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(54) **METHOD, SYSTEM AND APPLICATION NETWORK ELEMENT FOR IMPROVING QUALITY OF SERVICE**

VERFAHREN, SYSTEM UND ANWENDUNGSNETZWERKELEMENT ZUR DIENSTQUALITÄTSERHÖHUNG

PROCÉDÉ, SYSTÈME ET ÉLÉMENT DE RÉSEAU D'APPLICATION POUR AMÉLIORER LA QUALITÉ DE SERVICE

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to communications technologies, and in particular, to a method, a system, and an application network element for improving Quality of Service.

BACKGROUND OF THE INVENTION

[0002] In a communication network, an access network is configured to transmit service data of a User Equipment (abbreviated as UE) and an application network is configured to control the processing of the service data, that is, to provide services to the UE.

[0003] In the prior art, steps for allocating resources to the access network include: A UE obtains an IP address by creating a default bearer and sets up a Public Data Network (abbreviated as PDN) connection; the UE negotiates a resource required by a service, such as Quality of Service (abbreviated as QoS), codec, etc.. with the application network; the application network forms a service request and sends the service request to a Policy Charging and Rules Function (abbreviated as PCRF) entity, and the PCRF entity creates Policy Charging Control (abbreviated as PCC) rules according to the service request, the PCRF entity delivers the PCC rules to a Packet Data Network Gateway (abbreviated as P-GW); the P-GW, according to the PCC rules, sets up a dedicated service bearer required by the service; and the UE exchanges service data with a remote end (such as another UE) through the set up dedicated service bearer.

[0004] The method for setting up a service bearer in the prior art has the following problem. Through the above steps, the bearer for the UE to exchange service data is set up, during the process that the UE exchanges service data, if a resource of the access network is changed, for example, the access network is congested, the previously set up service bearer does not match the changed access network resource and the previously formed service request does not match the changed access network resource either; as a result, the QoS of the service deteriorates and the service is even caused to be interrupted.

[0005] Document D1 (WO 2009/019671 A1) discloses a method performed in one or more communication packet networks for improving end-to-end quality of service in the packet networks. The RAS keeps track of the network characteristics of particular access networks by using the update information from active devices in a predictive model of the access network. It thus models and predicts the characteristics of the network. End devices negotiate a session using their knowledge of their own resources and knowledge of predicted status of the network from the RAS.

[0006] Document D2 (WO 2004/036845 A1) discloses a method for controlling transmission of data bits in a bit transfer session for transmitting data information from an application server to a client. A radio resource managing unit sends information regarding the bandwidth on the wireless link that the bit transfer session currently is allowed to use. This feedback information from the radio resource managing unit is used to set and update flow control parameters continuously throughout the session.

[0007] Document D3 (US2008/273520 A1) discloses a communication network architecture for guaranteeing the end-to-end QoS in the communication network.

[0008] Document D4 (WO 2009/049684 A1) discloses a method for notifying an Application Function in a communications network of resource restrictions relating to a communication session.

SUMMARY OF THE INVENTION

[0009] In view of the problems existing in the prior art, embodiments of the present invention provide a method, a system, and an application network element for improving QoS, so that a service parameter or a service request related to a current service matches a changed access network resource, thereby improving the QoS.

[0010] An embodiment of the present invention provides a method for improving QoS, including:

when a resource of an access network is changed, receiving, by an application network, resource information sent by the access network, where the resource information is information that indicates a current resource status of the access network; and

adjusting, by the application network, a service request related to a current service according to the resource information and sending the adjusted service request to the access network; or negotiating, by the application network, the service parameter related to a current service with a User Equipment (UE) according to the resource information,

so that the UE modifies the service parameter related to the current service according to a result of the negotiation; wherein the application network is an IP Multimedia Subsystem (IMS); and the receiving, by the application network, the resource information sent by the access network comprises: receiving, by a Proxy-Call Session Control Function

(P-CSCF) entity in the IMS, the resource information sent by a Policy and Charging Rules Function (PCRF) entity.

[0011] An embodiment of the present invention provides a system for improving QoS, including:

an access network, configured to send resource information when a resource of the access network is changed, where the resource information is information that indicates a current resource status of the access network; and
an application network, configured to receive the resource information, adjust a service request related to a current service according to the resource information, and send the adjusted service request to the access network; or negotiate the service parameter related to the current service with the UE according to the resource information, so that the UE modifies the service parameter related to the current service according to a result of the negotiation;
wherein the application network is an IP Multimedia Subsystem (IMS) comprising a Proxy-Call Session Control Function (P-CSCF) entity and the access network comprises an eNB, and the P-CSCF entity is configured to receive the resource information from the PCRF entity.

[0012] An embodiment of the present invention further provides an application network element, including:

a receiving unit, configured to receive resource information sent by an access network,
where the resource information is information that indicates a current resource status of the access network; and
a processing unit, connecting with the receiving unit, configured to adjust a service request related to a current service according to the resource information received by the receiving unit and send the adjusted service request to the access network; or configured to negotiate the service parameter related to the current service with a the UE according to the resource information received by the receiving unit, so that the UE modifies the service parameter related to the current service according to a result of the negotiation;
wherein the application network element is a Proxy-Call Session Control Function (P-CSCF) in an IP Multimedia Subsystem (IMS), and the receiving unit is configured to receive the resource information sent by a Policy and Charging Rules Function (PCRF) entity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a flow chart of a method for improving QoS according to a first embodiment of the present invention;
FIG. 2 is a schematic structure diagram of an EPS involved in an embodiment of the present invention;
FIG. 3 is a signaling interaction diagram of a method for improving QoS according to a second embodiment of the present invention;
FIG. 4 is a signaling interaction diagram of a method for improving QoS according to a third embodiment of the present invention;
FIG. 5 is a signaling interaction diagram of a method for improving QoS according to a fourth embodiment of the present invention;
FIG. 6 is a signaling interaction diagram of a method for improving QoS according to a fifth embodiment of the present invention;
FIG. 7 is a signaling interaction diagram of a method for improving QoS according to a sixth embodiment of the present invention;
FIG. 8 is a signaling interaction diagram of a method for improving QoS according to a seventh embodiment of the present invention;
FIG. 9 is a signaling interaction diagram of a method for improving QoS according to an eighth embodiment of the present invention;
FIG. 10 is a signaling interaction diagram of a method for improving QoS according to a ninth embodiment of the present invention;
FIG. 11 is a schematic structure diagram of a system for improving QoS according to an embodiment of the present invention; and
FIG. 12 is a schematic structure diagram of an application network element according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0014] FIG. 1 is a flow chart of a method for improving QoS according to the first embodiment of the present invention, and includes:

Step 101: When a resource of an access network is changed, an application network receives resource information sent by the access network, where the resource information is information that indicates a current resource status of the access network.

Step 102: The application network adjusts a service request related to a current service according to the resource information and sends the adjusted service request to the access network; or the application network negotiates a service parameter related to the current service with a UE according to the resource information, so that the UE modifies the service parameter related to the current service according to a result of the negotiation.

[0015] In step 102, the adjusting, by the application network, the service request related to the current service according to the resource information may include: negotiating, by the application network, a service parameter related to the current service with the UE according to the resource information and adjusting the service request related to the current service.

[0016] After step 102, the access network may modify a current service bearer according to the adjusted service request, or re-set up a service bearer.

[0017] In the embodiments of the present invention, the service request is a requirement for various parameters related to the current service, for example, at least one of type of codec, bearer requirement, and access network parameter requirement related to the current service.

[0018] The resource information is information that indicates the current resource status of the access network. The resource information may be at least one of congestion indication, number of users, CPU usage, remaining bandwidth, acceptable codec, supportable service request (such as QoS Class Identifier (abbreviated as QCI)), and suggestion of a new bandwidth. The expression of the resource information may be a specific number or a specific identifier. For example, one identifier may be used to indicate that currently the access network is in congestion, and a specific number may be used to indicate current CPU usage of the access network.

[0019] According to the method provided in the embodiment of the present invention, when the resource of the access network is changed, the access network sends the resource information of the access network to the application network; and the application network adjusts the service request related to the current service according to the resource information and sends the adjusted service request to the access network, or the application network negotiates the current service parameter with the UE according to the resource information, so that the UE modifies the parameter related to the current service according to the a result of the negotiation. In this way, the service parameter or the service request related to the current service matches the changed access network resource and the QoS is improved.

[0020] There are multiple types of networks that can implement the function of an access network and there are also multiple types of networks that can implement the function of an application network.

[0021] FIG. 2 is a schematic structure diagram of an Evolved Packet System (abbreviated as EPS) involved in an embodiment of the present invention. The system includes an access network 1, a PCRF entity 3 and an application network 2. The access network 1 includes an Evolved UMTS Terrestrial Radio Access Network (abbreviated as E-UTRAN) 11, a Mobility Management Entity (abbreviated as MME) 12, a Serving Gateway (abbreviated as S-GW) 13, a Packet Data Network Gateway (abbreviated as P-GW) 14, a Home Subscriber Server (abbreviated as HSS) 15, a UMTS Terrestrial Radio Access Network (abbreviated as UTRAN 16, a GSM/EDGE Radio Access Network (abbreviated as GERAN) 17, and a Service GPRS Support Node (abbreviated as SGSN) 18.

[0022] The E-UTRAN 11, UTRAN 16, and GERAN 17 can implement all radio related functions. The E-UTRAN 11 may include an evolved NodeB (abbreviated as eNB), or include a Home eNB and a Home NodeB Gateway. The eNB may communicate with the UE.

[0023] The MME 12 and the SGSN 18 are responsible for the mobility management of a control plane, including management of user context and mobility state, and allocating temporary user identification.

[0024] The S-GW 13 is a user plane anchor point between different access networks in the 3GPP, and an interface for screening different access networks in the 3GPP.

[0025] The P-GW 14 is a user plane anchor point between a 3GPP access network and a non access network, and an interface with an external Packet Data Network.

[0026] The HSS 15 stores subscription information of users.

[0027] The application network provides services and applications to a user. In FIG. 2, the application network may be an IP Multimedia Subsystem (abbreviated as IMS). The IMS is a network that can implement packet voice and packet data and can provide uniform multimedia services and applications. The IMS uses an IP packet domain as a bearer channel for control signaling and medium transmission. The control signaling is call control signaling based on the Session Initiation Protocol (abbreviated as SIP).

[0028] To solve QoS and flow based charging problems, PCC architecture may enable a network to detect different service flows and implement QoS control and charging accounting for the service flows. The PCC architecture mainly includes a PCRF entity, a Policy and Charging Enforcement Function (abbreviated as PCEF) entity, a Subscription Profile Repository (abbreviated as SPR), an Application Function (abbreviated as AF) entity, an Offline Charging System

(abbreviated as OCS), and an Online Charging System (abbreviated as OCS).

[0029] The PCRF entity decides corresponding PCC rules according to restrictions of an access network, operator's policy, subscription profile, and information of an ongoing service of a user (obtained from the AF entity), and provides the PCC rules to the PCEF entity. PCEF entity enforces the PCC rules. The PCC rules include a rule for detecting a service data flow (such as, an IP flow set of voice), whether to gate, QoS corresponding to the service data flow, and flow based charging rule. The PCEF entity enforces the PCC rules delivered or designated by the PCRF entity. Specifically, the PCEF entity executes the detection and measurement of the service data flow, guarantees the QoS of the service data flow, processes traffic of user plane, and triggers session management of control plane. The PCRF entity dynamically generates or modifies the corresponding PCC rules according to the session information of the application layer of the AF entity. The PCEF entity may be located in a gateway.

[0030] In addition to sending the PCC rules to the PCEF entity, the PCRF entity may further request the PCEF entity to detect certain events, for example, an IP-CAN bearer loses or restores a connection and a gateway is in fault. When having detected the occurrence of a corresponding event, the PCEF entity reports the event to the PCRF entity, and the PCRF entity re-determines the PCC rules according to the reported event.

[0031] In a network structure shown in FIG. 2, the P-GW implements the functions of the PCEF entity and a Proxy-Call Session Control Function (abbreviated as P-CSCF) entity in the IMS implements the functions of the AF. The P-GW, the PCRF entity, and the P-CSCF form the PCC architecture.

[0032] A specific implementation process of the embodiment of the present invention is described below with reference to the network structure shown in FIG. 2.

[0033] In step 101, an eNB in the access network may send the resource information to the P-CSCF entity in the IMS. Specifically, the eNB sends the resource information to a UE and the UE sends a message that carries the resource information to the P-CSCF in the IMS.

[0034] FIG. 3 is a signaling interaction diagram of a method for improving QoS according to a second embodiment of the present invention and includes

Step 201: When a resource of an access network is changed, an eNB sends a S1-AP message that carries resource information to an MME, for example, the eNB sends an overload message OVERLOAD to the MME.

