COMMUNICATION METHOD AND APPARATUS

TECHNICAL FIELD

[0001] This application relates to the field of communication technologies, and in particular, to a communication method and apparatus.

BACKGROUND

[0002] Future 5G and its evolved networks not only need to meet a plurality of service requirements, but also need to provide wider service coverage. Satellites hold significant importance in the wireless communication field by virtue of their long communication distance, wide coverage, flexible networking, and freedom from geographical environment constraints and terrestrial device constraints.

[0003] Common services of terminal devices include voice communication. An IP multimedia subsystem (IP multimedia subsystem, IMS) may provide voice, video, information, and other services for users. In satellite communication scenarios, an access network device or a user plane function (User Plane Function, UPF) network element on the ground may be deployed on a satellite. However, because load capacity of the satellite is limited, an IMS system may be located on the ground. When two terminal devices need to access networks via satellites to perform a voice communication service, voice data of one terminal device needs to be transmitted to the IMS system on the ground via a user plane function network element on one satellite, then transmitted by the IMS system on the ground to a user plane function network element on the other satellite, and finally transmitted to the other terminal device. However, a delay of transmission between a satellite and the ground is high, resulting in a high delay of voice communication between two terminal devices. Therefore, there is an urgent need to provide a communication method, to reduce a delay incurred during services performed between terminal devices by using satellites.

SUMMARY

[0004] A communication method and apparatus are provided. The method may be applied to satellite communication, to reduce a delay incurred during services performed between terminal devices.

[0005] According to a first aspect, an embodiment of this application provides a

communication method. The method may be performed by a call session control function network element, or may be performed by a chip corresponding to the network element. This is not limited herein. Specifically, the method includes the following steps: The call session control function network element receives first invitation request information of a first terminal, where the first invitation request information requests to communicate with a second terminal.

[0006] The call session control function network element obtains first access information and second access information, where the first access information indicates that the first terminal accesses a network via a satellite, and the second access information indicates that the second terminal accesses a network via a satellite. The call session control function network element determines, based on the first access information and the second access information, to establish direct communication for the first terminal and the second terminal, where the direct communication means that data of an internet protocol multimedia subsystem IMS service between the first terminal and the second terminal is directly transmitted between a first satellite through which the first terminal accesses the network and a second satellite through which the second terminal accesses the network. The call session control function network element sends first request information to a first network element, where the first request information indicates to establish the direct communication between the first terminal and the second terminal.

[0007] After receiving the invitation request of the first terminal, the call session control function network element obtains the first access information and the second access information, where the first access information indicates that the first terminal accesses the network via the satellite, and the second access information indicates that the second terminal accesses the network via the satellite. The call session control function network element may determine, based on the first access information and the second access information, that the direct communication can be established between the first terminal and the second terminal, and send the first request information to the first network element, to indicate to perform the direct communication between the first terminal and the second terminal. Because the direct communication is that when the IMS service is performed between the first terminal and the second terminal, the data of the IMS service may be transmitted via a satellite without traversing the ground, thereby reducing duration required for performing the IMS service between the first terminal and the second terminal, and significantly improving user experience.

[0008] In a possible implementation, that the call session control function network element obtains the first access information includes: The call session control function network element obtains the first access information from the first terminal or a policy control function network element corresponding to a session of the first terminal, where the session of the first terminal is used for transmission of the data of the IMS service.

[0009] In this implementation, the first access information obtained by the call session control function network element may come from the first terminal, or may come from the policy control function network element corresponding to the session of the first terminal, so that it can be ensured that the call session control function network element can flexibly receive the first access information of the first terminal.

[0010] In a possible implementation, that the call session control function network element obtains the second access information includes:

[0011] The call session control function network element obtains the second access information from the second terminal, a policy control function network element corresponding to a session of the second terminal, or a call session control function network element corresponding to the second terminal, where the session of the second terminal is used for transmission of the data of the IMS service.

[0012] In this implementation, the second access information obtained by the call session control function network element may come from the second terminal, or may come from the policy control function network element corresponding to the session of the second terminal, so that it can be ensured that the call session control function network element can flexibly receive the second access information of the second terminal.

[0013] In a possible implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element obtains first network direct communication capability information, where the first network direct communication capability information indicates that a first network supports the direct communication, and the first terminal and the second terminal access the first network.

[0014] In this implementation, before determining, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the call session control function network element further needs to receive the first network direct communication capability information, so as to determine that the first network accessed by the first terminal and the second terminal supports the direct communication.

[0015] In a possible implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element receives first direct communication subscription information and second direct communication subscription information, where the first direct communication subscription information indicates that the first terminal is allowed to perform the

direct communication, and the second direct communication subscription information indicates that the second terminal is allowed to perform the direct communication.

[0016] Specifically, the call session control function network element may receive the first direct communication subscription information and the second direct communication subscription information from a unified data management network element.

[0017] In this implementation, before determining, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the call session control function network element further needs to receive the first direct communication subscription information of the first terminal and the second direct communication subscription information of the second terminal, to request subscription data of the first terminal and subscription data of the second terminal, so as to determine that the first terminal and the second terminal can perform the foregoing direct communication.

[0018] In a possible implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element obtains first media feature support information and second media feature support information, where the first media feature support information indicates a media feature used by the first terminal for the IMS service, and the second media feature support information indicates a media feature used by the second terminal for the IMS service.

[0019] In this implementation, before determining, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the call session control function network element further needs to receive the first media feature support information of the first terminal and the second media feature support information of the second terminal, so as to accurately know that the first terminal and the second terminal support the direct communication of the IMS service.

[0020] In a possible implementation, the first invitation request information includes direct communication request indication information, and the direct communication request indication information indicates that the first terminal expects to perform the direct communication with the second terminal.

[0021] In this implementation, the first invitation request information includes the direct communication request indication information, so that the call session control function network element can accurately determine, based on the direct communication request indication information, a task requested by the first terminal, that is, the first terminal expects to perform the foregoing direct communication with the second terminal.

[0022] In a possible implementation, the first request information includes identification information of the first terminal and identification information of the second terminal.

[0023] In this implementation, the first request information sent by the call session control function network element to the first network element includes the identification information of the first terminal and the identification information of the second terminal, so that the first network element can accurately allocate a corresponding tunnel to the first terminal and the second terminal based on the identification information of the first terminal and the identification information of the second terminal, thereby successfully establishing a transmission path between the first terminal and the second terminal, to ensure that the first terminal and the second terminal can perform the foregoing direct communication.

[0024] In a possible implementation, the first request information includes quality of service QoS information used for the direct communication.

[0025] In this implementation, the first request information sent by the call session control function network element to the first network element includes the quality of service QoS information used for the direct communication. Therefore, the first network element side may further establish a good transmission path for the direct communication between the first terminal and the second terminal based on the quality of service QoS information, so as to ensure end-to-end quality of service and further shorten a transmission delay.

[0026] In a possible implementation, the method further includes: The call session control function network element sends first invitation response information to the first terminal, where the first invitation response information indicates that the direct communication between the first terminal and the second terminal is accepted.

[0027] In this implementation, after determining, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the call session control function network element may further send the first invitation response information to the first terminal, to notify the first terminal that the foregoing direct communication with the second terminal can be performed.

[0028] According to a second aspect, an embodiment of this application provides a communication apparatus. The apparatus may be used in a call session control function network element, and has functions of implementing the first aspect or any possible implementation of the first aspect. The hardware or the software includes one or more units corresponding to the functions, for example, includes a receiving unit, a processing unit, and a sending unit.

[0029] According to a third aspect, this application further provides a communication apparatus. The apparatus may be used in a call session control function network element, and has functions of implementing the first aspect or any possible implementation of the first aspect. The

apparatus may include a receiving module, a processing module, and a sending module.

[0030] According to a fourth aspect, this application further provides a communication system. The system includes a call session control function network element configured to perform the method provided in the first aspect, and may further include a terminal device, a policy control function network element, a unified data management network element, and a session management function on the ground.

[0031] A possible system is provided. The system includes a user plane function network element and an access network device on a satellite.

[0032] It should be understood that the terminal device, the policy control function network element, the unified data management network element, and the session management function on the ground, and the user plane function network element and the access network device on the satellite may be configured to exchange information with the call session control function network element, to assist the call session control function network element in determining to establish direct communication for the first terminal and the second terminal.

[0033] According to a fifth aspect, an embodiment of this application further provides a computer storage medium. The storage medium stores a software program, and when the software program is read and executed by one or more processors, the method provided in the first aspect or any possible implementation of the first aspect may be implemented.

