. 2, and thus its details are omitted here.

25 [0077] At block 520, the CTF 130 transmits a request for online charging for the service to a further network device with an online charging functionality (in this example, the OCF 140). The process in block 520 is similar with process in 209 described in Fig. 2, and thus its details are omitted here.

[0078] At block 530, the CTF 130 receives, from the OCF 140, a response message to the
30 request. The process in block 530 is similar with process in 223 described in Fig. 2, and thus its details are omitted here.

[0079] At block 540, the CTF 130 determines whether the response message indicates that

the service is charged by an ACP for the terminal device 110, the ACP being determined by the terminal device 110 for charging for the service requested by the terminal device 110 in case that the terminal device 110 is out of credit. If the response message indicates that the service is charged by an ACP for the terminal device 110, at block 550, the CTF 130
5 transmit to the terminal device 110 a notification that a recharging is needed.

[0080] If the response message indicates that the service is charged by the terminal device itself or the service is not charged, at block 560, the CTF 130 performs other actions to response to the terminal device 110. In some embodiments, if the response message indicates that the service is charged, the CTF 130 allows the service to be delivered to the
10 terminal device 110. In some embodiments, if the response message indicates that the service is not charged, the CTF 130 denies the service. The processes in blocks 540-560 are similar with processes in 224 and 225 described in Fig. 2, and thus its details are omitted here.

[0081] Fig. 6 shows a flowchart of an example method 600 implemented at a network
15 device with a OCF for online charging in accordance with some embodiments of the present disclosure. The method 600 can be implemented at the OCF 140 shown in Figs. 1 and 2. For the purpose of discussion, the method 500 will be described with reference to Figs. 1 and 2. It is to be understood that the method 500 may include additional acts not shown and/or may omit some shown acts, and the scope of the present disclosure is not
20 limited in this regard.

[0082] At block 610, the OCF 140 receives, from a first network device with a charging trigger functionality such as the CTF 130, a request for online charging for a service requested by a terminal device such as the terminal device 110. The process in block 610 is similar with process in 209 described in Fig. 2, and thus its details are omitted here.

25 [0083] At block 620, the OCF 140 determines whether the terminal device 110 is out of credit or not. If it is determined at block 620 that the terminal device 110 has enough billing credit, at block 650, the OCF 140 charge the service from the terminal device.

[0084] If the terminal device 110 is out of credit, at block 630, the OCF 140 obtains first information about an ACP associated with the terminal device 110 from a second network
30 device with a network exposure functionality (in this example, the NEF 150). The processes in blocks 620 and 630 are similar with processes in 210-214 described in Fig. 2, and thus other details are omitted here.

[0085] At block 640, the OCF 140 determines, based on the first information, an ACP for charging for the service requested by the terminal device 110. In some embodiments, the OCF 140 may determine, from the first information, a candidate ACP available for charging for the service. Then an authentication is performed on the candidate ACP. In some
5 embodiments, the OCF 140 may obtain second information about an ACP associated with the candidate ACP from the NEF 150, determine whether the terminal device 110 is indicated in the second information, and when the terminal device 110 is indicated in the second information, determine the candidate ACP as the ACP for charging for the service. The processes in block 640 are similar with processes in 215-221 described in Fig. 2, and
10 thus its details are omitted here.

[0086] In some embodiments, the OCF 140 may charge the service from the determined ACP and transmit, to the CTF 130, a response message indicating that the service is charged by the determined ACP. These processes are similar with processes in 222-223 described in Fig. 2, and thus its details are omitted here.

15 [0087] With the solution of Fig. 6, a service requested by a terminal device is allowed to be charged by an ACP in case that the terminal device is out of credit, and thus the service continuity is secured and the user experience is enhanced. Further, by performing an authentication on the ACP for charging for the service, the safety for charging is ensured.

20 [0088] In some embodiments, an apparatus capable of performing the method 300 (for example, the terminal device 110) may comprise means for performing the respective steps of the method 300. The means may be implemented in any suitable form. For example, the means may be implemented in a circuitry or software module.

25 [0089] In some embodiments, the apparatus comprises: means for transmitting, to a network device with a network exposure functionality, a request for setting a further terminal device as an ACP for the terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and means for receiving an acknowledgement for the request from the network device.

30 [0090] In some embodiments, the means for transmitting transmits the request to the network device via an AS. In some embodiments, the request comprises an identification of the further terminal device as the ACP.

[0091] In some embodiments, an apparatus capable of performing the method 400 (for example, the NEF 150) may comprise means for performing the respective steps of the

method 400. The means may be implemented in any suitable form. For example, the means may be implemented in a circuitry or software module.

[0092] In some embodiments, the apparatus comprises: means for receiving, from a first terminal device, a request for setting a second terminal device as an ACP for the first terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and means for generating, based on the request, information of an ACP associated with the first terminal device.

[0093] In some embodiments, the apparatus further comprises means for storing the information of an ACP.

[0094] In some embodiments, the apparatus further comprises means for receiving, from a further network device with an online charging functionality, a request for obtaining the information of an ACP; and means for transmitting the information of an ACP to the further network device.