Step 202: After receiving the OVERLOAD sent by the eNB, the MME sends a message that carries the resource information to a UE, for example, sends a Modify EPS Bearer Context Request to the UE. After receiving the OVERLOAD sent by eNB, the MME obtains the resource information and according to the content of the resource information, for example, the resource information is supportable QCI, the MME may choose all bearers set up on the eNB or choose a bearer with a QCI other than the supportable QCI in the resource information, and send a message carrying the resource information and related to a specific bearer to the UE. Alternatively, the MME may choose a bearer guaranteeing Guaranteed Bit Rate (Guaranteed Bit Rate). The Modify EPS Bearer Context Request sent by the MME to the UE is a modification request specific to the GBR bearer. The choosing of the specific bearer can accurately reflect an affected bearer and reduce interaction of control signaling in the network.

After finishing step 202, the UE may send to the eNB a Modify EPS Bearer Context Response.

Step 203: After receiving the Modify EPS Bearer Context Request (Modify EPS Bearer Context Response), the UE obtains the resource information, and sends a message that carries the resource information to a P-CSCF entity in an IMS; for example, the UE sends SIP signaling to the P-CSCF.

Step 204: The P-CSCF entity negotiates a service parameter related to a current service with the UE according to the resource information in the received message, so that the UE can modify the parameter related to the current service according to a result of the negotiation. For example, the current service is a video service and when the access network resource is in congestion, the P-CSCF entity may negotiate the encoding scheme with the UE and choose an encoding scheme supported by UE and being able to effectively relieve the current congestion state of the access network. The UE may modify the encoding scheme according to a result of the negotiation.

Step 205: The P-CSCF entity adjusts a service request related to the current service according to the resource information in the received message, for example, adjusts a bandwidth requirement and an encoding requirement related to the current service, and sends the adjusted service request to a P-GW in the access network.

Step 206: The P-GW modifies a current service bearer according to the adjusted service request, or re-set up a service bearer.

[0035] In the second embodiment, after step 204 is performed, steps 205 and 206 may not be performed. Through step 204 in which the P-CSCF entity negotiates with the UE, the UE can modify the parameter related to the current service to match the changed resource of the access network, so as to improve the QoS.

[0036] In the second embodiment, after step 203 is performed, step 204 may not be performed, but steps 205 and 206 are performed sequentially, in which the P-CSCF entity adjusts the service request according to the resource information, so that the access network can modify the current service bearer according to the adjusted service request

or re-set up a service bearer, thereby improving the QoS.

[0037] In the second embodiment, after step 203 is performed, steps 204, 205, and 206 may be performed sequentially, so that the access network can modify the current service bearer according to the adjusted service requestor re-set up a service bearer, thereby improving the QoS.

[0038] In the second embodiment, in step 202, the MME may not choose a bearer and instead, the step to choose the bearer is performed by eNB. Specifically, in step 201, the eNB chooses a specific bearer and sends the resource information carried in a message related to the specific bearer to the MME. Then, steps 202--206 are performed. The choosing of the specific bearer can accurately reflect the affected bearer and reduce the interaction of the control signaling in the network.

[0039] FIG. 4 is a signaling interaction diagram of a method for improving QoS according to a third embodiment of the present invention and includes:

Step 301: An eNB sends an RRC message that carries resource information to a UE, where the RRC message may be a Radio Bearer Setup message.

Steps 302-305 are the same as steps 203-206.

[0040] In the embodiment shown in FIG. 1, in step 101, the eNB in the access network may send the resource information to the PCRF entity and then the PCRF entity sends the resource information to the P-CSCF entity in the IMS. The sending, by the eNB, the resource information to the PCRF entity may be that the eNB sends a message that carries the resource information to the MME; the MME sends the resource information to the P-GW; and the P-GW sends an IP-CAN message that carries the resource information to the PCRF entity.

[0041] The sending, by the P-GW, the IP-CAN message that carries the resource information to the PCRF entity may be that the P-GW sends an IP-CAN Session Modification message or an IP-CAN Session Notification message that carries the resource information. In embodiments below, description is made with the IP-CAN Session Modification message as an example.

[0042] The MME may send the resource information to the P-GW in the following ways. (1) The MME sends a message that carries the resource information to the S-GW and the S-GW sends a message that carries the resource information to the P-GW; (2) the MME sends a message that carries the resource information to the UE, the UE sends a Request Bearer Resource Modification message that carries the resource information to the MME, the MME sends a Request Bearer Resource Modification message that carries the resource information to the S-GW, and the S-GW sends a Request Bearer Resource Modification message that carries the resource information to the P-GW; and (3) the MME encapsulates the resource information in a GTP-C header and sends the GTP-C header to the S-GW through a bearer modification process, and the S-GW sends the GTP-C header to the P-GW.

[0043] (1) The MME sends a message that carries the resource information to the S-GW and the S-GW sends a message that carries the resource information to the P-GW.

[0044] FIG. 5 is a signaling interaction diagram of a method for improving QoS according to a fourth embodiment of the present invention and includes:

Step 401: An eNB sends an OVERLOAD that carries resource information to an MME. Specifically, the eNB may choose a specific bearer and send an OVERLOAD carrying the resource information and related to the specific bearer to the MME.

Step 402: The MME sends a message that carries the resource information to an S-GW. For example, the MME sends an Update Bearer Request to the S-GW. In step 401, the eNB may not choose a specific bearer and instead the specific bearer is chosen by the MME. Specifically, the MME may choose a specific bearer and send an Update Bearer Request carrying the resource information and related to the specific bearer to the S-GW.

Step 403: The S-GW sends a Update Bearer Request that carries the resource information to a P-GW.

Step 404: After receiving the Update Bearer Request, the P-GW sends an IP-CAN Session Modification message that carries the resource information to a PCRF entity. Optionally, after receiving the Update Bearer Request, the P-GW may make a judgment about the resource information therein to determine whether being repeated resource information, and in the case of repeated resource information, the P-GW may not send to the PCRF entity; in the case of not being repeated resource information, the P-GW sends the resource information to the PCRF entity through an IP-CAN Session Modification message. Alternatively, after receiving the Update Bearer Request, the P-GW may determine, according to the priority of the resource information therein, whether the resource information needs to be sent to the PCRF entity. For example, according to the requirement of a Guaranteed Bit Rate, the priority of resource information that can well guarantee the bit rate is set to be low and the priority of resource information that cannot well guarantee the bit rate is set to be high. With regard to resource information of a low priority, the P-GW may not send the resource information to the PCRF entity; with regard to resource information of a high priority, the P-GW may send the resource information to the PCRF. Alternatively, after receiving the Update

Bearer Request, the P-GW may determine whether the resource information therein matches current PCC rules; in case of being match, the resource information is discarded, in case of not being match, the resource information is sent to the PCRF entity.

Step 405: The PCRF entity selects a part of the resource information (for example, information related to codec or bandwidth) and sends the selected resource information to a P-CSCF entity; for example, the PCRF encapsulates the selected resource information in an information element defined by the Diameter protocol and sends the information element defined by the Diameter protocol to the P-CSCF entity.

Step 406: The P-CSCF entity negotiates with a UE over a service parameter related to a current service according to the resource information in the received message. For example, the current service is a video service and when an access network resource is in congestion, the P-CSCF entity may negotiate an encoding scheme with the UE and choose the encoding scheme supported by the UE and being able to effectively relieve the current congestion state of the access network.

Step 407: The P-CSCF entity adjusts a service request related to the current service according to the resource information in the received message. For example, the P-CSCF entity adjusts a bandwidth requirement and an encoding requirement related to the current service and sends the adjusted service request to the P-GW in the access network. Specifically, the adjusted service request may be sent to the PCRF entity through an information element defined by the Diameter protocol and the PCRF entity generates PCC rules according to the adjusted service request and sends the PCC rules to the P-GW.

Step 408: The P-GW modifies a current service bearer according to the adjusted service request, or re-sets up a service bearer.

[0045] In the fourth embodiment, after step 406 is performed, steps 407 and 408 may not be performed. Through step 406 in which the P-CSCF entity negotiates with the UE, the UE can modify the parameter related to the current service to match the changed resource of the access network, so as to improve the QoS.

[0046] In the fourth embodiment, after step 405 is performed, step 406 may not be performed, but steps 407 and 408 are performed sequentially, in which the P-CSCF entity adjusts the service request according to the resource information, so that the access network can modify the current service bearer according to the adjusted service request or re-set up a service bearer, thereby improving the QoS.

[0047] In the fourth embodiment, after step 405 is performed, steps 406, 407, and 408 may be performed sequentially so that the access network can modify the current service bearer according to the adjusted service request or re-set up a service bearer, thereby improving the QoS.

[0048] In the embodiment shown in FIG. 5, the eNB sends the resource information to the PCRF entity through steps 401-404. In steps 403 and 404, the resource information can not only be carried in the Update Bearer Request, but also be carried in other messages. For example, types of messages of GPRS tunneling protocol for control plane (abbreviated as GTP-C) may be added, and the resource information is carried in the added messages. Table 1 shows types of GTP-C messages involved in the embodiment of the present invention.

Table 1: Types of GTP-C messages involved in the embodiment of the present invention

Message Type Value (Decimal)	Message	Reference	GTP-C	GTP-U
0	Reserved			
	PGW to MME, MME to PGW, SGW to PGW, SGW to MME (S5/S8, S11)			
101	Delete PDN Connection Set Request		X	
102	Delete PDN Connection Set Response		X	
103 to 127	For future use			
	MME to SGW (S11)			
160	Create Forwarding Tunnel Request		X	
161	Create Forwarding Tunnel Response		X	
162	Suspend Notification		X	
163	Suspend Acknowledge		X	
164	Resume Notification		X	

(continued)

Message Type Value (Decimal)	Message	Reference	GTP-C	GTP-U
165	Resume Acknowledge		X	
166	Create Indirect Data Forwarding Tunnel Request		X	
167	Create Indirect Data Forwarding Tunnel Response		X	
168	Delete Indirect Data Forwarding Tunnel Request		X	
169	Delete Indirect Data Forwarding Tunnel Response		X	
170	Release Access Bearers Request		X	
171	Release Access Bearers Response		X	
172 to 175	For future use			

[0049] In Table 1, a new type of message sent from the MME to the SGW which can carry the resource information may be added between message type values 172-175. For example a new OVERLOAD may be added. A new type of message sent from the SGW to the PGW which can carry the resource information may be added between message type values 103-127.

[0050] (2) The MME sends a message that carries the resource information to the UE, the UE sends a Request Bearer Resource Modification message that carries the resource information to the MME, the MME sends a Request Bearer Resource Modification message that carries to the S-GW, and the S-GW sends a Request Bearer Resource Modification message that carries to the P-GW.

[0051] FIG. 6 is a signaling interaction diagram of a method for improving QoS according to a fifth embodiment of the present invention, and includes:

Step 501: An eNB sends an OVERLOAD that carries resource information to an MME. Specifically, the eNB may choose a specific bearer, and send an OVERLOAD related to the specific bearer and carrying the resource information to the MME.

Step 502: After receiving the OVERLOAD sent by the eNB, the MME sends a message that carries the resource information to a UE; for example, a Modify EPS Bearer Context Request is sent to the UE.

Step 503: The UE sends a Request Bearer Resource Modification message that carries the resource information to the MME, the MME sends a Request Bearer Resource Modification message that carries the resource information to an S-GW, and the S-GW sends a Request Bearer Resource Modification message that carries the resource information to a P-GW.

[0052] The implementation processes of Steps 504-508 are the same as those of steps 404-408. (3) The MME encapsulates the resource information in a GTP-C header and sends the GTP-C header to the S-GW through a bearer modification process, and the S-GW sends the GTP-C header to the P-GW.

[0053] A GTP-C header is included in the header of each data packet. Each data packet transmitted between the MME, the S-GW, and the P-GW carries the GTP-C header. The sending the GTP-C header to the S-GW through the bearer modification process includes: sending the GTP-C header that carries the resource information to the S-GW through a signaling message transmitted between the MME and the S-GW in the bearer modification process, where the signaling message is a type of data packet, and sending the GTP-C header that carries the resource information to the P-GW through a signaling message transmitted between the S-GW and the P-GW in the bearer modification process.

[0054] FIG. 7 is a signaling interaction diagram of a method for improving QoS according to a sixth embodiment of the present invention, and includes:

Step 601: An eNB sends an OVERLOAD that carries resource information to an MME. Specifically, the eNB may choose a specific bearer and send an OVERLOAD carrying the resource information and related to the specific bearer to the MME.

Step 602: After receiving the OVERLOAD sent by the eNB, the MME encapsulates the resource information in a GTP-C header.

Step 603: The GTP-C header is sent to an S-GW through a bearer modification process and the S-GW sends the GTP-C header to a P-GW.