[0034] According to a sixth aspect, an embodiment of this application further provides a computer program product including instructions. When the computer program product runs on a computer, the method provided in the first aspect or any possible implementation of the first aspect is performed.

[0035] According to a seventh aspect, an embodiment of this application provides a chip system. The chip system includes a processor, configured to support a call session control function network element to implement the function in the first aspect.

[0036] In a possible design, the chip system further includes a memory. The memory is configured to store program instructions and data that are necessary for execution of a loading apparatus. The chip system may include a chip, or may include a chip and another discrete component.

[0037] For technical effects that can be achieved in the second aspect or any possible implementation of the second aspect, refer to the descriptions of the technical effects that can be achieved in the first aspect or any possible implementation of the first aspect. Details are not described herein.

BRIEF DESCRIPTION OF DRAWINGS

[0038] FIG. 1 is a diagram of an application scenario to which a communication method is applicable according to an embodiment of this application;

[0039] FIG. 2 is a diagram of a communication system architecture to which a communication method is applicable according to an embodiment of this application;

[0040] FIG. 3A is a schematic flowchart of a communication method according to an embodiment of this application;

[0041] FIG. 3B is a simplified schematic flowchart of an instance of a communication method according to an embodiment of this application;

[0042] FIG. 4A is a schematic flowchart of a communication instance in a multi-IM CN scenario according to an embodiment of this application;

[0043] FIG. 4B is a schematic flowchart of a communication instance in a single-IM CN scenario according to an embodiment of this application;

[0044] FIG. 5 is a schematic flowchart of an instance of another communication method according to an embodiment of this application;

[0045] FIG. 6 is a diagram of a structure of a communication apparatus according to an embodiment of this application; and

[0046] FIG. 7 is a diagram of a structure of a communication device according to an embodiment of this application.

DESCRIPTION OF EMBODIMENTS

[0047] Embodiments of this application provide a communication method and apparatus. The method and the apparatus are based on a same or similar technical concept. Because the method and the apparatus have similar problem-resolving principles, implementations of the apparatus and the method may be mutually referenced. Repeated parts are not repeated.

[0048] The following first describes some terms in embodiments of this application, to facilitate understanding of a person skilled in the art.

[0049] (1) A call session control function network element in embodiments of this application may be a call session control function (Call Session Control Function, CSCF) network element in an IMS system architecture, and is responsible for session control.

[0050] Embodiments of this application may be performed by the call session control function network element or a chip corresponding to the call session control function network element. In addition, the call session control function network element in embodiments of this application may be a physical network element or a virtual network element. A specific form of the call session

control function network element is not limited in this application.

[0051] (2) An access network device in embodiments of this application may be a device that provides access for a terminal device, and includes a radio access network (Radio Access Network, RAN) device and an AN device. The RAN device is mainly a wireless network device in a 3GPP network, and the AN device may be a non-3GPP-defined access network device. The RAN device is configured to be responsible for functions on an air interface side, such as radio resource management, quality of service (quality of service, QoS) management, and data compression and encryption. The RAN device may include base stations in various forms, for example, a macro base station, a micro base station (which is also referred to as a small cell), a relay station, and an access point. In systems using different radio access technologies, a device having a function of a base station may be named differently. For example, the device is referred to as a RAN or a gNB (5G NodeB) in a 5th generation (5th generation, 5G) system, referred to as an evolved NodeB (evolved NodeB, eNB or eNodeB) in an LTE system, and referred to as a NodeB (NodeB) in a 3rd generation (3rd generation, 3G) system. A specific form of the access network device is not limited in this application.

[0052] (3) A policy control function network element in embodiments of this application may be a PCF network element in a communication system architecture, is configured to: provide a policy rule for a network entity for enforcement, support a unified policy framework to govern network behavior, and access subscription information in a unified data repository. For example, the policy control function network element in embodiments of this application is configured to deliver a rule to a session management network element, and is further configured to manage a service flow, that is, modify or delete a quality of service parameter of the service flow.

[0053] Embodiments of this application may be performed by the policy control function network element or a chip corresponding to the policy control function network element. In addition, the policy control function network element in this application may be a physical network element or a virtual network element. A specific form of the policy control function network element is not limited in this application.

[0054] (4) An internet protocol multimedia subsystem IMS in embodiments of this application is an IP-based multimedia system, which may also be referred to as an IP multimedia subsystem. The IMS system provides a next-generation IP-based mobile network with a multimedia service and platform oriented to packet switching, and can meet newer and more diversified multimedia service requirements of current terminal customers. Currently, the IMS is considered to be a core technology of a next-generation network and an important manner of implementing integration of mobile and fixed networks and triple integration of differentiated services including voice, data, and video.

[0055] It should be noted that the IMS system mentioned in this application means all or some network elements in the IMS system, for example, a network element related to a call session control function for processing session control and a related network element for processing media data. The IMS system may correspond to different network elements in different contexts. This is not limited in this application.

[0056] (5) Access information in embodiments of this application may be access type indication information of a terminal. The access type indication information may indicate that the terminal accesses a network via a satellite, or indicate that the terminal accesses a network in another manner. The access type indication information may alternatively be access type information or access technology type information. This is not specifically limited in this application.

[0057] (6) Quality of service (Quality of Service, QoS) in embodiments of this application may generally indicate a sum of characteristics and features of a service that can meet specified and potential requirements, that is, a degree to which service work can meet a requirement of a service recipient.

[0058] In the solutions of this application, the quality of service may be represented as a technology for effectively managing network resources, and may provide end-to-end quality of service assurance for different requirements of various services. Specifically, one network may use various basic technologies to provide better service capabilities for specified network communication, so as to avoid problems such as a network delay and network congestion. In addition, for a network with limited capacity, especially streaming multimedia applications such as voice over internet protocol (Voice over Internet Protocol, VoIP) and interactive personality TV (Interactive Personality TV, IPTV), it is very important to ensure the quality of service. This is because these media applications require a fixed transmission rate and are sensitive to a delay

[0059] In conclusion, the QoS may be an overall performance measurement of a service experienced by a network user. For example, the quality of service of the network may be measured by measuring service-related aspects such as a QoS packet loss rate, a bit rate, a throughput, a transmission delay, availability, and jitter.

[0060] (7) A media feature in embodiments of this application may be represented as a use function that can be supported by a terminal, for example, a media feature that may be used by the terminal device for voice communication, video communication, or photographing. In addition, the media feature may also be an attribute of the terminal. A specific attribute is not specifically limited in this application. The media feature in embodiments of this application is a media feature of the terminal device for voice communication.

[0061] (8) Direct communication subscription information in embodiments of this application

may indicate that a terminal subscribes to a preset function, and may perform direct communication via a satellite, to implement the preset function. Specific subscription content is not specifically limited in this application.

[0062] (9) "A plurality of" in embodiments of this application means two or more than two.

[0063] In addition, it should be understood that, in description of this application, terms such as "first" and "second" are merely used for distinguishing and description, but should not be understood as indicating or implying relative importance, or should not be understood as indicating or implying a sequence.

[0064] FIG. 1 is a diagram of a satellite mobile communication scenario to which an embodiment of this application may be applied. As shown in FIG. 1, in the satellite mobile communication system, a base station 1 and a user plane function network element 1 are loaded on a satellite 1, and a base station 2 and a user plane function network element 2 are loaded on a satellite 2. A terminal device 1 may access the base station 1 on the satellite 1 in a wireless communication mode, to communicate with the satellite 1. The base station 1 on the satellite 1 may establish a communication connection to the base station 2 on the satellite 2. A terminal device 2 may access the base station 2 on the satellite 2 in a wireless communication mode, to communicate with the satellite 2. The terminal device 1 transmits voice data to the terminal device 2 along a path of a line 1. To be specific, the voice data of the terminal device 1 is transmitted to the satellite 1. Then, the satellite 1 transmits the voice data to an IP multimedia subsystem (IP multimedia subsystem, IMS) system on the ground. Further, the voice data is transmitted by the IMS system to the satellite 2. Finally, the satellite 2 transmits the voice data to the terminal device 2. However, when transmission is performed along the path, because the ground is far from the satellites, a delay generated when voice communication is performed between the terminal device 1 and the terminal device 2 is large, and user experience is poor. It should be noted that, in this scenario, a UPF may also be deployed on the ground. In this case, after arriving at the ground by using a user plane network element on a satellite, media data may first pass through the UPF deployed on the ground, and then pass through the IMS system, or media data may directly arrive at the IMS system after arriving at the ground by using a user plane network element on a satellite. This is not limited in this application.