[0095] In some embodiments, an apparatus capable of performing the method 500 (for example, the CTF 130) may comprise means for performing the respective steps of the method 500. The means may be implemented in any suitable form. For example, the means may be implemented in a circuitry or software module.

[0096] In some embodiments, the apparatus comprises: means for acquiring a request for a service from a terminal device; means for in response to acquiring the request for the service, transmitting a request for online charging for the service to a further network device with an online charging functionality; means for receiving, from the further network device, a response message to the request; and means for in response to the response message indicating that the service is charged by an alternative charging party (ACP) for the terminal device, transmitting to the terminal device a notification that a recharging is needed, the ACP determined by the terminal device for charging for the service requested by the terminal device in case that the terminal device is out of credit.

[0097] In some embodiments, the apparatus further comprises: means for in response to the response message indicating that the service is charged, allowing the service to be delivered to the terminal device.

[0098] In some embodiments, an apparatus capable of performing the method 600 (for example, the OCF 140) may comprise means for performing the respective steps of the method 600. The means may be implemented in any suitable form. For example, the

means may be implemented in a circuitry or software module.

[0099] In some embodiments, the apparatus comprises: means for receiving, from a first network device with a charging trigger functionality, a request for online charging for a service requested by a terminal device; means for in response to receiving the request for online charging, determining whether the terminal device is out of credit or not; means for in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a network exposure functionality; and means for determining, based on the first information, an ACP for charging for the service requested by the terminal device.

[00100] In some embodiments, the means for determining comprises: means for determining, from the first information, a candidate ACP available for charging for the service; means for obtaining, from the second network device, second information about an ACP associated with the candidate ACP; means for determining whether the terminal device is indicated in the second information; and means for in response to determining that the terminal device is indicated in the second information, determining the candidate ACP as the ACP for charging for the service.

[00101] In some embodiments, the apparatus further comprises means for charging the service from the determined ACP; and means for transmitting, to the first network device, a response message indicating that the service is charged by the determined ACP.

[00102] Fig. 7 is a simplified block diagram of a device 700 that is suitable for implementing embodiments of the present disclosure. The device 700 can be considered as a further example implementation of the terminal device 110 or the network devices 130-150 as shown in Fig. 1. Accordingly, the device 700 can be implemented at or as at least a part of the terminal device 110 or the network devices 130-150.

[00103] As shown, the device 700 includes a processor 710, a memory 720 coupled to the processor 710, a suitable transmitter (TX) and receiver (RX) 740 coupled to a processing means 750 configured by the processor 710 and the memory 720, and a communication interface coupled to the TX/RX 740. The memory 710 stores at least a part of a program 730. The TX/RX 740 is for bidirectional communications. The TX/RX 740 has at least one antenna to facilitate communication, though in practice an Access Node mentioned in this application may have several ones. The communication interface may represent any

interface that is necessary for communication with other network elements, such as X2 interface for bidirectional communications between eNBs, S1 interface for communication between a Mobility Management Entity (MME)/Serving Gateway (S-GW) and the eNB, Un interface for communication between the eNB and a relay node (RN), or Uu interface for communication between the eNB and a terminal device.

[00104] The program 730 is assumed to include program instructions that, when executed by the associated processor 710, enable the device 700 to operate in accordance with the embodiments of the present disclosure, as discussed herein with reference to Figs. 2 to 6. The embodiments herein may be implemented by computer software executable by the processor 710 of the device 700, or by hardware, or by a combination of software and hardware. The processor 710 may be configured to implement various embodiments of the present disclosure. Furthermore, a combination of the processor 710 and memory 720 may form the processing means 750 adapted to implement various embodiments of the present disclosure.

[00105] The memory 720 may be of any type suitable to the local technical network and may be implemented using any suitable data storage technology, such as a non-transitory computer readable storage medium, semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory, as non-limiting examples. While only one memory 720 is shown in the device 700, there may be several physically distinct memory modules in the device 700. The processor 710 may be of any type suitable to the local technical network, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multicore processor architecture, as non-limiting examples. The device 700 may have multiple processors, such as an application specific integrated circuit chip that is slaved in time to a clock which synchronizes the main processor.

[00106] Generally, various embodiments of the present disclosure may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. Some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device. While various aspects of embodiments of the present disclosure are illustrated and described as block diagrams, flowcharts, or using some other pictorial representation, it will be appreciated that the blocks, apparatus, systems, techniques or

methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[00107] The present disclosure also provides at least one computer program product tangibly stored on a non-transitory computer readable storage medium. The computer program product includes computer-executable instructions, such as those included in program modules, being executed in a device on a target real or virtual processor, to carry out the process or method as described above with reference to Fig. 4 or 6. Generally, program modules include routines, programs, libraries, objects, classes, components, data structures, or the like that perform particular tasks or implement particular abstract data types. The functionality of the program modules may be combined or split between program modules as desired in various embodiments. Machine-executable instructions for program modules may be executed within a local or distributed device. In a distributed device, program modules may be located in both local and remote storage media.