[0055] The implementation processes of Steps 604-608 are the same as those of steps 404-408.

[0056] In step 602, the way to carry the resource information in the GTP-C header may be to carry the resource information in a spare bit of the GTP-C signaling message, for example, the resource information may be filled in the spare bit of the GTP-C signaling message. Table 2 shows a GTP-C header structure involved in the embodiments of the present invention, where the GTP-C header is a GTP-C header of an Evolved Packet Core (abbreviated as EPC).

Table 2: GTP-C header structure involved in embodiments of the present invention

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Version			P	T=1	Spare	Spare	Spare
2	Message Type							
3	Message Length (1st Octet)							
4	Message Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet)							
10	Sequence Number (2nd Octet)							
11	Sequence Number (3rd Octet)							
12	Spare							

[0057] In step 101 in the first embodiment, the resource information may be sent to the PCRF entity by the eNB in the access network. Specifically, the eNB may encapsulate the resource information in an extension header of a GTP-U data packet and transmit the resource information to the P-GW through a GTP-U tunnel, and the P-GW sends a message that carries the resource information to the PCRF entity.

[0058] FIG. 8 is a signaling interaction diagram of a method for improving QoS according to a seventh embodiment of the present invention, and includes:

Step 701: An eNB encapsulates resource information in an extension header of a GTP-U data packet. Specifically, the eNB may choose a specific bearer and encapsulate the resource information in an extension header of a GTP-U packet related to the specific bearer.

Step 702: The eNB sends the GTP-U extension header that carries the resource information to a P-GW through a GTP-U tunnel. The implementation processes of Steps 703-707 are the same as those of steps 404-408.

Table 3 shows a schematic structure diagram of a GTP-U header involved in embodiments of the present invention.

Table 3: Schematic structure diagram of a GTP-U header involved in embodiments of the present invention

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Version			PT	(*)	1	s	PN
2	Message Type							
3	Length (1st Octet)							
4	Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							

(continued)

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Version			PT	(*)	1	s	PN
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet) 1) 4)							
10	Sequence Number (2nd Octet) 1) 4)							
11	N-PDU (N-PDU Number2) 4))							
12	Next Extension Header Type(3) 4))							

[0059] The resource information may be included in the GTP-U extension header shown in Table 3, and in the GTP-U extension header shown in Table 3 octet 12 may extend a next extension header. The next extension header is as shown in Table 4. Table 4 shows a structure of the extension header extended from octet 12 of the GTP-U extension header shown in Table 3. Firstly, an extension header flag in the next extension header is set to be 1. That is, the third bit in octet 1 is set to be 1. Then, the resource information is carried in octet m+1, where m is a natural number.

Table 4: Structure of the extension header extended from octet 12 in the GTP-U extension header shown in Table 3

Octets 1	Extension Header Length
2 - m	Extension Header Content
m+1	Resource Information

[0060] In step 101 in the first embodiment, the resource information may be sent by the eNB in the access network to the PCRF entity. Specifically, the eNB may encapsulate the resource information in a GPRS Tunneling Protocol for User Plane (abbreviated as GTP-U) message capable of carrying the resource information and sends the GTP-U message capable of carrying the resource information to the P-GW through a GTP-U tunnel sending. The P-GW sends a message that carries the resource information to the PCRF entity. Table 5 shows types of GTP-U messages involved in the embodiment of the present invention.

Table 5 GTP-U message types involved in the embodiment of the present invention

Message Type Value (Decimal)	Message	Reference	GTP -C	GTP -U	GTP'
1	Echo Request		X	X	x
2	Echo Response		X	X	x
3-25	Reserved in 3GPP TS 32.295 [8] and 3GPP TS 29.060 [6]				
26	Error Indication			X	
27-30	Reserved in 3GPP TS 29.060 [6]				
31	Supported Extension Headers Notification		X	X	
32-252	Reserved in 3GPP TS 29.060 [6]				
253	eNB Load Report			X	
254	End Marker			X	
255	G-PDU			X	

[0061] In Table 5, the eNB load report message of message type value 253 may be a GTP-U message capable of carrying the resource information. Certainly, the message type value of a newly added GTP-U message capable of carrying the resource information may alternatively be other values and the name of the newly added GTP-U message capable of carrying the resource information may alternatively be other names without being limited to the eNB load report message.

[0062] FIG. 9 is a signaling interaction diagram of a method for improving QoS according to an eighth embodiment of the present invention, and includes:

Step 801: An eNB carries resource information in a newly added GTP-U message. Specifically, the eNB may choose a specific bearer and encapsulate the resource information in a newly added
GTP-U message related to the specific bearer.
Step 802: The eNB sends the newly added GTP-U message that carries the resource information to a P-GW through a GTP-U tunnel.

[0063] The implementation processes of Steps 803-807 are the same as those of steps 404-408.

[0064] In step 101 in the first embodiment, the resource information may be sent by the eNB in the access network to the PCRF entity. Specifically, the eNB sends an RRC message that carries the resource information to the UE; the UE sends a Request Bearer Resource Modification message that carries the resource information to the P-GW; and the P-GW sends a message that carries the resource information to the PCRF entity.

[0065] FIG. 10 is a signaling interaction diagram of a method for improving QoS according to a ninth embodiment of the present invention, and includes:

Step 901: An eNB sends an RRC message that carries resource information to a UE. Specifically, the eNB may choose a specific bearer and sends an RRC message carrying the resource information and related to the specific bearer to the UE.
Step 902: After receiving the RRC message sent by the eNB, the UE sends a Request Bearer Resource Modification message that carries the resource information to an MME, the MME sends a Request Bearer Resource Modification message that carries to an S-GW, and the S-GW sends a Request Bearer Resource Modification message that carries to a P-GW. After receiving the RRC message from the eNB, the UE may also choose a specific bearer, for example, the UE may choose a bearer guaranteeing Guaranteed Bit Rate, and sends a Request Bearer Resource Modification message carrying the resource information and related to the chosen bearer to the MME.
Step 903: The P-GW sends an IP-CAN Session Modification message that carries the resource information to a PCRF entity.

[0066] The implementation processes of Steps 903-907 are the same as those of steps 404-408.

[0067] In the embodiments shown in FIGs. 3 to 10, when the eNB sends the resource information, the eNB may choose a specific bearer and sends the resource information carried in a message related to the specific bearer to the MME, the S-GW, the UE, or the P-GW.

[0068] In the embodiments shown in FIGs. 3 and 4, the eNB sends the resource information to the P-CSCF entity without passing through the PCRF entity in the PCC architecture. In the embodiments shown in FIGs. 5, 6, 7, 8, 9 and 10, when the eNB sends resource information to the P-CSCF with passing through the PCRF entity in the PCC architecture.

[0069] In the foregoing embodiments of the present invention, the implementation way of the present invention is described by taking that the eNB sends the resource information as an example. The resource information may also be sent by other network element in the access network, for example, the resource information may be sent by a network element in a UTRAN or GERAN, or the resource information may be sent by a network element in a WiMAX network; or the resource information may be sent by other network element (such as the SGW or the PGW).

[0070] The specific process is similar to that in the foregoing embodiments. For example, the UTRAN sends an OVERLOAD that carries the resource information to the SGSN; the SGSN sends the resource information to the SGW; the SGW sends the resource information to the P-GW; the P-GW sends the resource information to the PCRF entity; the PCRF entity sends the resource information to the P-CSCF entity; and the P-CSCF entity re-negotiates the service parameter with the UE, or the P-CSCF entity adjusts the service request related to the current service according to the resource information and sends the adjusted service request to the P-GW in the access network. Furthermore, for example, the SGW sends the resource information to the P-GW; the P-GW sends the resource information to the PCRF entity; the PCRF entity sends the resource information to the P-CSCF entity; and the P-CSCF entity re-negotiates the service parameter with the UE, or the P-CSCF entity adjusts the service request related to the current service according to the resource information and sends the adjusted service request to the P-GW in the access network.

[0071] The application network may also be other IP application networks, such as Google servers.

[0072] FIG. 11 is a schematic structure diagram of a system for improving QoS according to an embodiment of the present invention. The system includes an access network 100 and an application network 200. The access network 100 is configured to send resource information when a resource of the access network 100 is changed, where the resource information is information that indicates a current resource status of the access network 100. The application network 200 is configured to receive the resource information, adjust a service request related to the current service according to the resource information, and send the adjusted service request to the access network 100, or negotiate a service parameter related to the current service with a UE according to the resource information, so that the UE modifies the service parameter related to the current service according to a result of the negotiation.

[0073] The application network 200 may be an IMS which includes a P-CSCF entity; and the access network 100 includes an eNB, where the eNB is configured to send the resource information to the P-CSCF entity. Specifically, the eNB may be configured to send the resource information to the P-CSCF entity through the UE.

[0074] The system shown in FIG. 11 may further include a PCRF entity which is connected respectively to the application network 200 and the access network 100; the application network is an IMS, in which the IMS includes a P-CSCF entity and the access network includes an eNB. The eNB may be specifically configured to send the resource information to the PCRF entity; and the PCRF entity is specifically configured to send the resource information to the P-CSCF entity.

[0075] The PCRF entity may be further configured to generate PCC rules according to the service request sent by the P-CSCF entity and send the PCC rules to a P-GW in the access network.

[0076] FIG. 12 is a schematic structure diagram of an application network element according to an embodiment of the present invention. The network element includes a receiving unit 300 and a processing unit 400, where the receiving unit 300 is connected to the processing unit 400. The receiving unit 300 is configured to receive resource information sent by an access network; the processing unit 400 is connected to the receiving unit 300 and is configured to adjust a service request related to a current service according to the resource information received by the receiving unit 300 and send the adjusted service request to the access network; or configured to negotiate with a UE over a service parameter related to the current service according to the resource information received by the receiving unit 300, so that the UE modifies the service parameter related to the current service according to a result of the negotiation.

[0077] Persons of ordinary skill in the art should understand that all or part of the steps in the methods of the embodiments can be implemented by hardware under the instruction of a program. The program may be stored in a computer readable storage medium and when the program runs, the steps in the methods of the embodiments are performed. The storage medium may be any medium that can store program codes, such as a ROM, a RAM, a magnetic disk, or Compact Disk-Read Only Memory. Finally, it should be noted that the embodiments are merely provided for describing the technical solutions of the present invention, but not intended to limit the present invention. Although the present invention has been described in details with reference to exemplary embodiments, it should be understood by persons of ordinary skill in the art that modifications or equivalent replacements can be made to the technical solutions of the present invention, and such modifications or equivalent replacements do not cause the modified technical solutions to depart from the scope of the present invention.

Claims

1. A method for improving Quality of Service, comprising:

when a resource of an access network (1) is changed, receiving (101), by an application network (2), resource information sent by the access network (1), wherein the resource information indicates a current resource status of the access network (1); and

adjusting (102), by the application network (2), a service request related to a current service according to the resource information and sending the adjusted service request to the access network (1); or negotiating, by the application network (2), a service parameter related to a current service with a User Equipment, UE, according to the resource information, so that the UE modifies the service parameter related to the current service according to a result of the negotiation;

wherein the application network (2) is an Internet Protocol, IP, Multimedia Subsystem, IMS; and

the receiving, by the application network (2), the resource information sent by the access network (1) comprises: receiving, by a Proxy-Call Session Control Function, P-CSCF, entity in the IMS, the resource information sent by a Policy and Charging Rules Function, PCRF, entity (3).

2. The method according to claim 1, wherein the adjusting (102), by the application network (2), the service request related to the current service according to the resource information comprises:

negotiating, by the application network (2), a service parameter related to the current service with a UE according to the resource information and adjusting a service request related to the current service.

3. The method according to claim 1, wherein
the resource information sent by the PCRF entity (3) is from an evolved NodeB, eNB, in the access network (1).

4. The method according to claim 3, wherein the resource information is:

sent by the eNB to an MME (12) through a message that carries the resource information, sent by the MME (12) to a Packet Data Network Gateway, P-GW (14), and sent by the P-GW (14) to the PCRF entity (3) through an IP-CAN message that carries the resource information; or
sent by the eNB to the UE through an RRC message that carries the resource information, sent by the UE to a P-GW (14) through a Request Bearer Resource Modification message that carries the resource information, and sent by the P-GW (14) to the PCRF entity (3) through an IP-CAN message that carries the resource information; or
encapsulated by the eNB in an extension header of a GPRS Tunnelling Protocol for User Plane, GTP-U, data packet and transmitted to a P-GW (14) through a GTP-U tunnel, and sent by the P-GW (14) to the PCRF entity (3) through an IP-CAN message that carries the resource information; or
encapsulated by the eNB in a GTP-U message capable of carrying the resource information and sent to a P-GW (14) through the GTP-U message that carries the resource information via a GTP-U tunnel, and sent by the P-GW (14) to the PCRF entity (3) through an IP-CAN message that carries the resource information.