[0065] Therefore, this application provides a communication mode, to support direct communication between the terminal device 1 and the terminal device 2 by using satellites, thereby reducing a delay generated when an IMS service is performed between the terminal device 1 and the terminal device 2, and greatly improving user experience. It should be noted that voice communication is often used as an example of the IMS service mentioned in this application.

[0066] It should be noted that the communication mode provided in embodiments of this

application is not only applicable to the foregoing 5G system architecture, but also applicable to but not limited to a long term evolution (long term evolution, LTE) communication system and various future evolved wireless communication systems.

[0067] The following describes in detail specific network elements/modules in the 5G system architecture.

[0068] Refer to FIG. 2. The 5G system mainly includes a network slice selection function (Network Slice Selection Function, NSSF) network element, a network exposure function (Network Exposure Function, NEF) network element, a network repository function (NF Repository Function, NRF) network element, a policy control function (Policy Control Function, PCF) network element, a unified data management (Unified Data Management, UDM) network element, an application function (Application Function, AF) network element, an authentication server function (Authentication Server Function, AUSF) network element, an access and mobility management function (Access and Mobility Management Function, AMF) network element, a session management function (Session Management Function, SMF) network element, a terminal (User Equipment, UE), an access network ((Radio) Access Network, (R)AN) device, a user plane function (User plane Function, UPF) network element, and a data network (Data Network, DN) For ease of description, using a policy control function as an example, the policy control function network element may be referred to as a PCF network element for short. Other network elements are similar. Details are not described.

[0069] Refer to FIG. 2. Nnssf, Nnef, Nausf, Nnrf, Namf, Npcf, Nsmf, Nudm and Naf are service-based interfaces exhibited by the NSSF, NEF, AUSF, NRF, SMF, PCF, SMF, UDM, and AF, respectively. Refer to FIG. 2. N1 is a reference point between the UE and the AMF, N2 is a reference point between the (R)AN and the AMF, N3 is a reference point between the (R)AN and the UPF, N4 is a reference point between the SMF and the UPF, and N6 is a reference point between the UPF and the DN.

[0070] The PCF network element is configured to: provide a policy rule for a network entity for enforcement, support a unified policy framework to govern network behavior, and access subscription information in a unified data repository (UDR).

[0071] The UDM network element is configured to centrally manage user data, store an authentication credential/authentication parameter, store and manage a permanent user ID (or a permanent UE identifier (Subscription Permanent Identifier, SUPI)) in a 5G system, and perform registration management on a serving network element of a user (for example, the AMF or the SMF that currently provides services for the terminal).

[0072] The SMF network element is responsible for tunnel maintenance, IP address allocation and management, UP function selection, policy enforcement, QoS control, charging data collection,

and roaming, and the like.

[0073] The UE is a handheld terminal, a notebook computer, a subscriber unit (subscriber unit), a cellular phone (cellular phone), a smartphone (smartphone), a wireless data card, a personal digital assistant (personal digital assistant, PDA) computer, a tablet computer, a wireless modem (modem), a handheld (handheld) device, a laptop computer (laptop computer), a cordless phone (cordless phone) or a wireless local loop (wireless local loop, WLL) station, a machine type communication (machine type communication, MTC) terminal, or another device that can access a network. The terminal device and the access network device communicate with each other by using an air interface technology.

[0074] The (R)AN device is a device that provides access for the terminal device, and includes a RAN device and an AN device. The RAN device is mainly a wireless network device in a 3GPP network, and the AN device may be a non-3GPP-defined access network device. The radio access network (radio access network, RAN) device is mainly responsible for functions on an air interface side, such as radio resource management, quality of service (quality of service, QoS) management, and data compression and encryption. The RAN device may include base stations in various forms, for example, a macro base station, a micro base station (also referred to as a small cell), a relay station, and an access point. In systems using different radio access technologies, a device having a function of a base station may be named differently. For example, the device is referred to as a RAN or a gNB (5G NodeB) in a 5th generation (5th generation, 5G) system, referred to as an evolved NodeB (evolved NodeB, eNB or eNodeB) in an LTE system, and referred to as a NodeB (NodeB) in a 3rd generation (3rd generation, 3G) system.

[0075] The UPF network element is configured for user data packet routing and forwarding, external data interconnect to a data network DN, QoS handling for a user plane, flow control rule enforcement (for example, gating, redirection, and traffic steering), and the like. The data network DN is a service network, for example, an IP multimedia subsystem (IP multimedia subsystem, IMS) and the internet, that provides a data transmission service for a user, for example, an operator service, an internet service, or a third-party service. The UE accesses the data network (DN, Data Network) by using a PDU (Packet Data Unit, packet data unit) session established between the UE and the DN.

[0076] Each network element in a core network may also be referred to as a functional entity or device, and may be a network element implemented on dedicated hardware, a software instance running on dedicated hardware, or an instance of a virtualized function on an appropriate platform. For example, a virtualization platform may be a cloud platform.

[0077] It should be noted that the communication system architecture shown in FIG. 2 is not limited to including only the network elements shown in the figure, and may further include other

devices not shown in the figure, which are not specifically described herein one by one in this application.

[0078] It should be noted that a distribution form of the network elements is not limited in embodiments of this application. The distribution form shown in FIG. 2 is merely an example, and is not limited in this application.

[0079] For ease of description, in this application, the network elements shown in FIG. 2 are used as examples for description below, and an XX network element is directly referred to as XX for short. For example, the SMF network element is referred to as an SMF for short. It should be understood that names of all network elements in this application are merely used as examples, and may also be referred to as other names in future communication. Alternatively, in future communication, a network element in this application may be replaced with another entity, device, or the like that has a same function. This is not limited in this application. Unified descriptions are provided herein, and details are not described below.

[0080] It should be noted that names of all messages and information in this application are merely used as examples, and may be other names. This is not limited in this application. It should be understood that a message or information from the network element 1 to the network element 2 may be a message directly sent by the network element 1 to the network element 2, or may be indirectly sent. For example, the network element 1 first sends the message to a network element 3, and then the network element 3 sends the message to the network element 2. Finally, the message or the information is sent to the network element 2 by using one or more network elements.

[0081] The following describes in detail an IMS system architecture in embodiments of this application.

[0082] One IMS system includes one or more call session control functions (Call Session Control Function, CSCF), media gateway control functions (Media Gateway Control Function, MGCF), IMS media gateways, multimedia resource function processors, subscription locator functions (Subscription Locator Function, SLF), interrupt gateway control functions, and application servers.

[0083] Generally, main components used in the IMS system include: a home subscriber server, a call session control function CSCF network element, a security gateway, an IP media server, and an application server.

[0084] The home subscriber server mainly stores user and service-related data, such as user identity, registration information, access parameters, and service triggering information. The HSS further has a user location function and an identity authentication function.

[0085] The call session control function network element includes a plurality of sub-components. Specifically, the sub-components include: a proxy call session control function

(Proxy-Call Session Control Function, P-CSCF) network element, an interrogating call session control function (Interrogating-Call Session Control Function, I-CSCF) network element, and a serving call session control function (Serving-Call Session Control Function, S-CSCF) network element.

[0086] The P-CSCF network element is a first point of contact for a user to access an IMS network. The P-CSCF network element acts as a proxy for all SIP signaling and completes call routing control; provides QoS resource reservation; supports SIP signaling compression to improve bandwidth usage of an air interface; provides NAT control to support NAT traversal of the intranet; and maintains a security association with the UE to protect privacy and integrity of signaling with the UE. The P-CSCF network element may be embodied as the AF, and interact with a network element such as the PCF.

[0087] The I-CSCF network element is a unified entry point for a user's home network, is responsible for allocating an S-CSCF and querying an S-CSCF serving a called party, and further completes a topology hiding function between IMS domains.

[0088] The S-CSCF network element is a service switching center of the IMS network, is mainly responsible for UE's registration request receiving and processing, user management, session control, service exchange, service control, SIP information processing, charging, and the like, and can trigger a SIP request to a corresponding AS according to an application trigger principle. The S-CSCF network element may interact with the UDM network element.

[0089] It should be noted that CSCF network elements corresponding to the terminal device 1 and the terminal device 2 may be the same or may be different. This is not limited in this application. A multi-IM CN (IP multimedia Core Network, IP multimedia core network) mentioned in the specification means that the terminal device 1 and the terminal device 2 correspond to different CSCF network elements, and a single-IM CN mentioned in the specification means that the terminal device 1 and the terminal device 2 correspond to a same CSCF network element.

[0090] The security gateway is a communication channel between telecommunication networks and between an enterprise and a telecommunication network. The security gateway mainly controls entry and exit of information on a NAT (network address translation) server and a firewall, and may also provide other security functions, such as packet filtering. In addition, the security gateway further has the following functions: enhancing a security policy between IMS domains, protecting control plane information entering and leaving the IMS domain, and setting and maintaining an IPsec security association (SA).