[00108] Program code for carrying out methods of the present disclosure may be written in any combination of one or more programming languages. These program codes may be provided to a processor or controller of a general purpose computer, special purpose computer, or other programmable data processing apparatus, such that the program codes, when executed by the processor or controller, cause the functions/operations specified in the flowcharts and/or block diagrams to be implemented. The program code may execute entirely on a machine, partly on the machine, as a stand-alone software package, partly on the machine and partly on a remote machine or entirely on the remote machine or server.

[00109] In the context of the present disclosure, the computer program codes or related data may be carried by any suitable carrier to enable the device, apparatus or processor to perform various processes and operations as described above. Examples of the carrier include a signal, computer readable media.

[00110] The above program code may be embodied on a machine readable medium, which may be any tangible medium that may contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device. The machine readable medium may be a machine readable signal medium or a machine readable storage medium. A machine readable medium may include but not limited to an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device,

or any suitable combination of the foregoing. More specific examples of the machine readable storage medium would include an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory),
5 an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[00111] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable
10 results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the present disclosure, but rather as descriptions of features that may be specific to particular embodiments. Certain features that are described in the context of separate embodiments
15 may also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment may also be implemented in multiple embodiments separately or in any suitable sub-combination.

[00112] Although the present disclosure has been described in language specific to structural features and/or methodological acts, it is to be understood that the present
20 disclosure defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

WHAT IS CLAIMED IS:

1. A terminal device comprising:
a processor; and
a memory coupled to the processor and storing instructions thereon, the instructions,
5 when executed by the processor, causing the terminal device to perform actions comprising:
transmitting, to a network device with a network exposure functionality, a
request for setting a further terminal device as an alternative charging party (ACP) for the
terminal device, the ACP provided for charging for a service requested by the terminal
device in case that the terminal device is out of credit; and
10 receiving an acknowledgement for the request from the network device.
2. The terminal device of Claim 1, wherein transmitting the request comprises:
transmitting the request to the network device via an application server (AS).
- 15 3. The terminal device of Claim 1, wherein the request comprises an identification
of the further terminal device as the ACP.
4. A network device in a communication system comprising:
a processor; and
20 a memory coupled to the processor and storing instructions thereon, the instructions,
when executed by the processor, causing the network device to perform actions comprising:
receiving, from a first terminal device, a request for setting a second terminal
device as an alternative charging party (ACP) for the first terminal device, the ACP
provided for charging for a service requested by the terminal device in case that the
25 terminal device is out of credit; and
generating, based on the request, information of an ACP associated with the
first terminal device.
5. The network device of Claim 4, wherein the actions further comprise:
30 storing the information of an ACP.
6. The network device of Claim 4, wherein the actions further comprise:
receiving, from a further network device with an online charging functionality, a

request for obtaining the information of an ACP; and

in response to receiving the request, transmitting the information of an ACP to the further network device.

5 7. The network device of Claim 4, wherein the network device is a network exposure functionality (NEF) device.

8. A network device in a communication system comprising:

a processor; and

10 a memory coupled to the processor and storing instructions thereon, the instructions, when executed by the processor, causing the network device to perform actions comprising:

acquiring a request for a service from a terminal device;

in response to acquiring the request for the service, transmitting a request for online charging for the service to a further network device with an online charging
15 functionality;

receiving, from the further network device, a response message to the request; and

in response to the response message indicating that the service is charged by an alternative charging party (ACP) for the terminal device, transmitting to the terminal
20 device a notification that a recharging is needed, the ACP determined by the terminal device for charging for the service requested by the terminal device in case that the terminal device is out of credit.

9. The network device of Claim 8, wherein the actions further comprise:

25 in response to the response message indicating that the service is charged, allowing the service to be delivered to the terminal device.

10. The network device of Claim 8, wherein the network device is a charging trigger functionality (CTF) device.

30

11. A network device in a communication system comprising:

a processor; and

a memory coupled to the processor and storing instructions thereon, the instructions, when executed by the processor, causing the network device to perform actions comprising:

receiving, from a first network device with a charging trigger functionality, a request for online charging for a service requested by a terminal device;

in response to receiving the request for online charging, determining whether the terminal device is out of credit or not;

5 in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a network exposure functionality; and

determining, based on the first information, an ACP for charging for the service requested by the terminal device.

10

12. The network device of Claim 11, wherein determining the ACP comprises:

determining, from the first information, a candidate ACP available for charging for the service;

15 obtaining, from the second network device, second information about an ACP associated with the candidate ACP;

determining whether the terminal device is indicated in the second information; and

in response to determining that the terminal device is indicated in the second information, determining the candidate ACP as the ACP for charging for the service.

20

13. The network device of Claim 11, wherein the actions further comprise:

charging the service from the determined ACP; and

transmitting, to the first network device, a response message indicating that the service is charged by the determined ACP.

25

14. The network device of Claim 11, wherein the network device is an online charging functionality (OCF) device.

15. A method implemented at a terminal device, comprising:

30 transmitting, to a network device with a network exposure functionality, a request for setting a further terminal device as an alternative charging party (ACP) for the terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and

receiving an acknowledgement for the request from the network device.

16. The method of Claim 15, wherein transmitting the request comprises:
transmitting the request to the network device via an application server.