5. The method according to claim 4, wherein,
the message that carries the resource information relates to a specific bearer chosen by the eNB;
the RRC message that carries the resource information relates to a specific bearer chosen by the eNB;
the resource information in the extension header of the GTP-U data packet relates to a specific bearer chosen by the eNB;
the resource information in the GTP-U message capable of carrying the resource information relates to a specific bearer chosen by the eNB;
wherein the specific bearer is a Guaranteed Bit Rate bearer or a bearer with a QoS Class Identifier not in the resource information.

6. The method according to claim 4, wherein the resource information is
sent by the MME (12) to an Serving Gateway, S-GW (13) through a message that carries the resource information, and sent by the S-GW (13) to the P-GW (14) through a message that carries the resource information; or
sent by the MME (12) to the UE through a message that carries the resource information, sent by the UE to the MME though a Request Bearer Resource Modification message that carries the resource information, sent by the MME (12) to an S-GW (13) through a Request Bearer Resource Modification message that carries the resource information, and sent by the S-GW (13) to the P-GW (14) through a Request Bearer Resource Modification message that carries the resource information; or
encapsulated by the MME (12) to an S-GW (13) through the resource information in a GTP-C header sent in a bearer modification process, and sent by the S-GW (13) to the P-GW (14).

7. The method according to claim 4, wherein the resource information is sent by the P-GW (14) to the PCRF entity (3) through an IP-CAN Session Modification message or an IP-CAN Session Notification message that carries the resource information.

8. The method according to any one of claims 1 to 7, wherein the resource information is sent by the PCRF entity (3) to the P-CSCF entity through an information element that carries the resource information and is defined by Diameter protocol.

9. The method according to claim 8, wherein the sending the adjusted service request to the access network (1) comprises: sending, by the P-CSCF entity in the IMS, an information element that carries the resource information and is defined by Diameter protocol to the PCRF entity (3); and generating, by the PCRF entity (3), Policy and Charging Control, PCC, rules according to the adjusted service request and sending the PCC rules to the P-GW in the access network (1).

10. The method according to claim 9, wherein the sending the adjusted service request to the access network (1) comprises: sending, by the P-CSCF entity in the IMS, the adjusted service request to the P-GW (14) in the access network (1).

11. A system for improving Quality of Service, comprising:

an access network (1), configured to send resource information when a resource of the access network (1) is changed, wherein the resource information indicates a current resource status of the access network (1);
an application network (2), configured to receive the resource information, adjust a service request related to a current service according to the resource information and send the adjusted service request to the access network (1); or negotiate the service parameter related to the current service with the UE, according to the resource information, so that the UE modifies the service parameter related to the current service according to a result of the negotiation; and
wherein the application network (2) is an IP Multimedia Subsystem, IMS, comprising a Proxy-Call Session Control Function, P-CSCF, entity and the P-CSCF entity is configured to receive the resource information from a Policy and Charging Rules Function, PCRF, entity (3).

12. The system according to claim 11, wherein the access network (1) comprises an evolved NodeB, eNB; and the eNB is configured to send the resource information to the PCRF entity (3).

13. The system according to claim 11, further comprising the PCRF entity (3), and the PCRF entity (3) is connected to the application network (2) and the access network (1) respectively.

14. The system according to claim 11, wherein the PCRF entity (3) is further configured to generate Policy and Charging Control, PCC, rules according to the service request sent by the P-CSCF entity and send the PCC rules to a Packet Data Network Gateway, P-GW (14), in the access network (1).

15. An application network element, comprising:

a receiving unit (300), configured to receive resource information sent by an access network (1), wherein the resource information indicates a current resource status of the access network (1); and
a processing unit (400), connected to the receiving unit (300), configured to adjust a service request related to a current service according to the resource information received by the receiving unit (300) and send the adjusted service request to the access network (1); or negotiate the service parameter related to the current service with the UE, according to the resource information received by the receiving unit (300), so that the UE modifies the service parameter related to the current service according to a result of the negotiation;
wherein the application network element is a Proxy-Call Session Control Function, P-CSCF, in an IP Multimedia Subsystem, IMS, and the receiving unit (300) is configured to receive the resource information sent by a Policy and Charging Rules Function, PCRF, entity (3).

16. The application network element according to claim 15, wherein the resource information sent by the PCRF entity (3) is from an evolved NodeB, eNB, in the access network (1).

Patentansprüche

1. Verfahren zum Verbessern der Dienstgüte, umfassend:

wenn eine Ressource eines Zugangsnetzwerks (1) geändert wird, Empfangen (101), durch ein Anwendungsnetzwerk (2), von durch das Zugangsnetzwerk (1) gesendeten Ressourceninformationen, wobei die Ressourceninformationen einen aktuellen Ressourcenstatus des Zugangsnetzwerks (1) angeben; und
Anpassen (102), durch das Anwendungsnetzwerk (2), einer Dienstanforderung in Bezug auf einen aktuellen Dienst gemäß den Ressourceninformationen und Senden der angepassten Dienstanforderung zu dem Zugangsnetzwerk (1); oder Aushandeln,
durch das Anwendungsnetzwerk (2), eines Dienstparameters in Bezug auf einen aktuellen Dienst mit einer Benutzerausrüstung (User Equipment, UE) gemäß den Ressourceninformationen, sodass die UE den Dienstparameter in Bezug auf den aktuellen Dienst gemäß einem Ergebnis der Aushandlung modifiziert;
wobei das Anwendungsnetzwerk (2) ein "Internet Protocol (IP) Multimedia Subsystem" (IMS) ist; und
das Empfangen, durch das Anwendungsnetzwerk (2), der durch das Zugangsnetzwerk (1) gesendeten Ressourceninformationen Folgendes umfasst: Empfangen, durch eine "Proxy-Call Session Control Function"(P-CSCF)-Entität in dem IMS, der durch eine "Policy and Charging Rules Function" (PCRF)-Entität (3) gesendeten Ressourceninformationen.

2. Verfahren nach Anspruch 1, wobei das Anpassen (102), durch das Anwendungsnetzwerk (2), der Dienstanforderung in Bezug auf den aktuellen Dienst gemäß den Ressourceninformationen Folgendes umfasst:
Aushandeln, durch das Anwendungsnetzwerk (2), eines Dienstparameters in Bezug auf den aktuellen Dienst mit einer UE gemäß den Ressourceninformationen und Anpassen einer Dienstanforderung in Bezug auf den aktuellen Dienst.

3. Verfahren nach Anspruch 1, wobei
die durch die PCRF-Entität (3) gesendeten Ressourceninformationen von einer "evolved NodeB" (eNB) in dem Zugangsnetzwerk (1) stammen.

4. Verfahren nach Anspruch 3, wobei die Ressourceninformationen:

von der eNB durch eine Nachricht, die die Ressourceninformationen enthält, zu einer MME (12) gesendet werden, von der MME (12) zu einem Paketdatennetzwerk-Gateway (P-GW) (14) gesendet werden und von dem P-GW (14) durch eine IP-CAN-Nachricht, die die Ressourceninformationen enthält, zu der PCRF-Entität (3) gesendet werden; oder
von der eNB durch eine RRC-Nachricht, die die Ressourceninformationen enthält, zu der UE gesendet werden, von der UE durch eine Nachricht über eine angeforderte Trägerressourcenmodifikation, die die Ressourceninformationen enthält, zu einem P-GW (14) gesendet werden, und von dem P-GW (14) durch eine IP-CAN-Nachricht, die die Ressourceninformationen enthält, zu der PCRF-Entität (3) gesendet werden; oder
von der eNB in einen Erweiterungs-Header eines "GPRS Tunnelling Protocol for User Plane" (GTP-U)-Datenpakets eingekapselt werden und durch einen GTP-U-Tunnel zu einem P-GW (14) übertragen werden und von dem P-GW (14) durch eine IP-CAN-Nachricht, die die Ressourceninformationen enthält, zu der PCRF-Entität (3) gesendet werden; oder
von der eNB in eine GTP-U-Nachricht, die dazu in der Lage ist, die Ressourceninformationen zu enthalten, eingekapselt werden und durch die GTP-U-Nachricht, die die Ressourceninformationen enthält, über einen GTP-U-Tunnel zu einem P-GW (14) gesendet werden und von dem P-GW (14) durch eine IP-CAN-Nachricht, die die Ressourceninformationen enthält, zu der PCRF-Entität (3) gesendet werden.

5. Verfahren nach Anspruch 4, wobei
die Nachricht, die die Ressourceninformationen enthält, einen von der eNB ausgewählten spezifischen Träger betrifft;
die RRC-Nachricht, die die Ressourceninformationen enthält, einen von der eNB ausgewählten spezifischen Träger betrifft;
die Ressourceninformationen in dem Erweiterungs-Header des GTP-U-Datenpakets einen von der eNB ausgewählten spezifischen Träger betreffen;
die Ressourceninformationen in der GTP-U-Nachricht, die dazu in der Lage ist, die Ressourceninformationen zu enthalten, einen von der eNB ausgewählten spezifischen Träger betreffen;
wobei der spezifische Träger ein Träger mit garantierter Bitrate oder ein Träger mit einem QoS-Klassenindikator ist, der nicht in den Ressourceninformationen enthalten ist.

6. Verfahren nach Anspruch 4, wobei die Ressourceninformationen von der MME (12) durch eine Nachricht, die die Ressourceninformationen enthält, zu einem bedienenden Gateway (Serving Gateway, S-GW) (13) gesendet werden und von dem S-GW (13) durch eine Nachricht, die die Ressourceninformationen enthält, zu dem P-GW (14) gesendet werden; oder
von der MME (12) durch eine Nachricht, die die Ressourceninformationen enthält, zu der UE gesendet werden, von der UE durch eine Nachricht über eine angeforderte Trägerressourcenmodifikation, die die Ressourceninformationen enthält, zu der MME gesendet werden, von der MME (12) durch eine Nachricht über eine angeforderte Trägerressourcenmodifikation, die die Ressourceninformationen enthält, zu einem S-GW (13) gesendet werden und von dem S-GW (13) durch eine Nachricht über eine angeforderte Trägerressourcenmodifikation, die die Ressourceninformationen enthält, zu dem P-GW (14) gesendet werden; oder
von der MME (12) durch die Ressourceninformationen in einem GTP-C-Header, die in einem Trägermodifikationsverfahren gesendet werden, in einen S-GW (13) eingekapselt werden und von dem S-GW (13) zu dem P-GW (14) gesendet werden.

7. Verfahren nach Anspruch 4, wobei die Ressourceninformationen von dem P-GW (14) durch eine IP-CAN-Sitzungsmodifikations-Nachricht oder eine IP-CAN-Sitzungsbenachrichtigungs-Nachricht, die die Ressourceninformationen enthält, zu der PCRF-Entität (3) gesendet werden.

8. Verfahren nach einem der Ansprüche 1 bis 7, wobei die Ressourceninformationen von der PCRF-Entität (3) durch ein Informationselement, das die Ressourceninformationen enthält und durch das Diameter-Protokoll definiert ist, zu der P-CSCF-Entität gesendet werden.

9. Verfahren nach Anspruch 8, wobei das Senden der angepassten Dienstanforderung zu dem Zugangsnetzwerk (1) Folgendes umfasst: Senden, durch die P-CSCF-Entität in dem IMS, eines Informationselements, das die Ressourceninformationen enthält und durch das Diameter-Protokoll definiert ist, zu der PCRF-Entität (3); und Erzeugen, durch die PCRF-Entität (3), von Richtlinien- und Ladesteuerungs(Policy and Charging Control, PCC)-Regeln gemäß der angepassten Dienstanforderung und Senden der PCC-Regeln zu dem P-GW in dem Zugangsnetzwerk (1).

10. Verfahren nach Anspruch 9, wobei das Senden der angepassten Dienstanforderung zu dem Zugangsnetzwerk (1) Folgendes umfasst: Senden, durch die P-CSCF-Entität in dem IMS, der angepassten Dienstanforderung zu dem P-GW (14) in dem Zugangsnetzwerk (1).

11. System zum Verbessern der Dienstgüte, umfassend:

ein Zugangsnetzwerk (1), das dazu konfiguriert ist, Ressourceninformationen zu senden, wenn eine Ressource des Zugangsnetzwerks (1) geändert wird, wobei die Ressourceninformationen einen aktuellen Ressourcenstatus des Zugangsnetzwerks (1) angeben;
ein Anwendungsnetzwerk (2), das dazu konfiguriert ist, die Ressourceninformationen zu empfangen, eine Dienstanforderung in Bezug auf einen aktuellen Dienst gemäß den Ressourceninformationen anzupassen und die angepasste Dienstanforderung zu dem Zugangsnetzwerk (1) zu senden; oder den Dienstparameter in Bezug auf den aktuellen Dienst mit der UE gemäß den Ressourceninformationen auszuhandeln,
sodass die UE den Dienstparameter in Bezug auf den aktuellen Dienst gemäß einem Ergebnis der Aushandlung modifiziert; und
wobei das Anwendungsnetzwerk (2) ein "IP Multimedia Subsystem" (IMS) umfassend eine "Proxy-Call Session Control Function"(P-CSCF)-Entität ist und die P-CSCF-Entität dazu konfiguriert ist, die Ressourceninformationen von einer "Policy and Charging Rules Function" (PCRF)-Entität (3) zu empfangen.