[0091] The IP media server has all streaming media functions and can provide rich multimedia information, such as text. The IP media server is responsible for management-related code

conversion work of a coder (encoder/decoder) and streaming media, and work such as echo cancellation, sound detection, and sound generation. The IP media server can also provide stream multiplication and stream broadcasting to meet a requirement of a conference application, and can also be connected to a circuit switched network.

[0092] The application server provides a multimedia service for the IMS network. The application server mainly provides access permission for all other IMS components such as SIP Servlet. The application server can also be used to deploy a new service. The IMS uses a modular architecture. Therefore, the new service can be deployed by simply replacing or upgrading the application server. This strategy is completely different from a previous vertical model, in which services are always deployed as single-point solutions, with each service using its own set of dedicated devices. The application server may be located in a home network or a third-party network. If the application server is located in the third-party network, the application server cannot be connected to the HSS. Because the application server is an OSA (open service architecture) application server, the application server may securely access the IMS from an external network and is connected to a GSM CAMEL (customized applications for mobile networks enhanced logic) server.

[0093] An embodiment of this application provides a communication method. The method may be applied to the satellite communication scenario in FIG. 1, and is applicable to but not limited to the 5G system architecture shown in FIG. 2. In addition, the method may be performed by a network element in this application, or may be performed by a chip corresponding to the network element. The network element in this application may be a physical network element, or may be a virtual network element. A form of the network element in this application is not specifically limited.

[0094] FIG. 3A is a specific flowchart of a communication method according to an embodiment of this application. The method may specifically include the following steps.

[0095] S301A: A call session control function network element receives first invitation request information of a first terminal.

[0096] For example, for step S301A, refer to S301B in a simplified procedure of an instance shown in FIG. 3B. That is, a CSCF network element receives first invitation request information from UE 1.

[0097] In an implementation, that the call session control function network element receives the first invitation request information of the first terminal includes: The first invitation request information includes direct communication request indication information, where the direct communication request indication information indicates that the first terminal expects to perform direct communication with a second terminal.

[0098] It should be understood that the first invitation request information is a session request initiated by an inviter to an invitee. For example, the first terminal is an inviter, the second terminal is an invitee, and the first terminal invites the second terminal to join a session. When the first terminal needs to request to perform a voice communication session with the second terminal, the first invitation request information sent by the first terminal is used to request to perform the direct communication with the second terminal.

[0099] In addition, the direct communication in this application means that data of an internet protocol multimedia subsystem IMS service between the first terminal and the second terminal is directly transmitted between a first satellite through which the first terminal accesses a network and a second satellite through which the second terminal accesses a network.

[00100] Optionally, the first invitation request information may further include identity information of the first terminal and identity information of the second terminal.

[00101] It should be noted that the first invitation request information may further include access type indication information of the first terminal and/or media feature support information of the first terminal. The access type indication information of the first terminal indicates that the first terminal accesses the network via the satellite. The media feature support information of the first terminal may indicate that the first terminal supports a media feature for an IMS service of direct voice communication.

[00102] The media feature supported by the first terminal may include a voice data encoding and decoding method that is supported by the first terminal and that is used for the direct voice communication. This is not specifically limited in this application.

[00103] In an implementation, the first invitation request information includes access network information (P-Access-Network-Info, PANI). If the PANI includes access type information, the access type indication information is the access type information, and the access type information indicates satellite access, for example, low Earth orbit satellite access, medium Earth orbit satellite access, or high Earth orbit satellite access. The access type is not specifically limited in this application. If the PANI includes access technology type information, the access type indication information is the access technology type information, and the access technology type information indicates a satellite access technology, for example, a low Earth orbit satellite access technology, a medium Earth orbit satellite access technology, or a high Earth orbit satellite access technology. The access technology type is not specifically limited in this application.

[00104] S302A: The call session control function network element obtains first access information and second access information.

[00105] In an implementation, that the call session control function network element obtains the first access information and the second access information includes: The call session control

function network element obtains the first access information from the first terminal or a policy control function network element corresponding to a session of the first terminal, where the session of the first terminal is used for transmission of the data of the IMS service; and the call session control function network element obtains the second access information from the second terminal, a policy control function network element corresponding to a session of the second terminal, or a call session control function network element corresponding to the second terminal, where the session of the second terminal is used for transmission of the data of the IMS service. The first access information indicates that the first terminal accesses a network via a satellite, and the second access information indicates that the second terminal accesses a network via a satellite.

[00106] It should be noted that the first access information and the second access information may be used as access type indication information, to indicate that the first terminal and the second terminal perform access by using satellites. For details, refer to the description in step S301. Details are not described herein.

[00107] S303A: The call session control function network element determines, based on the first access information and the second access information, to establish direct communication for the first terminal and the second terminal.

[00108] In an implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element obtains first network direct communication capability information, where the first network direct communication capability information indicates that a first network supports the direct communication, and the first terminal and the second terminal access the first network.

[00109] Specifically, the call session control function network element may obtain the first network direct communication capability information from the policy control function network element, or may receive the first network direct communication capability information from another network element. This is not specifically limited in this application.

[00110] When the call session control function network element obtains the first network direct communication capability information from the policy control function network element, the method may specifically include: The call session control function network element sends authentication authorization request information to the policy control function network element. Optionally, the authentication authorization request information includes network direct communication capability request information, and the network direct communication capability request information requests to obtain information about whether a network supports direct communication. Further, the call session control function network element receives authentication

authorization response information from the policy control function network element, where the authentication authorization response information may carry the first network direct communication capability information.

[00111] In an implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element receives first direct communication subscription information and second direct communication subscription information, where the first direct communication subscription information indicates that the first terminal is allowed to perform the direct communication, and the second direct communication subscription information indicates that the second terminal is allowed to perform the direct communication.

[00112] Specifically, the call session control function network element may obtain the first direct communication subscription information and the second direct communication subscription information from a unified data management network element. Before receiving the first direct communication subscription information and the second direct communication subscription information from the unified data management network element, the call session control function network element needs to send subscription data request information of the first terminal to the unified data management network element, to request subscription data of the first terminal. The subscription data request information may include subscription data type information, and the subscription data type information may indicate that a type of the subscription data is satellite communication subscription data or direct communication subscription data. This application may limit an indication function of the subscription data type information according to an actual situation.

[00113] It should be understood that the first direct communication subscription information and the second direct communication subscription information may indicate that the direct communication between the first terminal and the second terminal is allowed, or may indicate that the direct communication between the first terminal and the second terminal is not allowed. This may be indicated according to an actual situation.

[00114] In an implementation, before the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further includes: The call session control function network element obtains first media feature support information of the first terminal and second media feature support information of the second terminal, where the first media feature support information indicates a media feature used by the first terminal for the IMS service, and the second media feature support information indicates a media feature used

by the second terminal for the IMS service.

[00115] Specifically, the call session control function network element may obtain the first media feature support information of the first terminal from the first terminal, and obtain the second media feature support information of the second terminal from the second terminal. The media feature support information may indicate that the terminal supports a media feature of direct voice communication, or may indicate that the terminal does not support a media feature of direct voice communication. This is not specifically limited in this application. In addition, the media feature supported by the terminal may include a voice data encoding and decoding method that is supported by the first terminal and that is used for the direct voice communication. This is not specifically limited in this application.

[00116] In an implementation, the first media feature support information needs to match the second media feature support information of the second terminal, that is, all or a part of the media feature support information of the first terminal needs to be consistent with all or a part of the second media feature support information.

[00117] It should be noted that the call session control function network element may determine to establish the direct communication for the first terminal and the second terminal only when determining that all the information obtained in the foregoing implementations indicates that the first terminal, the second terminal, and the network support the direct communication, and if any one thereof does not support the direct communication, determine that the direct communication cannot be established between the first terminal and the second terminal.

[00118] For example, for information exchanged before the call session control function network element determines to establish the direct communication for the first terminal and the second terminal in steps S302A and S303A, refer to S302B shown in FIG. 3B. That is, the CSCF exchanges a satellite access type, direct communication capability information, and direct communication support information with a PCF/UDM.

[00119] For determining, by the call session control function network element, to establish the direct communication for the first terminal and the second terminal in steps S302A and S303A, refer to S305B in the simplified procedure of the instance shown in FIG. 3B. That is, the CSCF determines to accept direct voice communication. In addition, before the call session control function network element determines to establish the direct communication for the first terminal and the second terminal, the method further includes: sending second invitation request information to the second terminal, and receiving second invitation response information from the second terminal, so as to ensure that the second terminal agrees to accept the establishment of the direct communication with the first terminal. For details, refer to S303B and S304B in the simplified procedure of the instance shown in FIG. 3B.