17. The method of Claim 15, wherein the request comprises an identification of
5 the further terminal device as the ACP.

18. A method implemented at a network device in a communication system,
comprising:

receiving, from a first terminal device, a request for setting a second terminal device
10 as an alternative charging party (ACP) for the first terminal device, the ACP provided for
charging for a service requested by the terminal device in case that the terminal device is
out of credit; and

generating, based on the request, information of an ACP associated with the first
terminal device.

15

19. The method of Claim 18, further comprising:
storing the information of an ACP.

20. The method of Claim 18, further comprising:

receiving, from a further network device with an online charging functionality, a
20 request for obtaining the information of an ACP; and

in response to receiving the request, transmitting the information of an ACP to the
further network device.

21. The method of Claim 18, wherein the network device is a network exposure
25 functionality (NEF) device.

22. A method implemented at a network device in a communication system,
comprising:

30 acquiring a request for a service from a terminal device;

in response to acquiring the request for the service, transmitting a request for online
charging for the service to a further network device with an online charging functionality;

receiving, from the further network device, a response message to the request; and

in response to the response message indicating that the service is charged by an

alternative charging party (ACP) for the terminal device, transmitting to the terminal device a notification that a recharging is needed, the ACP being determined by the terminal device for charging for the service requested by the terminal device in case that the terminal device is out of credit.

5

23. The method of Claim 22, further comprising:

in response to the response message indicating that the service is charged, allowing the service to be delivered to the terminal device.

10

24. The method of Claim 22, wherein the network device is a charging trigger functionality (CTF) device.

25. A method implemented at a network device in a communication system, comprising:

15

receiving, from a first network device with a charging trigger functionality, a request for online charging for a service requested by a terminal device;

in response to receiving the request for online charging, determining whether the terminal device is out of credit or not;

20

in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a network exposure functionality; and

determining, based on the first information, an ACP for charging for the service requested by the terminal device.

25

26. The method of Claim 25, wherein determining the ACP comprises:

determining, from the first information, a candidate ACP available for charging for the service;

obtaining, from the second network device, second information about an ACP associated with the candidate ACP;

30

determining whether the terminal device is indicated in the second information; and
in response to determining that the terminal device is indicated in the second information, determining the candidate ACP as the ACP for charging for the service.

27. The method of Claim 25, further comprising:

charging the service from the determined ACP; and
transmitting, to the first network device, a response message indicating that the service is charged by the determined ACP.

5 28. The method of Claim 25, wherein the network device is an online charging functionality (OCF) device.

 29. An apparatus implemented at a terminal device, comprising:
 means for transmitting, to a network device with a network exposure functionality, a
10 request for setting a further terminal device as an alternative charging party (ACP) for the terminal device, the ACP provided for charging for a service requested by the terminal device in case that the terminal device is out of credit; and
 means for receiving an acknowledgement for the request from the network device.

15 30. An apparatus implemented at a network device in a communication system, comprising:

 means for receiving, from a first terminal device, a request for setting a second terminal device as an alternative charging party (ACP) for the first terminal device, the ACP provided for charging for a service requested by the terminal device in case that the
20 terminal device is out of credit; and

 means for generating, based on the request, information of an ACP associated with the first terminal device.

 31. An apparatus implemented at a network device in a communication system,
25 comprising:

 means for acquiring a request for a service from a terminal device;

 means for in response to acquiring the request for the service, transmitting a request for online charging for the service to a further network device with an online charging functionality;

30 means for receiving, from the further network device, a response message to the request; and

 means for in response to the response message indicating that the service is charged by an alternative charging party (ACP) for the terminal device, transmitting to the terminal device a notification that a recharging is needed, the ACP being determined by the terminal

device for charging for the service requested by the terminal device in case that the terminal device is out of credit.

32. An apparatus implemented at a network device in a communication system,
5 comprising:

means for receiving, from a first network device with a charging trigger functionality, a request for online charging for a service requested by a terminal device;

means for in response to receiving the request for online charging, determining whether the terminal device is out of credit or not;

10 means for in response to determining that the terminal device is out of credit, obtaining first information about an alternative charging party (ACP) associated with the terminal device from a second network device with a network exposure functionality; and

means for determining, based on the first information, an ACP for charging for a service requested by the terminal device.

15 33. A computer readable storage medium having instructions stored thereon, the instructions, when executed on at least one processor, causing the at least one processor to carry out the method according to any of claims 15 to 17.

20 34. A computer readable storage medium having instructions stored thereon, the instructions, when executed on at least one processor, causing the at least one processor to carry out the method according to any of claims 18 to 21.

25 35. A computer readable storage medium having instructions stored thereon, the instructions, when executed on at least one processor, causing the at least one processor to carry out the method according to any of claims 22 to 24.

30 36. A computer readable storage medium having instructions stored thereon, the instructions, when executed on at least one processor, causing the at least one processor to carry out the method according to any of claims 25 to 28.