12. System nach Anspruch 11, wobei das Zugangsnetzwerk (1) eine "evolved NodeB" (eNB) umfasst; und die eNB dazu konfiguriert ist, die Ressourceninformationen zu der PCRF-Entität (3) zu senden.

13. System nach Anspruch 11, ferner umfassend die PCRF-Entität (3), und die PCRF-Entität (3) ist mit dem Anwendungsnetzwerk (2) bzw. dem Zugangsnetzwerk (1) verbunden.

14. System nach Anspruch 11, wobei die PCRF-Entität (3) ferner dazu konfiguriert ist, Richtlinien- und Ladesteuerungs(Policy and Charging Control, PCC)-Regeln gemäß der von der P-CSCF-Entität gesendeten Dienstanforderung zu erzeugen und die PCC-Regeln zu einem Paketdatennetzwerk-Gateway (P-GW) (14) in dem Zugangsnetzwerk (1) zu senden.

15. Anwendungsnetzwerkelement, umfassend:

eine Empfangseinheit (300), die dazu konfiguriert ist, von einem Zugangsnetzwerk (1) gesendete Ressourceninformationen zu empfangen, wobei die Ressourceninformationen einen aktuellen Ressourcenstatus des Zugangsnetzwerks (1) angeben; und
eine mit der Empfangseinheit (300) verbundene Verarbeitungseinheit (400), die dazu konfiguriert ist, eine Dienstanforderung in Bezug auf einen aktuellen Dienst gemäß den von der Empfangseinheit (300) empfangenen Ressourceninformationen anzupassen und die angepasste Dienstanforderung zu dem Zugangsnetzwerk (1) zu senden; oder den Dienstparameter in Bezug auf den aktuellen Dienst mit der UE gemäß den von der Empfangseinheit (300) empfangenen Ressourceninformationen auszuhandeln, sodass die UE den Dienstparameter in Bezug auf den aktuellen Dienst gemäß einem Ergebnis der Aushandlung modifiziert;
wobei das Anwendungsnetzwerkelement eine "Proxy-Call Session Control Function" (P-CSCF) in einem "IP Multimedia Subsystem" (IMS) ist und die Empfangseinheit (300) dazu konfiguriert ist, die von einer "Policy and Charging Rules Function" (PCRF)-Entität (3) gesendeten Ressourceninformationen zu empfangen.

16. Anwendungsnetzwerkelement nach Anspruch 15, wobei die durch die PCRF-Entität (3) gesendeten Ressourceninformationen von einer "evolved NodeB" (eNB) in dem Zugangsnetzwerk (1) stammen.

Revendications

1. Procédé pour améliorer la qualité de service, comprenant les étapes suivantes :

lorsqu'une ressource d'un réseau d'accès (1) est modifiée, recevoir (101), par un réseau d'application (2), des informations de ressources envoyées par le réseau d'accès (1), où les informations de ressources indiquent un état actuel des ressources du réseau d'accès (1) ; et
ajuster (102), par le réseau d'application (2), une demande de service liée à un service en cours selon les informations de ressources, et envoyer la demande de service ajustée au réseau d'accès (1) ; ou négocier, par le réseau d'application (2), un paramètre de service lié à un service en cours avec un équipement utilisateur, UE, selon les informations de ressources, de manière à ce que l'UE modifie le paramètre de service lié au service en cours selon le résultat de la négociation ;
où le réseau d'application (2) est un sous-système multimédia, IMS, à protocole Internet, IP ; et
la réception, par le réseau d'application (2), des informations de ressources envoyées par le réseau d'accès (1) comprend : la réception, par une entité de fonction de commande de session d'appel mandataire, P-CSCF, de l'IMS, des informations de ressources envoyées par une entité de fonction de politique et de règles de tarification, PCRF (3).

2. Procédé selon la revendication 1, dans lequel l'ajustement (102), par le réseau d'application (2), de la demande de service liée au service en cours selon les informations de ressources comprend les étapes suivantes :
négocier, par le réseau d'application (2), un paramètre de service lié au service en cours avec un UE selon les informations de ressources et ajuster une demande de service liée au service en cours.

3. Procédé selon la revendication 1, dans lequel :
les informations de ressources envoyées par l'entité PCRF (3) proviennent d'un noeud B évolué, eNB, situé dans le réseau d'accès (1).

4. Procédé selon la revendication 3, dans lequel les informations de ressources sont :

envoyées par l'eNB à une MME (12) par l'intermédiaire d'un message qui achemine les informations de ressources, envoyées par la MME (12) à une passerelle de réseau de données par paquets, P-GW (14), et envoyées par la P-GW (14) à l'entité PCRF (3) par l'intermédiaire d'un message IP-CAN qui achemine les informations de ressources ; ou
envoyées par l'eNB à l'UE par l'intermédiaire d'un message RRC qui achemine les informations de ressources, envoyées par l'UE à une P-GW (14) par l'intermédiaire d'un message de demande de modification des ressources porteuses qui achemine les informations de ressources, et envoyées par la P-GW (14) à l'entité PCRF (3) par l'intermédiaire d'un message IP-CAN qui achemine les informations de ressources ; ou
encapsulées par l'eNB dans un en-tête d'extension d'un paquet de données de protocole de tunnellisation GPRS pour plan utilisateur, GTP-U, et transmises à une P-GW (14) par l'intermédiaire d'un tunnel GTP-U, et envoyées par la P-GW (14) à l'entité PCRF (3) par l'intermédiaire d'un message IP-CAN qui achemine les informations de ressources ; ou
encapsulées par l'eNB dans un message GTP-U capable d'acheminer les informations de ressources et envoyées à une P-GW (14) par l'intermédiaire du message GTP-U qui achemine les informations de ressources par l'intermédiaire d'un tunnel GTP-U, et envoyées par la P-GW (14) à l'entité PCRF (3) par l'intermédiaire d'un message IP-CAN qui achemine les informations de ressources.

5. Procédé selon la revendication 4, dans lequel :

le message qui achemine les informations de ressources se rapporte à une porteuse spécifique choisie par l'eNB ;
le message RRC qui achemine les informations de ressources se rapporte à une porteuse spécifique choisie par l'eNB ;
les informations de ressources contenues dans l'en-tête d'extension du paquet de données GTP-U se rapportent à une porteuse spécifique choisie par l'eNB ;
les informations de ressources contenues dans le message GTP-U et capables d'acheminer les informations de ressources se rapportent à une porteuse spécifique choisie par l'eNB ;
où la porteuse spécifique est une porteuse à débit binaire garanti ou une porteuse avec un identificateur de classe de QoS ne figurant pas dans les informations de ressources.

6. Procédé selon la revendication 4, dans lequel les informations de ressources sont :

envoyées par la MME (12) à une passerelle de desserte, S-GW (13) par l'intermédiaire d'un message qui achemine les informations de ressources, et
envoyées par la S-GW (13) à la P-GW (14) par l'intermédiaire d'un message qui achemine les informations de ressources ; ou
envoyées par la MME (12) à l'UE par l'intermédiaire d'un message qui achemine les informations de ressources, envoyées par l'UE à la MME par l'intermédiaire d'un message de demande de modification des ressources porteuses qui achemine les informations de ressources, envoyées par la MME (12) à une S-GW (13) par l'intermédiaire d'un message de demande de modification des ressources porteuses qui achemine les informations de ressources, et envoyées par la S-GW (13) à la P-GW (14) par l'intermédiaire d'un message de demande de modification des ressources porteuses qui achemine les informations de ressources ; ou
encapsulées par la MME (12) vers une S-GW (13) par l'intermédiaire des informations de ressources contenues dans un en-tête GTP-C envoyées dans un processus de modification de porteuse, et envoyées par la S-GW (13) à la P-GW (14).

7. Procédé selon la revendication 4, dans lequel les informations de ressources sont envoyées par la P-GW (14) à l'entité PCRF (3) par l'intermédiaire d'un message de modification de session IP-CAN ou d'un message de notification de session IP-CAN qui achemine les informations de ressources.

8. Procédé selon l'une quelconque des revendications 1 à 7, dans lequel les informations de ressources sont envoyées par l'entité PCRF (3) à l'entité P-CSCF par l'intermédiaire d'un élément d'informations qui achemine les informations de ressources et qui est défini par le protocole Diameter.

9. Procédé selon la revendication 8, dans lequel l'envoi de la demande de service ajustée au réseau d'accès (1) comprend les étapes suivantes : envoyer, par l'entité P-CSCF dans l'IMS, un élément d'informations qui achemine les informations de ressources et qui est défini par le protocole Diameter à l'entité PCRF (3) ; et générer, par l'entité PCRF (3), des règles de politique et de contrôle de tarification, PCC, selon la demande de service ajustée, et envoyer les règles PCC à la P-GW dans le réseau d'accès (1).

10. Procédé selon la revendication 9, dans lequel l'envoi de la demande de service ajustée au réseau d'accès (1) comprend l'étape suivante : envoyer, par l'entité P-CSCF dans l'IMS, de la demande de service ajustée à la P-GW (14) dans le réseau d'accès (1).

11. Système pour améliorer la qualité de service, comprenant :

un réseau d'accès (1), configuré pour envoyer des informations de ressources lorsqu'une ressource du réseau d'accès (1) est modifiée, où les informations de ressources indiquent un état actuel des ressources du réseau d'accès (1) ;
un réseau d'application (2), configuré pour recevoir les informations de ressources, ajuster une demande de service liée à un service en cours selon les informations de ressources et envoyer la demande de service ajustée au réseau d'accès (1) ; ou
négocier le paramètre de service lié au service en cours avec l'UE, selon les informations de ressources, de manière à ce que l'UE modifie le paramètre de service lié au service en cours selon le résultat de la négociation ; et où le réseau d'application (2) est un sous-système multimédia IP, IMS, comprenant une entité de fonction de commande de session d'appel mandataire, P-CSCF, et l'entité P-CSCF est configurée pour recevoir les informations de ressources d'une entité de fonction de politique et de règles de tarification, PCRF (3).

12. Système selon la revendication 11, dans lequel le réseau d'accès (1) comprend un noeud B évolué, eNB ; et l'eNB est configuré pour envoyer les informations de ressources à l'entité PCRF (3).

13. Le système selon la revendication 11, comprenant en outre l'entité PCRF (3), et l'entité PCRF (3) est connectée au réseau d'application (2) et au réseau d'accès (1), respectivement.

14. Système selon la revendication 11, dans lequel l'entité PCRF (3) est en outre configurée pour générer des règles de politique et de contrôle de tarification, PCC, selon la demande de service envoyée par l'entité P-CSCF, et pour envoyer les règles PCC à une passerelle de réseau de données par paquets, P-GW (14), dans le réseau d'accès (1).

15. Élément de réseau d'application, comprenant :

une unité de réception (300), configurée pour recevoir des informations de ressources envoyées par un réseau d'accès (1), où les informations de ressources indiquent un état actuel des ressources du réseau d'accès (1) ; et une unité de traitement (400), connectée à l'unité de réception (300), configurée pour ajuster une demande de service liée à un service en cours selon les informations de ressources reçues par l'unité de réception (300), et envoyer la demande de service ajustée au réseau d'accès (1) ; ou négocier le paramètre de service lié au service en cours avec l'UE, selon les informations de ressources reçues par l'unité de réception (300), de manière à ce que l'UE modifie le paramètre de service lié au service en cours selon le résultat de la négociation ; où l'élément de réseau d'application est une fonction de commande de session d'appel mandataire, P-CSCF, dans un sous-système multimédia IP, IMS, et l'unité de réception (300) est configurée pour recevoir les informations de ressources envoyées par une entité de fonction de politique et de règles de tarification, PCRF (3).

16. Élément de réseau d'application selon la revendication 15, dans lequel les informations de ressources envoyées par l'entité PCRF (3) proviennent d'un noeud B évolué, eNB, dans le réseau d'accès (1).