[00120] S304A: The call session control function network element sends first request information to the first network element, where the first request information indicates to establish the direct communication between the first terminal and the second terminal.

[00121] For example, for step S304A in which the call session control function network element sends the first request information to the first network element, refer to S306B in the simplified procedure of the instance shown in FIG. 3B, that is, direct communication setup information.

[00122] Further, step S307B may be performed to indicate an SMF network element to allocate a tunnel to an S-UPF 1 corresponding to the session of the first terminal, allocate a tunnel to an S-UPF 2 corresponding to the session of the second terminal, and finally establish a tunnel for the direct communication between the first terminal and the second terminal. For this step, refer to S307B to S309B in the simplified procedure of the instance shown in FIG. 3B. How to establish the communication tunnel (transmission path) is not specifically limited in this application.

[00123] Optionally, the first request information includes address information of the first terminal and address information of the second terminal, or includes other identification information of the first terminal and the second terminal. In addition, the first request information may further include quality of service QoS information used for the direct communication between the first terminal and the second terminal.

[00124] In an implementation, after determining to establish the direct communication for the first terminal and the second terminal, the call session control function network element may further send first invitation response information to the first terminal, where the first invitation response information indicates that the direct communication between the first terminal and the second terminal is accepted. For this step, refer to S310B in the simplified procedure of the instance shown in FIG. 3B.

[00125] It should be noted that, if the call session control function network element determines that the direct communication cannot be established between the first terminal and the second terminal, the first invitation response information sent by the call session control function network element to the first terminal may indicate that the direct communication between the first terminal and the second terminal is rejected. In addition, the first network element in this application may include a policy control function network element and a unified data management network element, or may include another network element. This is not specifically limited in this application.

[00126] It should be noted that, in the communication method provided in this application, the first terminal and the second terminal may perform the foregoing steps by using a same call session control function network element, that is, a single-IM CN scenario; or the first terminal and the second terminal may perform the foregoing steps by using different call session control function network elements, that is, a multi-IM CN scenario.

[00127] In conclusion, in the communication method provided in this application and shown in FIG. 3A, the call session control function network element receives the first invitation request information of the first terminal, and then obtains the first access information of the first terminal and the second access information of the second terminal, where the first access information indicates that the first terminal performs access via the satellite, and the second access information indicates that the second terminal performs access via the satellite. Next, the call session control function network element determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal. Finally, the call session control function network element sends the first request information to the first network element, to indicate to establish the direct communication for the first terminal and the second terminal. This method allows for transmission of data of an IMS service between the first terminal and the second terminal without traversing the ground, thereby reducing duration required for performing the IMS service between the first terminal and the second terminal, and greatly improving user experience.

[00128] Based on the communication method provided in the foregoing embodiment, the following describes the method in this application in detail with reference to a specific embodiment. This embodiment is mainly used in a multi-IM CN scenario, to implement direct voice communication performed by a terminal via a satellite. In this embodiment, UE 1 and UE 2 may respectively access networks by using corresponding satellites. To be specific, the UE 1 may access the network by using a first satellite, and the UE 2 may access the network by using a second satellite. Each satellite includes one access device (for example, a base station gNB 1 or a gNB 2) and one UPF network element. In addition, the UE 1 and the UE 2 are respectively served by corresponding CSCF network elements. To be specific, the call session control function corresponding to the UE 1 may be represented by a CSCF#1 network element, and the call session control function corresponding to the UE 2 may be represented by a CSCF#2. The call session control function CSCF#1 network element includes one or more of a P-CSCF#1 network element, an I-CSCF#1 network element, and an S-CSCF#1 network element. The call session control function CSCF#2 network element includes one or more of a P-CSCF#2 network element, an I-CSCF#2 network element, and an S-CSCF#2 network element.

[00129] Refer to FIG. 4A. An execution object on a network side in this embodiment is a network element. A CSCF network element in this embodiment is the call session control function network element in FIG. 3A. A UDM network element in this embodiment is the unified data management network element in FIG. 3A. A PCF network element in this embodiment is the policy control function network element in FIG. 3A. A UPM network element in this embodiment is the user plane function network element in FIG. 3A. A specific implementation procedure of this

embodiment is as follows:

[00130] S401: The terminal UE 1 sends first invitation request information to the P-CSCF#1 network element, where the first invitation request information requests to communicate with the second terminal UE 2.

[00131] Correspondingly, the P-CSCF#1 network element receives the first invitation request information.

[00132] Optionally, the first invitation request information may be an INVITE request message.

[00133] Specifically, the first invitation request information includes identity information of the UE 1 and identity information of the UE 2, for example, identification information of the UE 1 and identification information of the UE 2.

[00134] Optionally, the first invitation request information includes first access type indication information, and the first access type indication information indicates that the UE 1 accesses a network via a satellite. It should be noted that the first access type indication information may further indicate another access type. Unless otherwise specified, the first access type indication information indicates that the UE 1 accesses the network via the satellite.

[00135] In a first implementation, the first invitation request information includes access network information (P-Access-Network-Info, PANI), and the PANI includes first access type (Access Type) information, that is, the first access type indication information is the first access type information, and the first access type information indicates that the UE 1 accesses the network via the satellite. How the first access type information specifically indicates that the UE 1 accesses the network via the satellite is not limited in this application. For example, the UE 1 accesses the network by using a low Earth orbit satellite, the UE 1 accesses the network by using a medium Earth orbit satellite, or the UE 1 accesses the network by using a high Earth orbit satellite.

[00136] In a second implementation, the first invitation request information includes a PANI (P-Access-Network-Info, access network information), and when the PANI includes first access technology type (RAT Type) information, the first access type indication information is the first access technology type information, and the first access technology type information indicates a satellite access technology type. How the first access technology type information indicates a satellite access technology type is not limited in this application, for example, may be a low Earth orbit satellite access technology, a medium Earth orbit satellite access technology, or high Earth orbit satellite access technology.

[00137] Optionally, the first invitation request information may further include first direct communication request indication information and first media feature support information. The first direct communication request indication information indicates that the UE 1 requests to perform direct voice communication with the another terminal UE 2 via the satellite, and the direct

voice communication means that data of the voice communication between the UE 1 and the UE 2 only passes through the UE 1, the satellite, and the UE 2. The first media feature support information indicates that the UE 1 supports a media feature used for the direct voice communication. It should be noted that the first media feature support information may further indicate that the UE 1 does not support the media feature used for the direct voice communication. Unless otherwise specified, the first media feature support information indicates that the UE 1 supports the media feature used for the direct voice communication, and the media feature supported by the UE 1 may include a voice data encoding and decoding method that is supported by the UE 1 and that is used for the direct voice communication. It should be understood that the direct voice communication is the foregoing direct communication.

[00138] S402: The P-CSCF#1 network element sends first authentication authorization request information to the PCF network element.

[00139] Correspondingly, the PCF network element receives the first authentication authorization request information.

[00140] Optionally, the first authentication authorization request information may be an authentication authorization request message, AA-Request information or AAR information for short.

[00141] The first authentication authorization request information requests to perform authentication authorization on whether the voice communication of the UE 1 conforms to policy and charging control (Policy and Charging Control) supervision (supervision).

[00142] In an implementation, if the first invitation request information received by the P-CSCF#1 network element includes one or more of the first access type indication information and the first direct communication request indication information in S401, the first authentication authorization request information sent by the P-CSCF#1 network element to the PCF network element includes first network direct communication capability request information, and the first network direct communication capability request information requests to obtain information about whether a first network supports direct inter-satellite communication.

[00143] It should be understood that the direct inter-satellite communication may be establishing a link between satellites to transmit voice data. In addition, the foregoing network is a network including a network element on a satellite and a network element on the ground.

[00144] In a second implementation, if the first invitation request information received by the P-CSCF#1 network element includes one or more of the first access type indication information and the first direct communication request indication information in S401, the first authentication authorization request information sent by the P-CSCF#1 network element to the PCF network element includes first direct communication indication information, and the first direct

communication indication information indicates that the UE 1 needs the direct communication. If the first authentication authorization request information includes the first direct communication indication information, the first authentication authorization request information requests to perform authentication authorization on whether the direct voice communication of the UE 1 conforms to policy and charging control supervision.

[00145] S403: The PCF network element sends first authentication authorization response information to the P-CSCF#1 network element.

[00146] Correspondingly, the P-CSCF#1 network element receives the first authentication authorization response information.