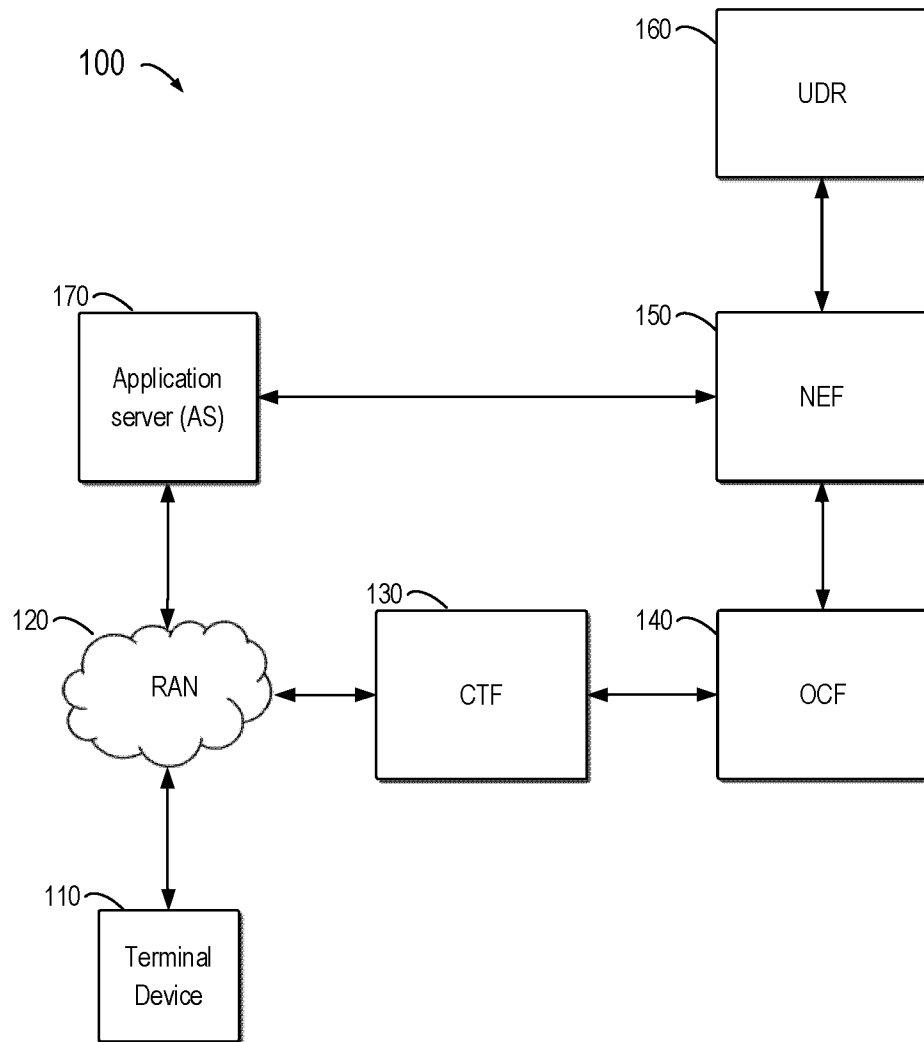


Fig. 1

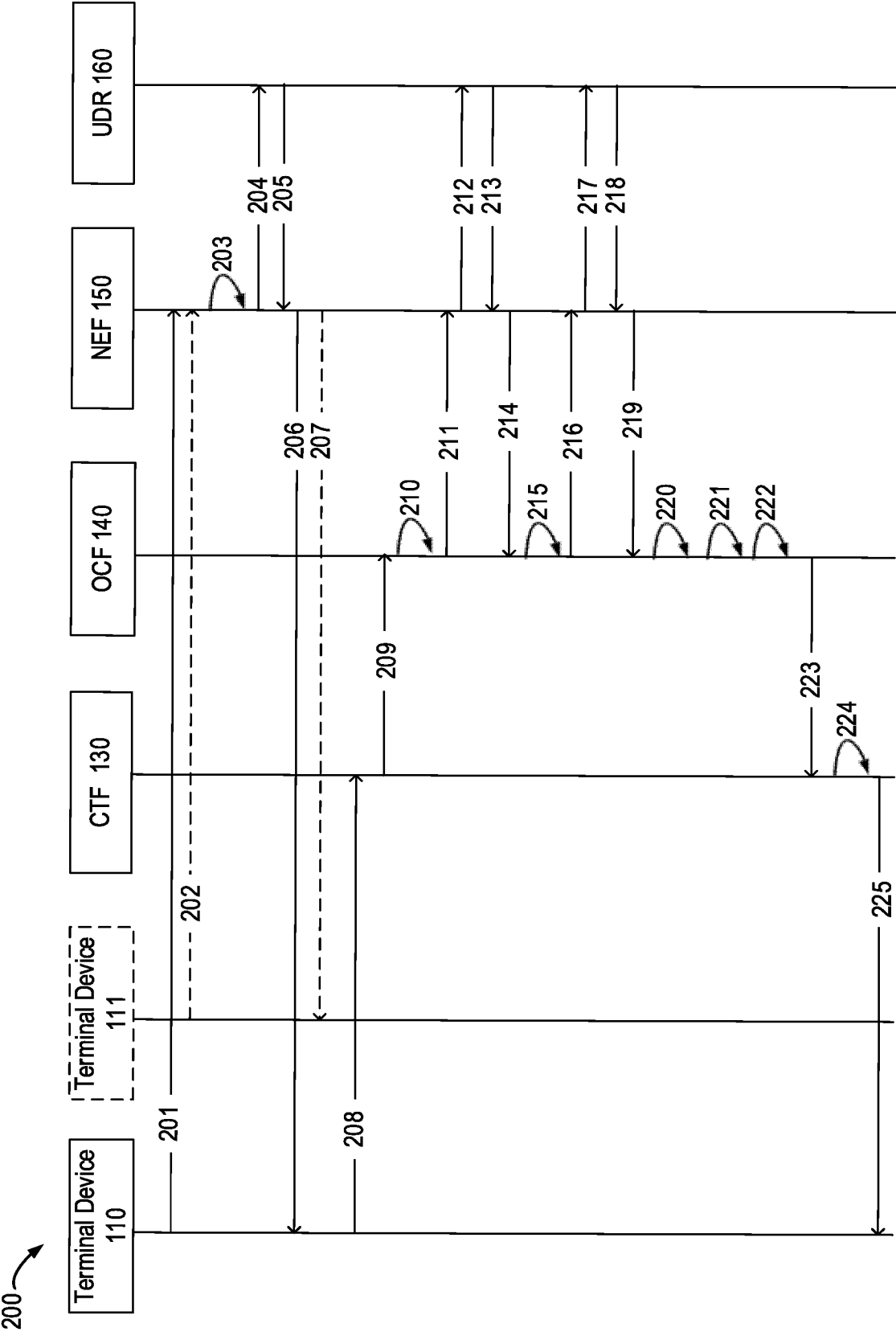


Fig. 2

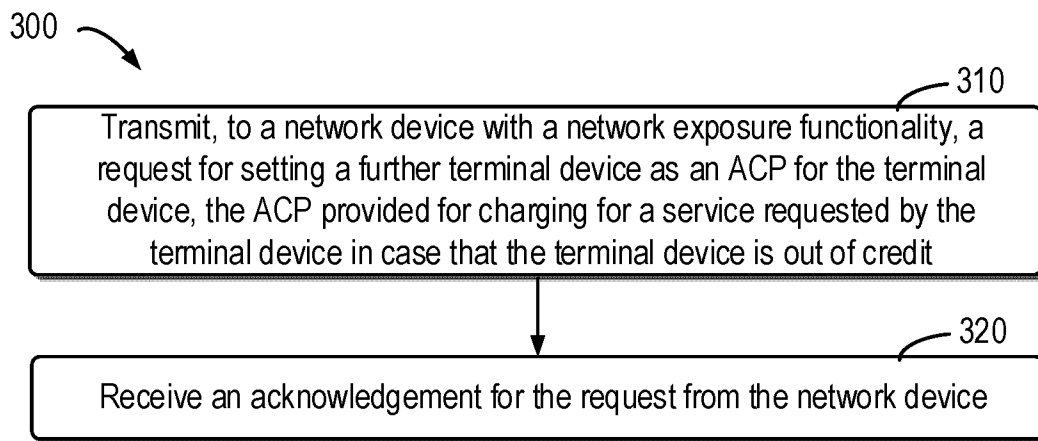


Fig. 3

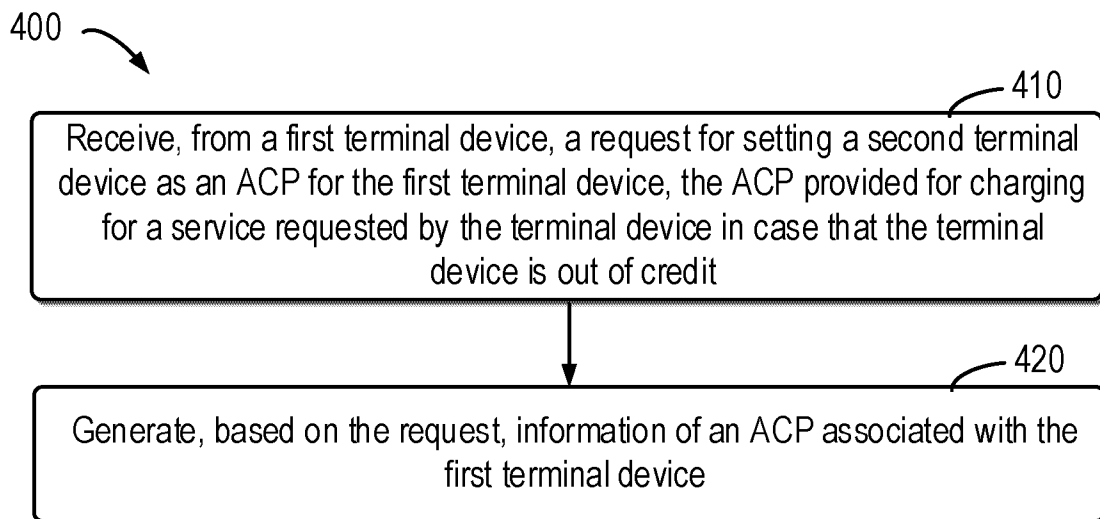


Fig. 4

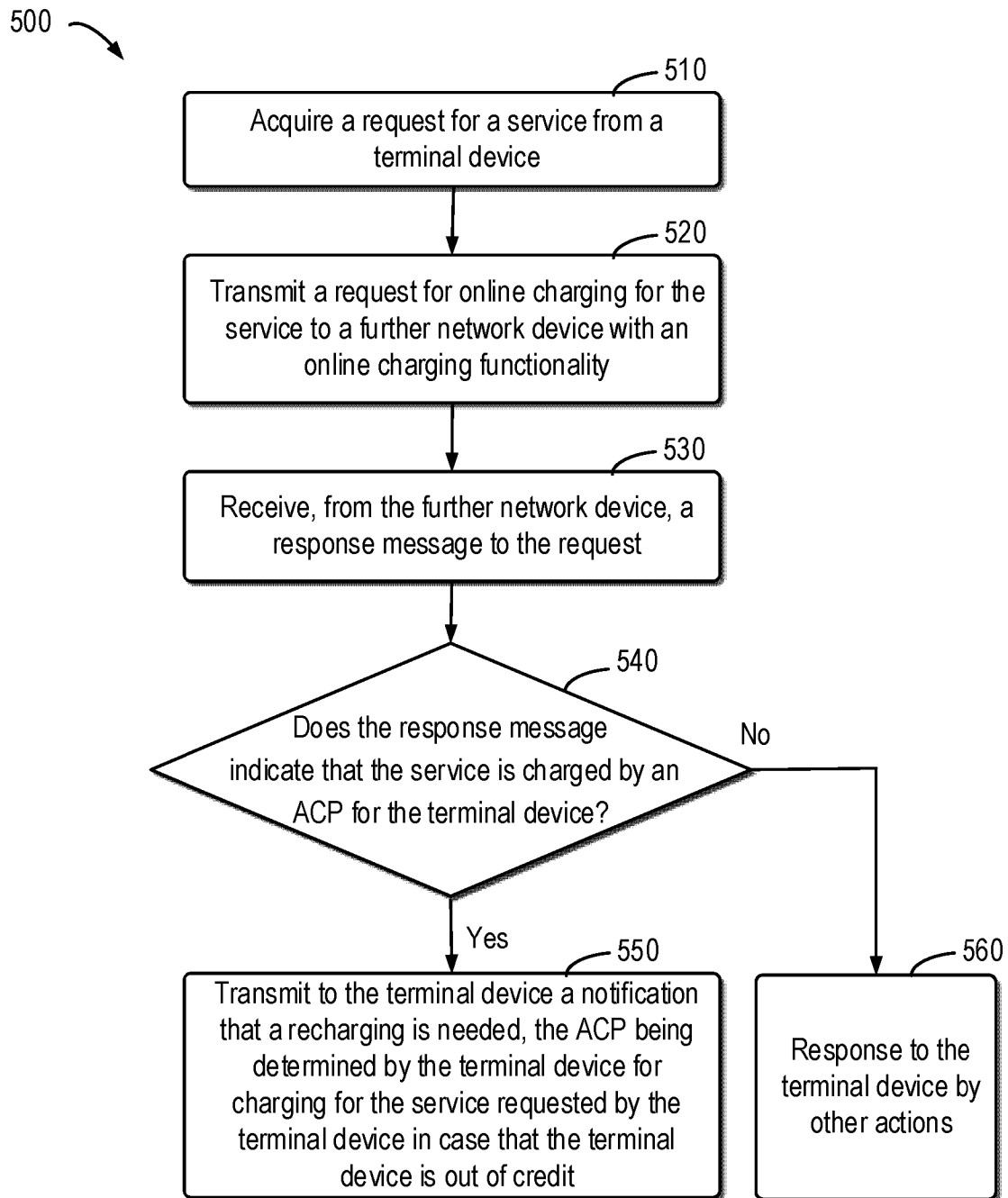


Fig. 5

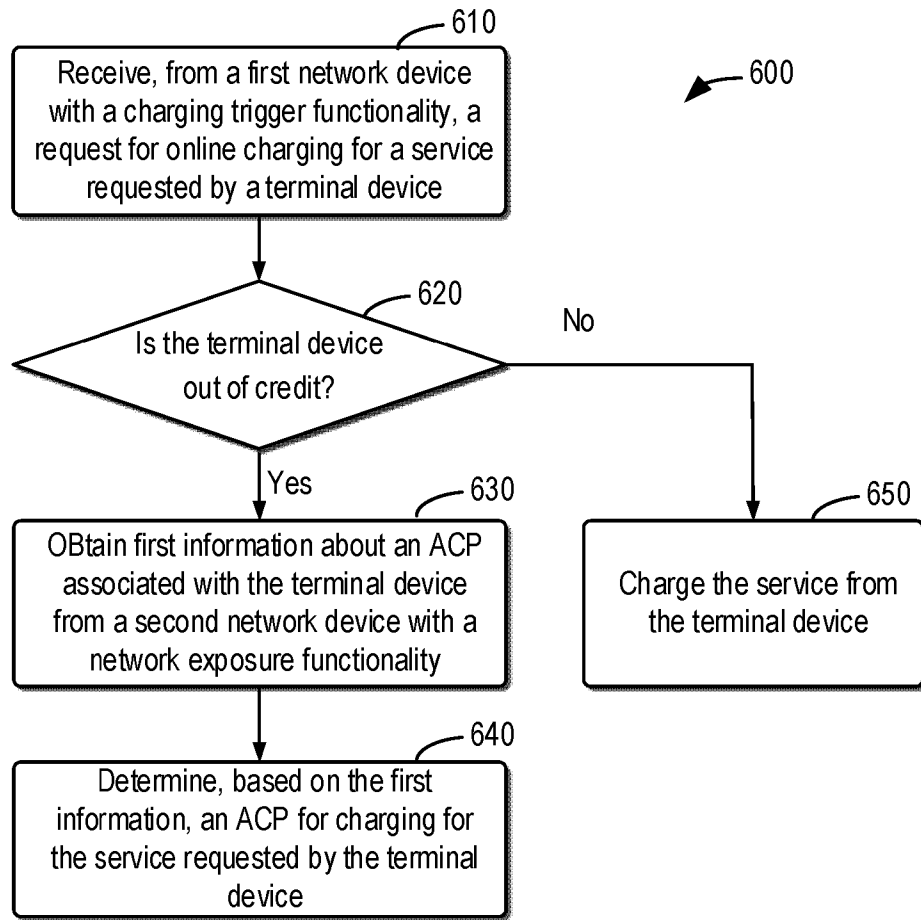


Fig. 6

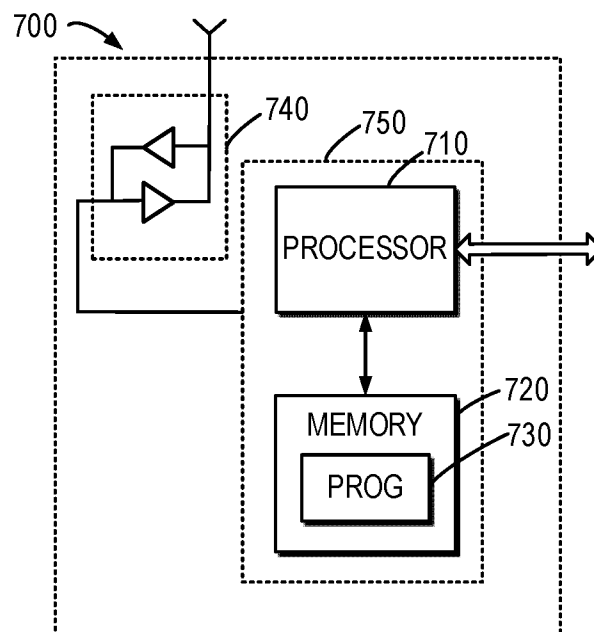


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/122710

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/14(2006.01)i

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; H04W; H04Q; G06Q; H04M

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

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