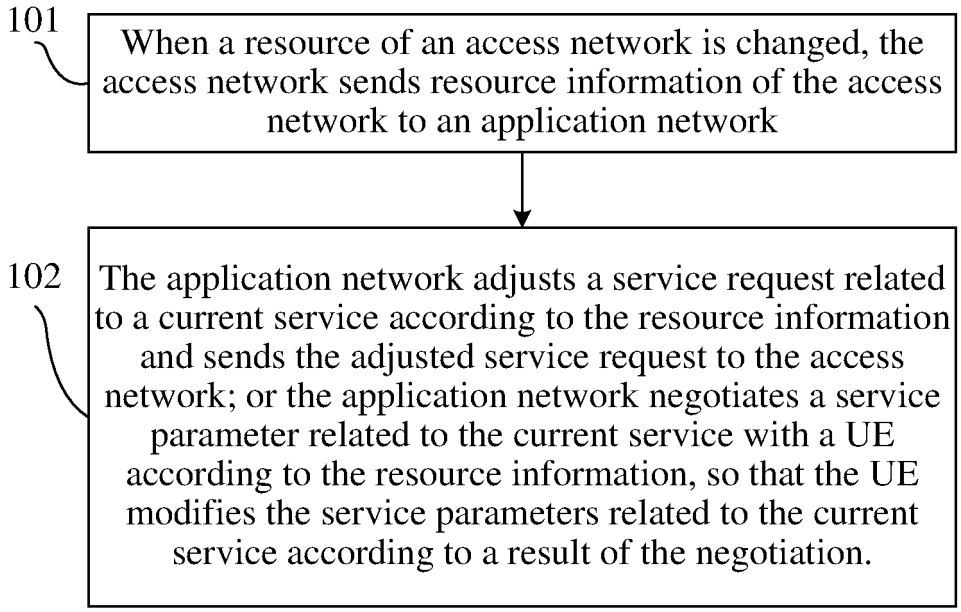
101
When a resource of an access network is changed, the access network sends resource information of the access network to an application network
102
The application network adjusts a service request related to a current service according to the resource information and sends the adjusted service request to the access network; or the application network negotiates a service parameter related to the current service with a UE according to the resource information, so that the UE modifies the service parameters related to the current service according to a result of the negotiation.

FIG. 1

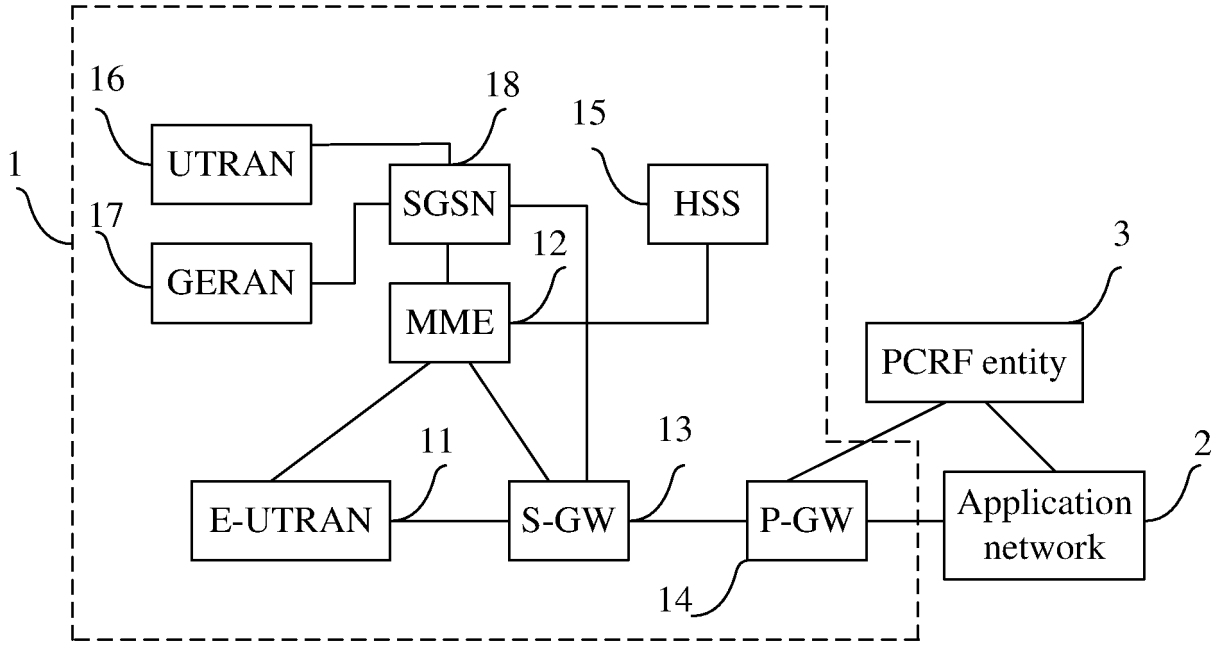
1
16
UTRAN
17
GERAN
18
SGSN
15
HSS
12
MME
3
PCRF entity
11
E-UTRAN
13
S-GW
P-GW
14
Application network
2

FIG. 2

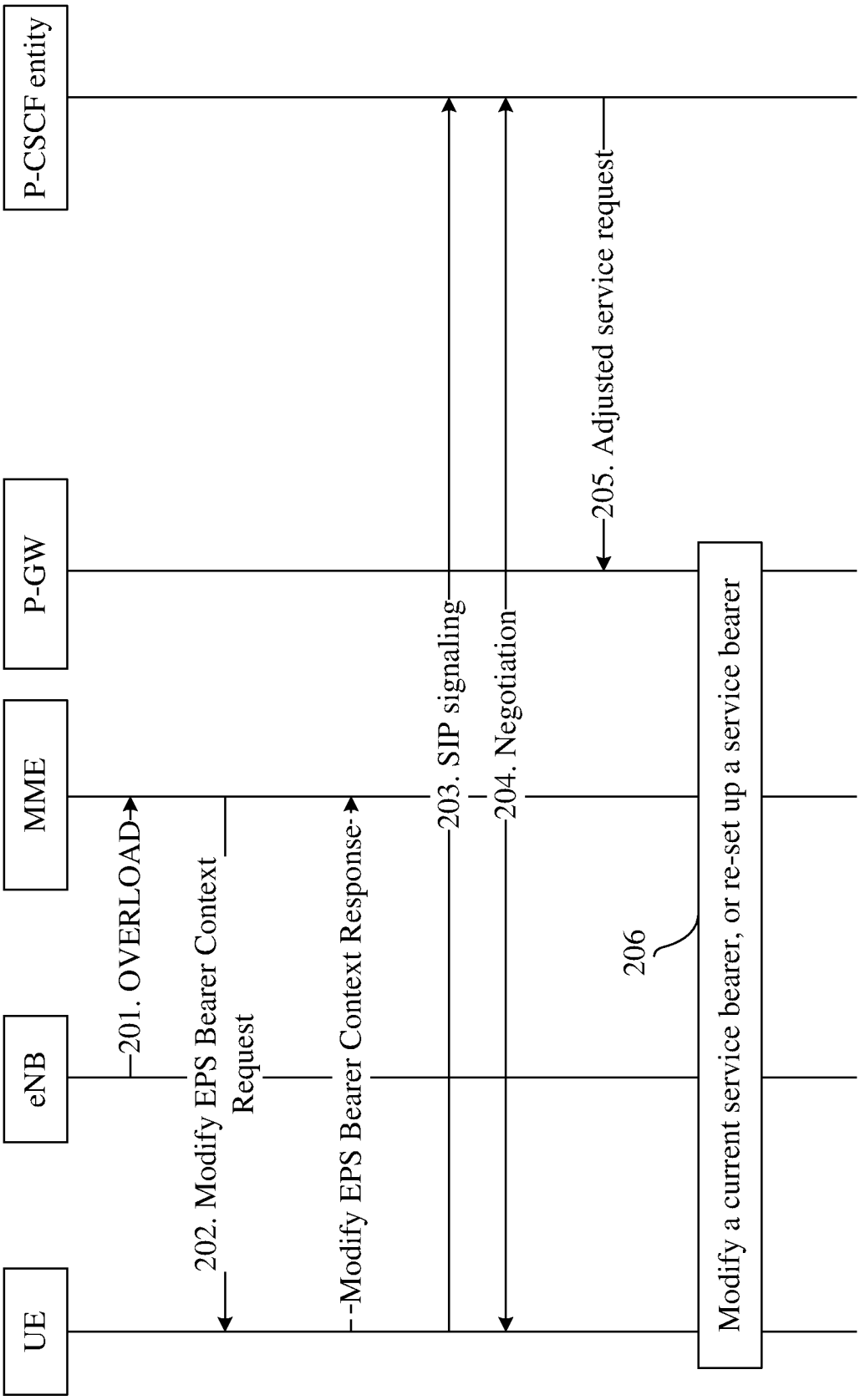
UE
eNB
MME
P-GW
P-CSCF entity
201. OVERLOAD
202. Modify EPS Bearer Context Request
Modify EPS Bearer Context Response
203. SIP signaling
204. Negotiation
205. Adjusted service request
206
Modify a current service bearer, or re-set up a service bearer

FIG. 3

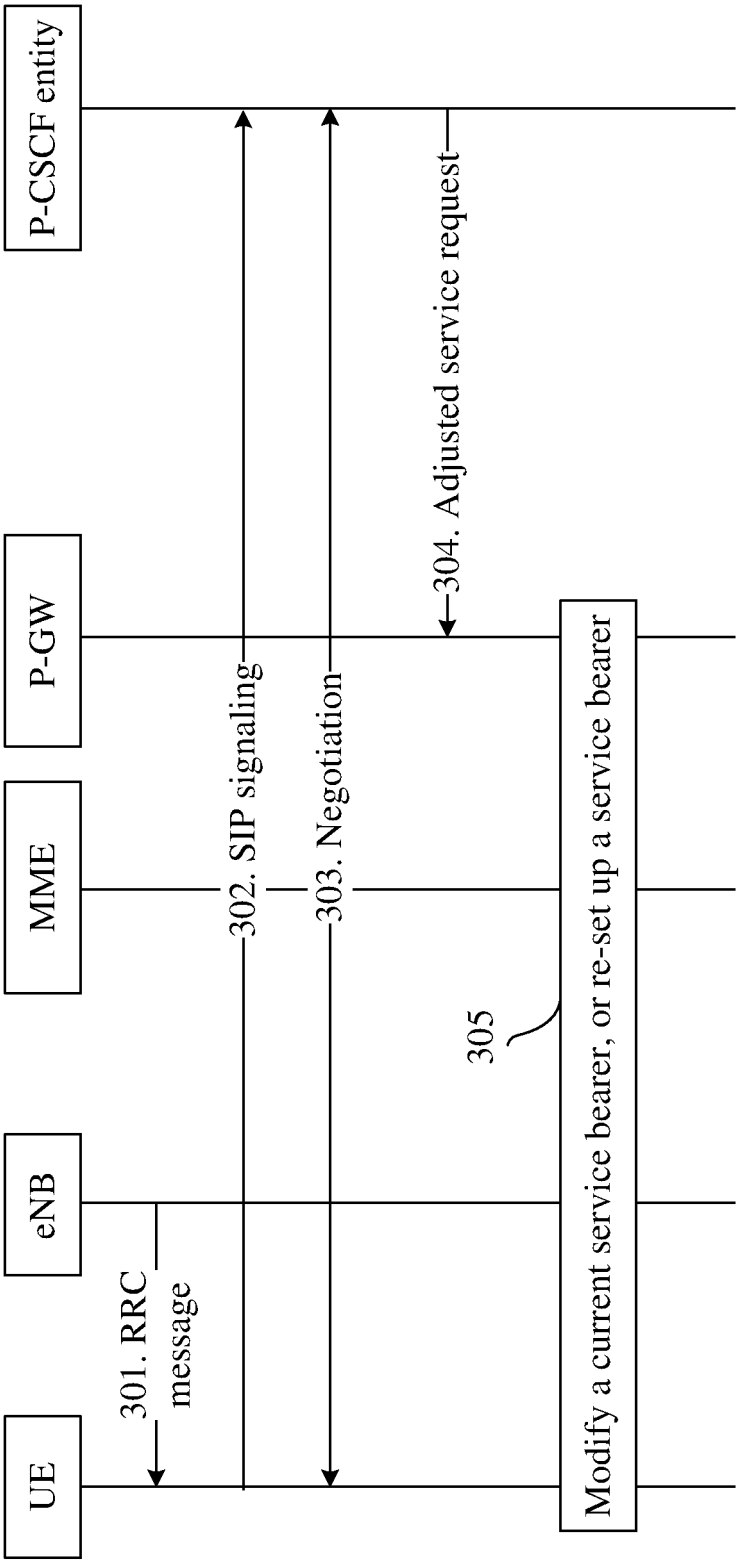
UE
eNB
MME
P-GW
P-CSCF entity
301. RRC message
302. SIP signaling
303. Negotiation
304. Adjusted service request
305
Modify a current service bearer, or re-set up a service bearer