[00147] Optionally, the first authentication authorization response information may be an authentication authorization answer message, AA-Answer information or AAA information for short.

[00148] Optionally, the first authentication authorization response information includes access type indication information, and the access type indication information indicates that the first terminal accesses the network via the satellite.

[00149] In a first implementation, the first invitation request information in step S401 does not include access type indication information, and the first authentication authorization response information in step S403 includes first access type indication information. The first access type indication information is the same as the first access type indication in step S401, and details are not described herein.

[00150] In a second implementation, the first invitation request information in step S401 includes the first access type indication information, the first access type indication information in step S401 is first access type information, and first access type indication information included in the first authentication authorization response information in step S403 is the first access technology type information in step S401. The first access technology type information is the same as the first access technology type information in step S401, and details are not described herein.

[00151] In a third implementation, if the first authentication authorization request information includes one or more of the first network direct communication capability request information and the first direct communication indication information, the first authentication authorization response information includes the first network direct communication capability information and first direct communication authorization result information.

[00152] It should be understood that the first direct communication authorization result information indicates that the UE 1 is allowed or not allowed to perform the direct voice communication. The first network direct communication capability information indicates that the network accessed by the UE 1 supports or does not support direct inter-satellite communication,

and the direct inter-satellite communication is the same as that described in step 2.

[00153] In a fourth implementation, if the first authentication authorization request information includes the first direct communication indication information, the first authentication authorization response information includes first direct communication authorization result information.

[00154] It should be noted that step S402 and step S403 are optional steps.

[00155] S404: The P-CSCF#1 network element sends second invitation request information to the S-CSCF#1 network element.

[00156] Correspondingly, the S-CSCF#1 network element receives the second invitation request information.

[00157] It should be understood that the P-CSCF#1 network element, the S-CSCF#1 network element, and the I-CSCF#1 network element are all network elements that serve the UE 1, that is, belong to an originating network (Originating Network).

[00158] In an implementation, the second invitation request information includes one or more of first access type indication information and first network direct communication capability information. The first access type indication information and the first network direct communication capability information are the same as the first access type indication information and the first network direct communication capability information in step S403.

[00159] In a second implementation, the second invitation request information includes first direct communication indication information, and the first direct communication indication information is the same as the first direct communication indication information in the first authentication authorization request information in step S402.

[00160] In a second implementation, the following several cases may be specifically included:

[00161] In a first case, if at least one of the first invitation request information in step S401 and the first authentication authorization response information in step S403 includes the first access type indication information, the second invitation request information includes the first direct communication indication information.

[00162] In a second case, if at least one of the first invitation request information in step S401 and the first authentication authorization response information in step S403 includes the first access type indication information, and the first network direct communication capability information indicates that the network supports the direct inter-satellite communication, the second invitation request information includes the first direct communication indication information.

[00163] In a third case, if at least one of the first invitation request information in step S401 and the first authentication authorization response information in step S403 includes the access type indication information, and the first direct communication authorization result information

included in the first authentication and authorization response information indicates that the UE 1 is allowed to perform the direct voice communication, the second invitation request information includes the first direct communication indication information.

[00164] It should be noted that, if at least one of the first invitation request information in step S401 and the first authentication authorization response information in step S403 includes the first access type indication information, and the first network direct communication capability information in the first authentication authorization response information indicates that the network accessed by the UE 1 does not support the direct inter-satellite communication, or the first direct communication authorization result information in the first authentication authorization response information indicates that the UE 1 is not allowed to perform the direct voice communication, the second invitation request information does not include the first direct communication indication information.

[00165] In addition, if at least one of the first invitation request information in step S401 and the first authentication authorization response information in step S403 includes the first access type indication information, and the first network direct communication capability information in the first authentication authorization response information indicates that the network accessed by the UE 1 does not support the direct inter-satellite communication, or the first direct communication authorization result information in the first authentication authorization response information indicates that the UE 1 is not allowed to perform the direct voice communication, steps S404 to S429 are not performed, but step S430 is directly performed, that is, the P-CSCF#1 network element sends first invitation response information to the UE 1, where the first invitation response information indicates that the direct voice communication is rejected. In this case, the first invitation response information includes first direct communication result indication information, and the first direct communication result indication information indicates that the direct voice communication is rejected, or the information itself indicates the direct voice communication is rejected.

[00166] It should be noted that a preferred solution in this embodiment is as follows: The second invitation request information includes one or more of the first access type indication information and the first network direct communication capability information, but does not include the first direct communication indication information.

[00167] An optional solution in this embodiment is as follows: The second invitation request information includes the first direct communication indication information, but does not include the first access type indication information and the first network direct communication capability information.

[00168] In addition, if the first invitation request information in step S401 includes the first

media feature support information, the second invitation request information may further include first media feature support information. The first media feature support information is the same as the first media feature support information in step S401, and details are not described herein.

[00169] S405: The S-CSCF#1 network element sends first subscription data request information to the UDM network element.

[00170] Correspondingly, the UDM network element receives the first subscription data request information. The first subscription data request information requests subscription data of the UE 1.

[00171] In a first implementation, the first subscription data request information includes first subscription data type information, and the first subscription data type information indicates that a type of the subscription data of the UE 1 is satellite communication subscription data.

[00172] Therefore, the first subscription data type information may indicate that the type of the subscription data is direct communication subscription data. Alternatively, if the second invitation request information includes one or more of the first access type indication information, the first network direct communication capability information, and the first direct communication indication information, the first subscription data request information includes the first subscription data type information.

[00173] It should be noted that, when requesting the subscription data of the UE 1 from the UDM network element, the S-CSCF#1 network element may further request subscription data of the UE 2. Therefore, the first subscription data request information may include subscription data type information of the UE 1 and subscription data type information of the UE 2. Details are the same as those described above. In this case, step S409 and step S410 are not performed.

[00174] S406: The UDM network element sends first subscription data response information to the S-CSCF#1 network element.

[00175] Correspondingly, the S-CSCF#1 network element receives the first subscription data response information.

[00176] In an implementation, if the first subscription data request information in step S405 includes the first subscription data type information, and the first subscription data type information indicates that the type of the subscription data of the UE 1 is the satellite communication subscription data, the first subscription data response information includes first direct communication support information. The first direct communication support information indicates that the UE 1 supports or does not support the direct voice communication, that is, the first terminal is allowed to perform the direct communication.

[00177] In another implementation, if the S-CSCF #1 may further request the subscription data of the UE 2 in step S405, the first direct communication support information indicates that the first

terminal is allowed to perform the direct communication and the second terminal is allowed to perform the direct communication, that is, the UE 1 and the UE 2 support the direct communication.

[00178] It should be noted that step S405 and step S406 are optional steps.

[00179] S407: The S-CSCF#1 network element sends third invitation request information to the I-CSCF#2 network element.

[00180] Correspondingly, the I-CSCF#2 network element receives the third invitation request information.

[00181] It should be understood that the P-CSCF#2 network element, the S-CSCF#2 network element, and the I-CSCF#2 network element are all network elements that serve the UE 2, that is, belong to a terminating network (Terminating Network).

[00182] In an implementation, if the second invitation request information received by the S-CSCF #1 in step S404 includes one or more of the first access type indication information, the first network direct communication capability information, the first media feature support information, and the first direct communication indication information, the third invitation request information sent by the S-CSCF#1 network element to the I-CSCF#2 network element in step S407 includes the first direct communication indication information.

[00183] In a second implementation, if the first direct communication support information in the first subscription data response information in step S406 indicates that the UE 1 supports the direct voice communication, the third invitation request information includes the first direct communication indication information.

[00184] In a third implementation, if the first direct communication support information in the first subscription data response information in step S406 indicates that the UE 1 does not support the direct voice communication, the third invitation request information does not include the first direct communication indication information.

[00185] It should be noted that, if the first direct communication support information in the first subscription data response information in step S406 indicates that the UE 1 does not support the direct voice communication, step S407 may not be performed, and the S-CSCF#1 network element sends third invitation response information to the P-CSCF#1 network element, where the third invitation response information indicates that the direct voice communication is rejected. Then, step S429 is directly performed, which is the same as step S404. Details are not described herein.

[00186] S408: The I-CSCF#2 network element sends fourth invitation request information to the S-CSCF#2 network element.

[00187] Correspondingly, the S-CSCF#2 network element receives the fourth invitation request information.

[00188] Specifically, the fourth invitation request information includes one or more of first

direct communication indication information, first access type indication information, first direct communication support information, first network direct communication capability information, and first media feature support information.