WPI,EPODOC,CNPAT,CNKI,3GPP: UE,terminal,alternate, backup, candidate, replace, substitue,charge,bill,NEF,OCF,OCS, credit,balance,fund,out,disable

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 106332040 A (HUAWEI TECHNOLOGIES CO., LTD.) 11 January 2017 (2017-01-11) description, paragraphs [0071]-[0151] and figures 1-5	1-36
Y	CN 105321073 A (CHINA MOBILE GROUP GUANGDONG CO., LTD.) 10 February 2016 (2016-02-10) description, paragraphs [0021]-[0033]	1-36
A	CN 103679449 A (LAKALA PAYMENT CO., LTD.) 26 March 2014 (2014-03-26) the whole document	1-36
A	CN 102415086 A (COMVERSE, INC.) 11 April 2012 (2012-04-11) the whole document	1-36
A	US 2014286199 A1 (ALCATEL-LUCENT USA INC. ET AL.) 25 September 2014 (2014-09-25) the whole document	1-36
A	NOKIA NETWORKS. "3GPP TSG-SA5 Meeting #96 S5-144417" <i>Corrections for alignment between charging specifications</i> , 22 August 2014 (2014-08-22), the whole document	1-36

☒ 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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2018/122710

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HUAWEI. "3GPP TSG-SA5(Telecom Management) S5-071659" <i>Add online charging description to Alternate Charged Party (ACP)</i> , 31 August 2007 (2007-08-31), the whole document	1-36

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2018/122710

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	106332040	A	11 January 2017	WO	2017000644	A1	05 January 2017
CN	105321073	A	10 February 2016	None			
CN	103679449	A	26 March 2014	None			
CN	102415086	A	11 April 2012	BR	PI0924966	A2	01 November 2016
				WO	2010126464	A1	04 November 2010
				CA	2758464	A1	04 November 2010
				RU	2011145400	A	20 May 2013
				US	2012041871	A1	16 February 2012
				IL	216040	A	29 October 2015
				IN	201102078	P3	21 December 2012
US	2014286199	A1	25 September 2014	CN	103095470	A	08 May 2013
				EP	2772045	A2	03 September 2014
				WO	2013061154	A2	02 May 2013