FIG. 4

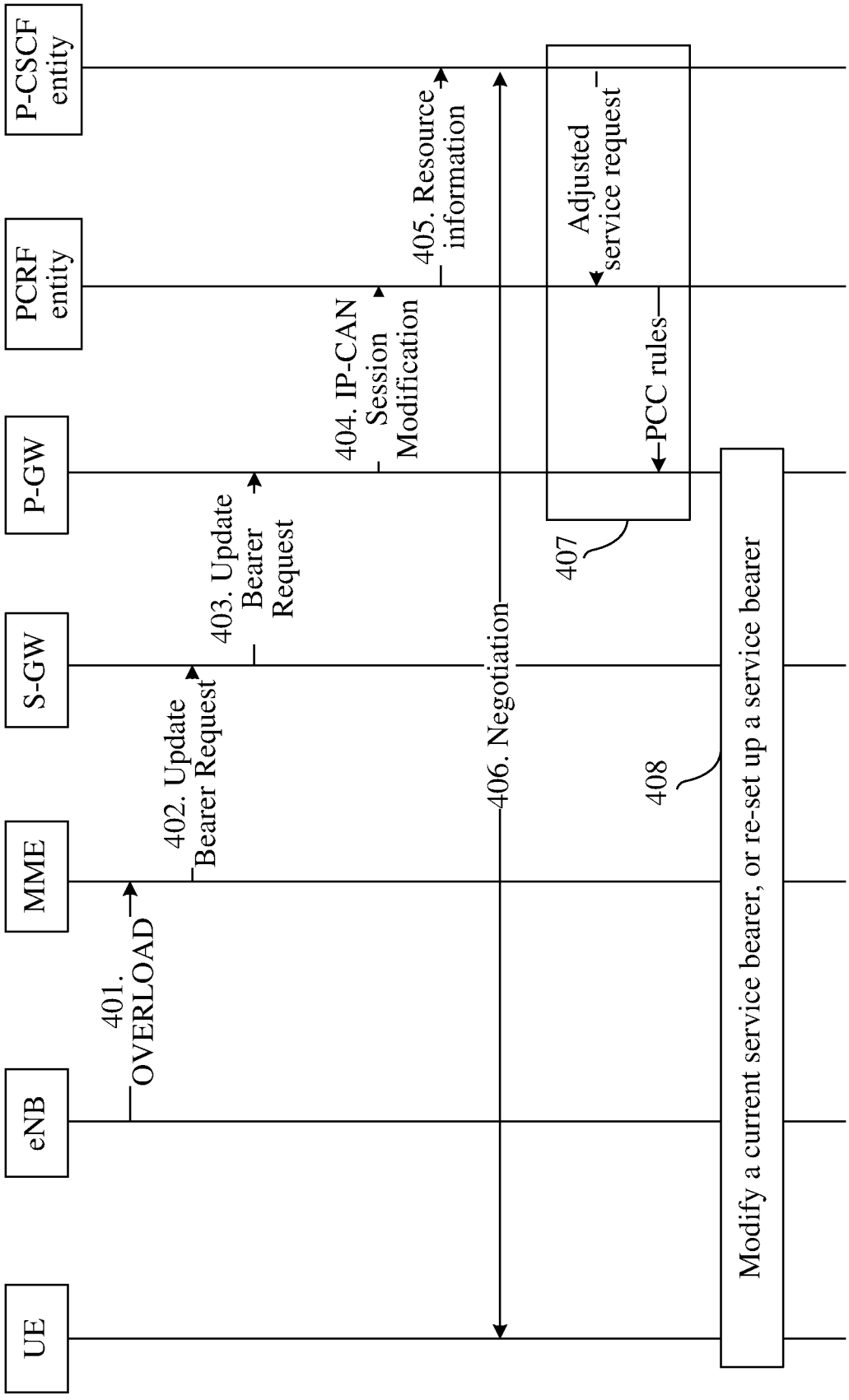
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
401. OVERLOAD
402. Update Bearer Request
403. Update Bearer Request
404. IP-CAN Session Modification
405. Resource information
406. Negotiation
407
Adjusted service request
PCC rules
408
Modify a current service bearer, or re-set up a service bearer

FIG. 5

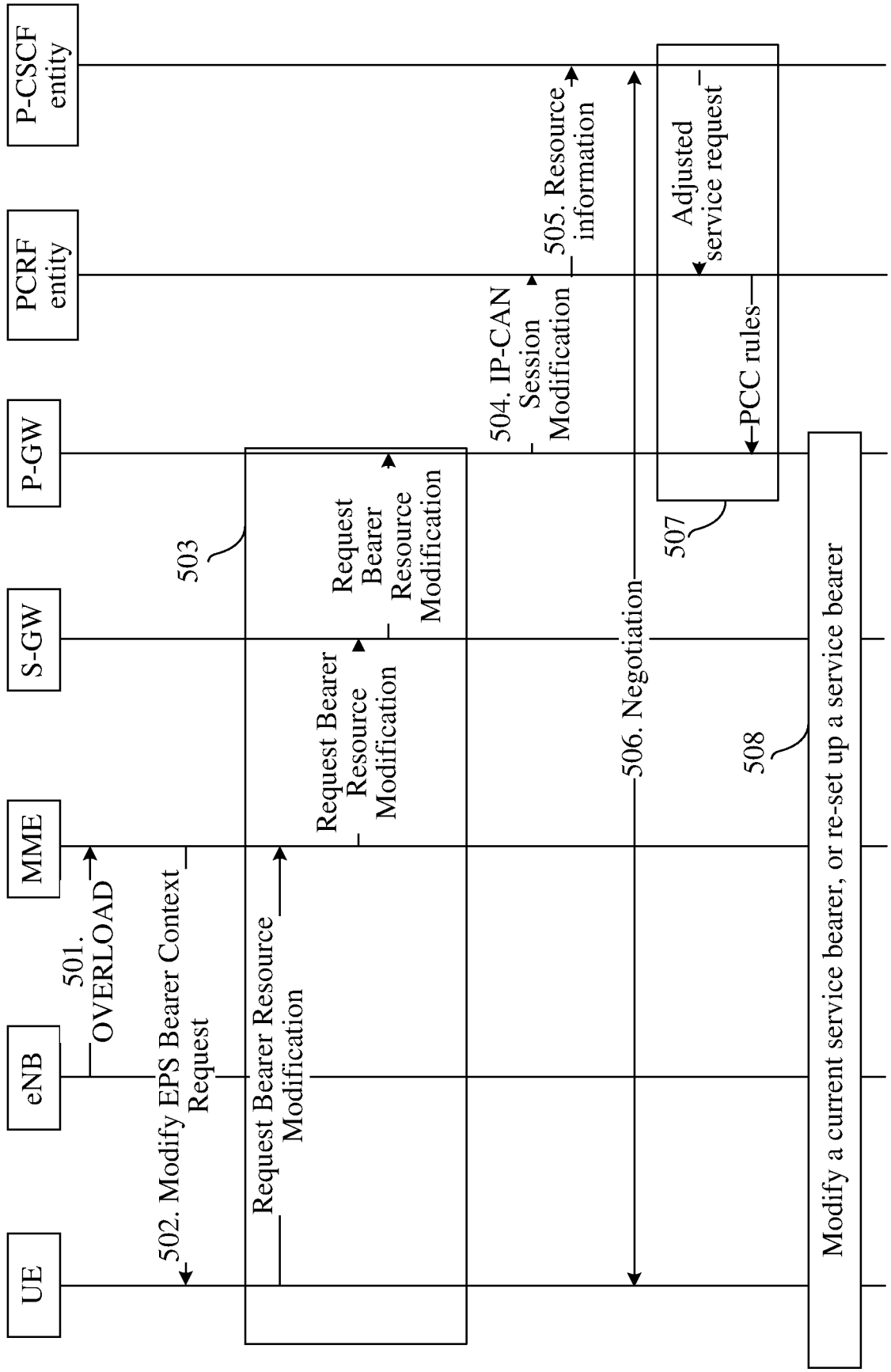
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
501. OVERLOAD
502. Modify EPS Bearer Context Request
Request Bearer Resource Modification
503
Request Bearer Resource Modification
Request Bearer Resource Modification
504. IP-CAN Session Modification
505. Resource information
506. Negotiation
507
Adjusted service request
PCC rules
508
Modify a current service bearer, or re-set up a service bearer

FIG. 6

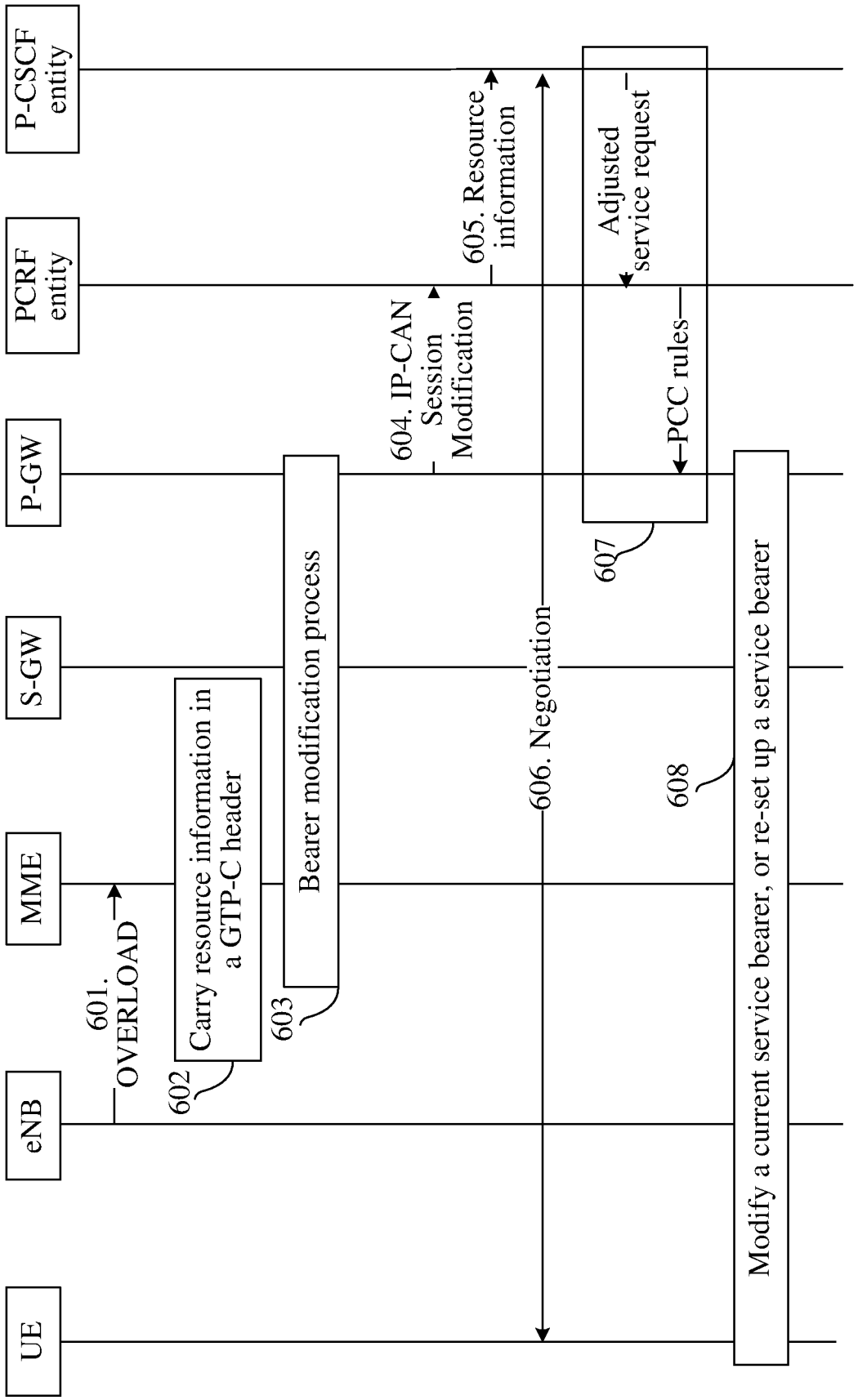
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
601. OVERLOAD
602
Carry resource information in a GTP-C header
603
Bearer modification process
604. IP-CAN Session Modification
605. Resource information
606. Negotiation
607
Adjusted service request
PCC rules
608
Modify a current service bearer, or re-set up a service bearer