[00189] It should be noted that, in a preferred solution of this embodiment, the third invitation request information in step S407 and the fourth invitation request information in step S408 may include only the first direct communication indication information. In an optional solution of this embodiment, the invitation request information in step S407 and step S408 does not include the first direct communication indication information, but includes one or more of the first access type indication information, the first direct communication support information, the first network direct communication capability information, and the first media feature support information.

[00190] In an optional solution of this embodiment, the third invitation request information in step S407 and the fourth invitation request information in step S408 necessarily include the first access type indication information.

[00191] S409: The S-CSCF#2 network element sends second subscription data request information to the UDM network element.

[00192] Correspondingly, the UDM network element receives the second subscription data request information, where the second subscription data request information requests subscription data of the UE 2.

[00193] Optionally, the second subscription data request information includes second subscription data type information, and the second subscription data type information indicates that a type of the subscription data of the UE 2 is satellite communication subscription data.

[00194] In an implementation, the second subscription data type information indicates that the type of the subscription data of the UE 2 is second direct communication subscription data.

[00195] In a second implementation, if step S408 includes one or more of the first direct communication indication information, the first access type indication information, the first network direct communication capability information, and the first direct communication indication information, the second subscription data request information includes the second subscription data type information.

[00196] If the subscription data of the UE 2 is queried in step S405, step S409 and step S410 are not performed.

[00197] S410: The UDM network element sends second subscription data response information to the S-CSCF#1 network element.

[00198] Correspondingly, the S-CSCF#1 network element receives the second subscription data response information.

[00199] Optionally, the second subscription data response information includes second direct

communication support information, and the second direct communication support information indicates that the UE 2 supports or does not support the direct voice communication, that is, the UE 2 supports or does not support the direct voice communication with the another terminal via the satellite, that is, the UE 2 is allowed to perform the direct communication.

[00200] In a first implementation, if the second subscription data request information includes the second subscription data type information, and the second subscription data type information indicates that the type of the subscription data of the UE 2 is the satellite communication subscription data, the second subscription data response information includes the second direct communication support information.

[00201] It should be noted that step S409 and step S410 are optional steps.

[00202] S411: The S-CSCF#2 network element sends fifth invitation request information to the P-CSCF#2 network element.

[00203] Correspondingly, the P-CSCF#2 network element receives the fifth invitation request information.

[00204] Optionally, the fifth invitation request information includes second direct communication indication information, and the second direct communication indication information has a same function as the first direct communication indication information in step S402.

[00205] In an implementation, if the fourth invitation request information in step S408 includes one or more of the first access type indication information, the first direct communication support indication information, the first network direct communication capability information, and the first direct communication indication information, the fifth invitation request information includes the second direct communication indication information.

[00206] In a second implementation, if the second direct communication support information in the second subscription data response information in step S410 indicates that the UE 2 supports the direct voice communication, the fifth invitation request information includes the second direct communication indication information.

[00207] It should be noted that, in a second implementation, if the second direct communication support information in the second subscription data response information in step S410 indicates that the UE 2 does not support the direct voice communication, the fifth invitation request information does not include the second direct communication indication information. Alternatively, step S411 is not performed. The S-CSCF#2 network element sends fourth invitation response information to the I-CSCF#2 network element, where the fifth invitation response information indicates that the direct voice communication is rejected. The I-CSCF#2 network element sends third invitation response information to the S-CSCF#1 network element, where the

third invitation response information indicates that the direct voice communication is rejected. The S-CSCF#1 network element sends second invitation response information to the P-CSCF#1 network element, where the second invitation response information indicates that the direct voice communication is rejected. After this step, step S429 is directly performed. For details, refer to step S404. Details are not described herein.

[00208] S412: The P-CSCF#2 network element sends second authentication authorization request information to the PCF network element.

[00209] Correspondingly, the PCF network element receives the second authentication authorization request information.

[00210] Optionally, the second authentication authorization request information includes the second direct communication indication information.

[00211] In a first implementation, if the fifth invitation request information in step S411 includes the second direct communication indication information, the second authentication authorization request information includes the second direct communication indication information.

[00212] It should be noted that, if the first network direct communication capability information is not involved in steps S402 and S403, the second authentication authorization request information includes the second network direct communication capability request information. When the UE 1 and the UE 2 perform the direct voice communication, the networks accessed by the UE 1 and the UE 2 may belong to a same network. Therefore, the first network direct communication capability information is the second network direct communication capability information.

[00213] It should be noted that the PCF in steps S402 and S403 and the PCF in steps S412 and S413 may not be a same PCF. The PCF in steps S402 and S403 is a PCF corresponding to a session that is of the UE 1 and that is used to transmit data of an IMS service, and the PCF in steps S412 and S413 is a PCF corresponding to a session that is of the UE 2 and that is used to transmit data of an IMS service.

[00214] S413: The PCF network element sends second authentication authorization response information to the P-CSCF#2 network element.

[00215] Correspondingly, the P-CSCF#2 network element receives the second authentication authorization response information.

[00216] Optionally, the second authentication authorization response information includes second access type indication information. Because the UE 1 accesses the network via the satellite and the UE 2 accesses the network via the satellite, types of the satellites accessed by the UE 1 and the UE 2 may be the same. That is, the second access type indication information has a same

function as the first access type indication information in step S401. Details are not described herein.

[00217] Optionally, if the first network direct communication capability information is not involved in steps S402 and S403, the second authentication authorization response information includes the second network direct communication capability information. For details, refer to step S403. It should be understood that, when the UE 1 and the UE 2 perform the direct voice communication, the networks accessed by the UE 1 and the UE 2 may belong to a same network. Therefore, the second network direct communication capability information is the first network direct communication capability information.

[00218] S414: The P-CSCF#2 network element sends sixth invitation request information to the UE#2 network element.

[00219] Correspondingly, the UE#2 network element receives the sixth invitation request information.

[00220] In an implementation, if the fifth invitation request information in step S411 includes the second direct communication indication information, and the second access type indication information included in the second authentication authorization response information in step S413 indicates that the UE 2 does not perform access via the satellite, step S414 is not performed. The P-CSCF#2 network element sends fifth invitation response information to the S-CSCF#2 network element, where the fifth invitation response information indicates that the direct voice communication is rejected. Subsequently, the S-CSCF#2 network element performs a procedure of rejecting the invitation response information returned by the S-CSCF#2 network element in step S411. Details are not described herein.

[00221] S415: The UE 2 sends sixth invitation response information to the P-CSCF#2 network element.

[00222] Correspondingly, the P-CSCF#2 network element receives the sixth invitation response information.

[00223] Optionally, the sixth invitation response information may include second access type indication information, and the second access type indication information indicates that the UE 2 accesses the network via the satellite. Details are the same as the first access type indication information in step S401. It should be noted that the second access type indication information may further indicate another access type, for example, indicate that the UE 2 does not perform access via the satellite.

[00224] Another specifically indicated access type is not limited in this application. Unless otherwise specified, the second access type indication information indicates that the UE 2 accesses the network via the satellite.

[00225] Optionally, the sixth invitation response information may further include second media feature support information, where the second media feature support information indicates that the UE 2 supports a media feature used for the direct voice communication. It should be noted that the second media feature support information may further indicate that the UE 2 does not support the media feature used for the direct voice communication. Unless otherwise specified, the second media feature support information indicates that the UE 2 supports the media feature used for the direct voice communication. The media feature supported by the UE 2 may include a voice data encoding and decoding method that is supported by the UE 2 and that is used for the direct voice communication.

[00226] It should be noted that the second direct communication support information in step S410, the second access type indication information in step S413, the second access type indication information in step S415, and the second media feature support information in step S415 are all for the UE 2. When the UE 1 and the UE 2 perform the direct voice communication, the networks accessed by the UE 1 and the UE 2 are a same network. Therefore, the first network direct communication capability information is the same as the second network direct communication capability information.

[00227] S416: The P-CSCF#2 network element sends fifth invitation response information to the S-CSCF#2 network element.

[00228] Correspondingly, the S-CSCF#2 network element receives the fifth invitation response information.

[00229] Optionally, the fifth invitation response information includes second access type information. The second access type information is type information of the satellite accessed by the UE 2.

[00230] In a first implementation, if at least one of the second authentication authorization response information in step S413 and the sixth invitation response information in step S415 includes the second access type indication information, the fifth invitation response information includes the second access type information.

[00231] Optionally, the fifth invitation response information includes second media feature support information.

[00232] In a second implementation, if at least one of the second authentication authorization response information in step S413 and the sixth invitation response information in step S415 includes the second access type indication information, and the second access type indication information indicates that the UE 2 does not perform access via the satellite, the fifth invitation response information indicates that the direct voice communication is rejected.

[00233] S417: The S-CSCF#2 network element sends fourth invitation response information to

the I-CSCF#2 network element.