FIG. 7

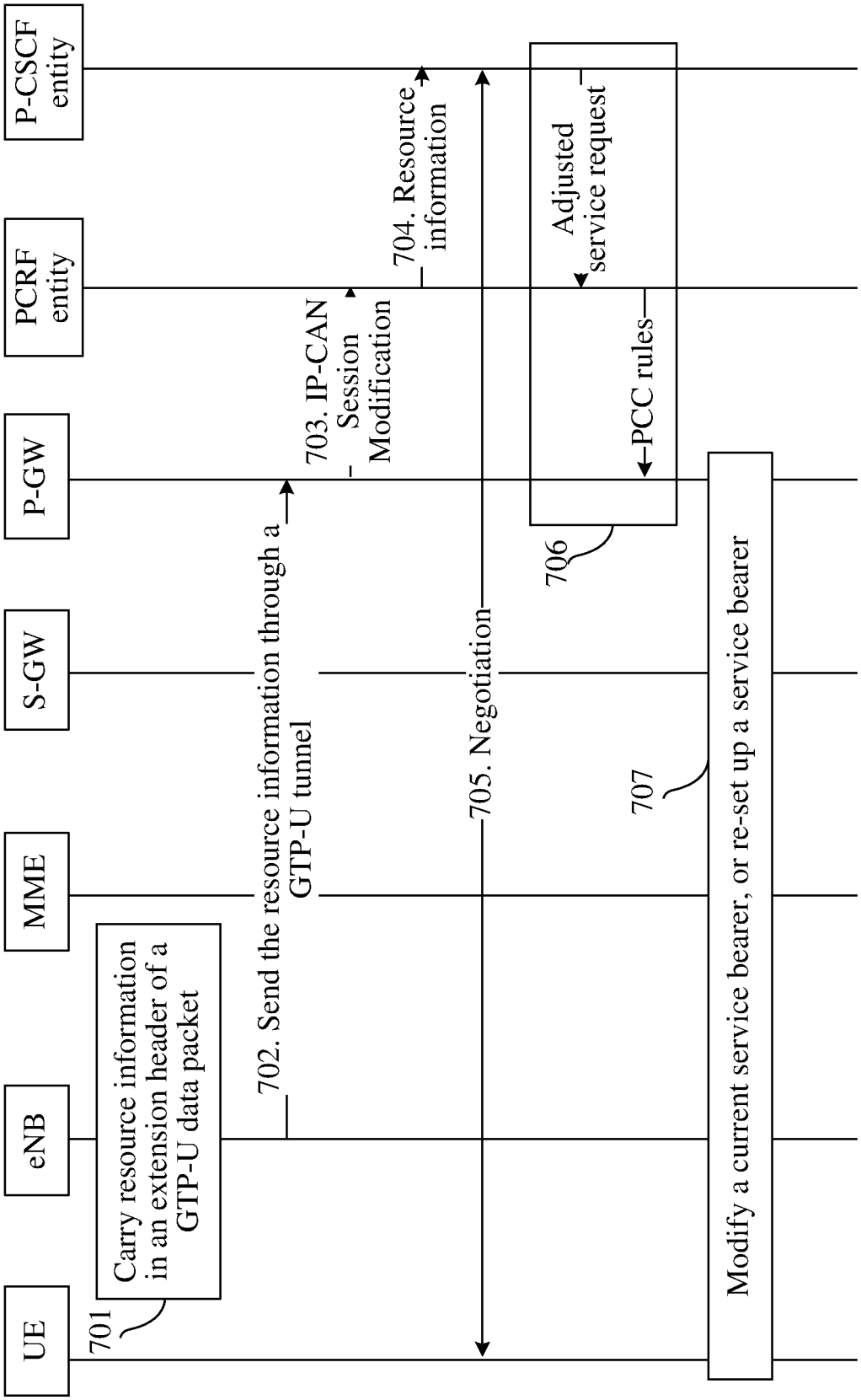
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
701
Carry resource information in an extension header of a GTP-U data packet
702. Send the resource information through a GTP-U tunnel
703. IP-CAN Session Modification
704. Resource information
705. Negotiation
706
Adjusted service request
PCC rules
707
Modify a current service bearer, or re-set up a service bearer

FIG. 8

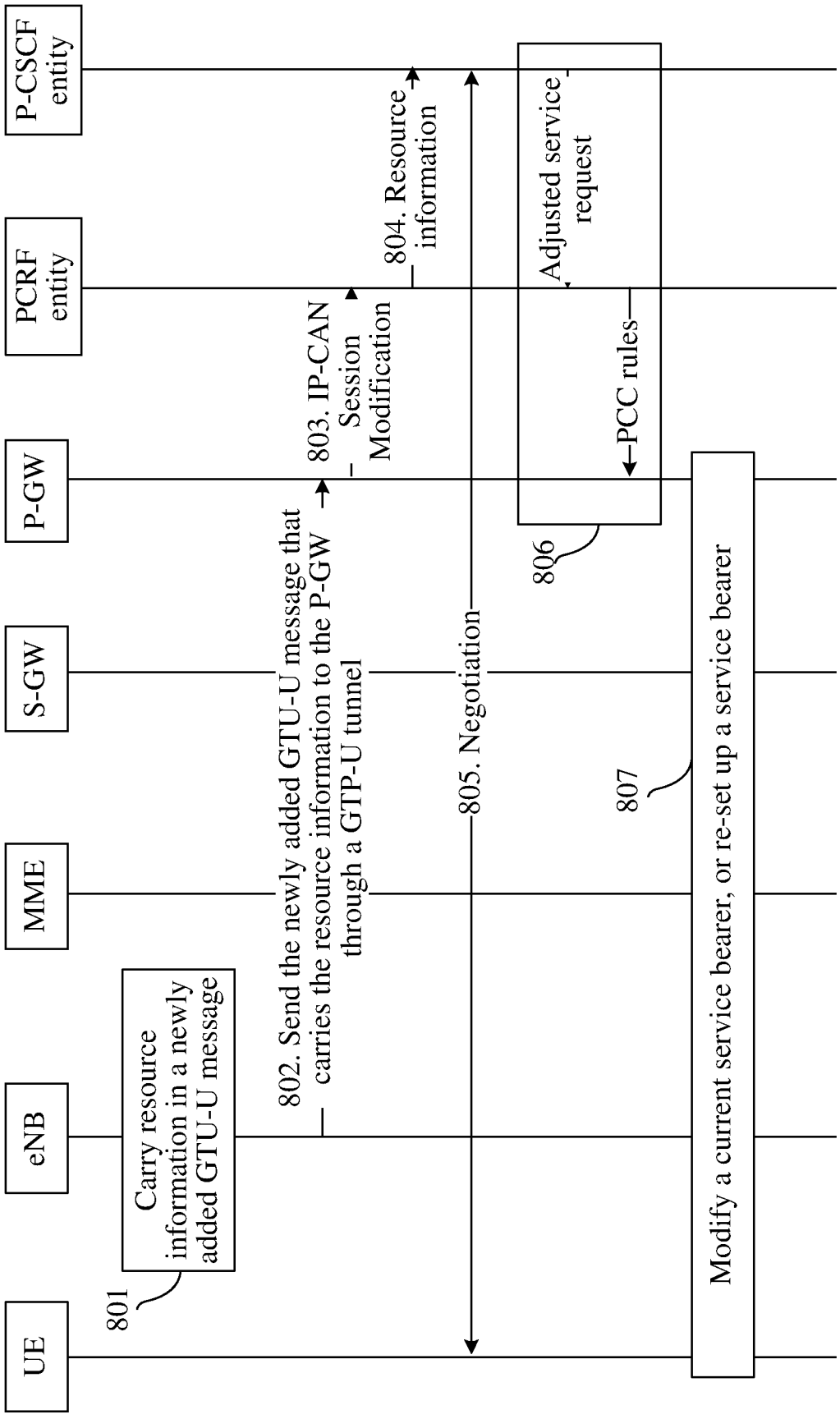
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
801
Carry resource information in a newly added GTU-U message
802. Send the newly added GTU-U message that carries the resource information to the P-GW through a GTP-U tunnel
803. IP-CAN Session Modification
804. Resource information
805. Negotiation
806
Adjusted service request
PCC rules
807
Modify a current service bearer, or re-set up a service bearer

FIG. 9

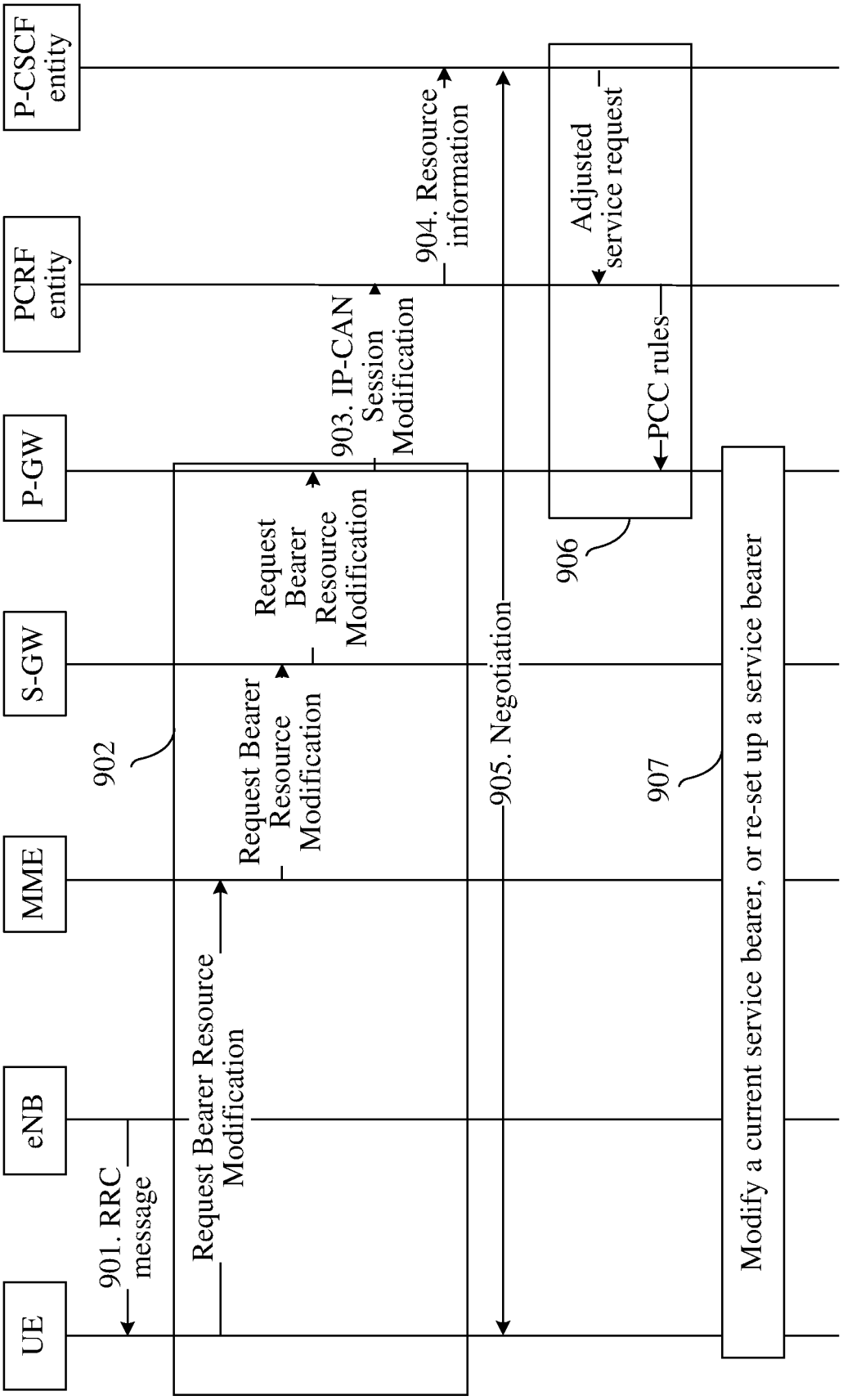
UE
eNB
MME
S-GW
P-GW
PCRF entity
P-CSCF entity
901. RRC message
Request Bearer Resource Modification
Request Bearer Resource Modification
Request Bearer Resource Modification
903. IP-CAN Session Modification
904. Resource information
905. Negotiation
906
Adjusted service request
PCC rules
907
Modify a current service bearer, or re-set up a service bearer
902

FIG. 10

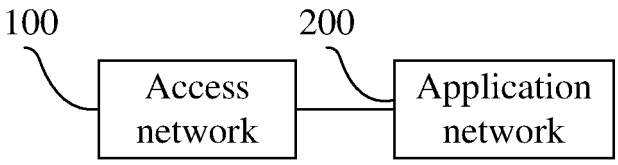
100
200
Access network
Application network

FIG. 11

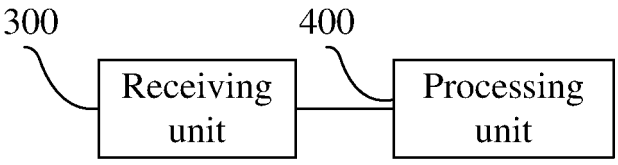
300
400
Receiving unit
Processing unit

FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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- US 2008273520 A1 **[0007]**
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