[00234] Correspondingly, the I-CSCF#2 network element receives the fourth invitation response information.

[00235] Optionally, the fourth invitation response information includes one or more of second access type information, second media feature support information, second direct communication support information, and second network direct communication capability information (first network direct communication capability information).

[00236] In a first implementation, if the first direct communication indication information is included in step S408, that is, corresponds to the preferred solution in step S408, the fourth invitation response information includes one or more of the second access type information, the second media feature support information, the second direct communication support information, and the second network direct communication capability information (first network direct communication capability information), and in this solution, the second access type information is mandatory.

[00237] In a second implementation, the fourth invitation response information includes second direct communication result indication information, and the second direct communication result indication information indicates that the UE 2 accepts or rejects the direct voice communication. Therefore, the fourth invitation response information indicates that the direct voice communication is accepted or rejected. Alternatively, the fourth invitation response information itself indicates that the direct voice communication is accepted or rejected.

[00238] In a third implementation, if one or more of the first access type indication information, the first direct communication support information, the first network direct communication capability information, and the first media feature support information are included in step S408, that is, corresponds to the optional solution in step S408, the fourth invitation response information includes second direct communication result indication information. If the following conditions are all met, the S-CSCF#2 network element determines to establish the direct communication for the UE 1 and the UE 2, and the specific conditions may be:

[00239] (1) The first access type indication information of the UE 1 indicates that the UE 1 accesses the network via the satellite, and the second access type indication information of the UE 2 indicates that the UE 2 accesses the network via the satellite.

[00240] (2) If the first media feature support information of the UE 1 and the second media feature support information of the UE 2 are received, and both the media feature supported by the UE 1 and the media feature supported by the UE 2 support the media feature used for the direct voice communication, in an implementation, the media feature supported by the UE 1 needs to match the media feature supported by the UE 2.

[00241] (3) If the first network direct communication capability information and the second network direct communication capability information (the first network direct communication capability information is the second network direct communication capability information) are received, it is indicated that the networks accessed by the UE 1 and the UE 2 support the direct inter-satellite communication.

[00242] (4) If the first direct communication support information of the UE 1 and the second direct communication support information of the UE 2 are received, and the first direct communication support information of the UE 1 and the second direct communication support information of the UE 2 indicate that both the UE 1 and the UE 2 support the direct voice communication, that is, the UE 1 is allowed to perform direct communication and the UE 2 is allowed to perform the direct communication.

[00243] If any one of the foregoing conditions is not met, the S-CSCF#2 network element determines to reject the direct voice communication.

[00244] It should be noted that, in a possible scenario, that is, when only some information is obtained, not all conditions need to be met, and in this case, the S-CSCF#2 network element determines to establish the direct communication for the UE 1 and the UE 2. If only the first access type indication information of the UE 1 and the second access type indication information of the UE 2 are present, only (1) needs to be met.

[00245] S418: The I-CSCF#2 network element sends third invitation response information to the S-CSCF#1 network element.

[00246] Correspondingly, the S-CSCF#1 network element receives the third invitation response information.

[00247] Specifically, content included in the third invitation response information is the same as that in step S417, and details are not described herein.

[00248] S419: The S-CSCF#1 network element determines to accept the direct voice communication, that is, establishes the direct communication for the UE 1 and the UE 2.

[00249] In a first implementation, the S-CSCF#1 network element receives any one or more of the first network direct communication capability information (second network direct communication capability information), and the access type indication information, the direct communication support information, and the media feature support information of the UE 1 and the UE 2. If the four conditions in step S417 are all met, the S-CSCF#1 network element determines to accept the direct voice communication; otherwise, the S-CSCF#1 network element determines to reject the direct voice communication.

[00250] It should be understood that the access type indication information of the UE 1 and the access type indication information of the UE 2 are the first access type indication information and

the second access type indication information; the direct communication support information of the UE 1 and the direct communication support information of the UE 2 are the first direct communication support information and the second direct communication support information; and the media feature support information of the UE 1 and the media feature support information of the UE 2 are the first media feature support information and the second media feature support information.

[00251] A manner of determining the S-CSCF #1 is the same as that in step S417, and details are not described.

[00252] In a second implementation, the third invitation response information received by the S-CSCF#1 network element indicates that the direct voice communication is accepted or rejected.

[00253] It should be noted that, for a case in which the direct voice communication is rejected, refer to the foregoing description. Details are not described herein.

[00254] In this embodiment, FIG. 4A and FIG. 4B belong to a procedure of a same embodiment. For steps S401 to S409, refer to FIG. 4A. For steps S420 to S430, refer to FIG. 4B.

[00255] S420: The S-CSCF#1 network element sends second invitation response information to the P-CSCF#1 network element.

[00256] Correspondingly, the P-CSCF#1 network element receives the second invitation response information.

[00257] In a first implementation, the second invitation response information includes QoS requirement information used for the direct voice communication, where the QoS requirement information is information such as a QoS identifier or parameter.

[00258] In a second implementation, the second invitation response information indicates that the direct voice communication is accepted, and a specific indication manner is the same as that in step S417.

[00259] S421: The P-CSCF#1 network element sends direct communication setup information to the PCF network element.

[00260] Correspondingly, the PCF network element receives the direct communication setup information.

[00261] Optionally, the direct communication setup information includes information about the UE 1 and information about the UE 2. Specifically, the direct communication setup information includes IP address information of the UE 1 and IP address information of the UE 2, or the direct communication setup information includes identification information of the UE 1 and identification information of the UE 2, where the identification information may be a generic public subscription identity (Generic Public Subscription Identifier, GPSI). It should be noted that the identification information mentioned in this application may also indicate address information.

[00262] Optionally, the direct communication setup information includes direct communication setup indication information, and the direct communication setup indication information indicates to establish the direct voice communication for the UE 1 and the UE 2.

[00263] Optionally, the direct communication setup information may further include QoS requirement information used for the direct voice communication.

[00264] It should be noted that, after step S421, the method further includes: The PCF network element further needs to send response information to the P-CSCF#2 network element, where the response information is used to acknowledge the reception. To simplify this step, a procedure in which the PCF network element sends the response information to the P-CSCF#2 network element is not individually shown in FIG. 4B, but a double-headed arrow is used to represent interaction between the PCF network element and the P-CSCF#2 network element. Step S422 is the same, and details are not described.

[00265] S422: The PCF network element sends direct communication setup information to the SMF network element.

[00266] Correspondingly, the SMF network element receives the direct communication setup information.

[00267] Optionally, the direct communication setup information includes information about the UE 1 and information about the UE 2. Specifically, this step is the same as step S421. For details, refer to step S421.

[00268] The PCF network element receives the information about the UE 1 and the information about the UE 2. The PCF network element respectively determines a PDU session identifier of the UE 1 and a PDU session identifier of the UE 2 based on the information about the UE 1 and the information about the UE 2, and includes the identification information in the direct communication setup information.

[00269] Optionally, the direct communication setup information may include the direct communication setup indication information.

[00270] Optionally, the direct communication setup information may include QoS information used for the direct voice communication. The QoS information is the same as the QoS requirement information in step S421, or the PCF network element determines the QoS information based on the QoS requirement information in step S421, for example, from the perspective of a form change.

[00271] It should be noted that the direct communication setup information in step S421 and that in step S422 may be same information or different information. This is not specifically limited herein.

[00272] S423: The SMF network element allocates an S-UPF1 tunnel and an S-UPF2 tunnel.

[00273] That is, the SMF network element allocates tunnel information used for the direct voice

communication in an S-UPF1 network element and an S-UPF2 network element.

[00274] The S-UPF1 network element is a user plane network element of a PDU session used by the UE 1 for the direct voice communication, and the S-UPF2 network element is a user plane network element of a PDU session used by the UE 2 for the direct voice communication.

[00275] It should be understood that, in this application, the S-UPF1 network element and the S-UPF2 network element may be located on two different satellites. The tunnel is a tunnel between the S-UPF1 network element and the S-UPF2 network element, and the tunnel is used to transmit voice data.

[00276] In a first implementation, the SMF network element receives the information about the UE 1 and the information about the UE 2. The SMF network element determines, based on the information about the UE 1 and the information about the UE 2, an identifier of the PDU session of the UE 1 and an identifier of the PDU session of the UE 2 that are used for the direct voice communication. The SMF network element allocates the tunnel information to the PDU sessions of the UE 1 and the UE 2, that is, the tunnel information used for the direct voice communication in the S-UPF 1 and the S-UPF 2.

[00277] In a second implementation, the SMF network element receives an identifier of the PDU session of the UE 1 and an identifier of the PDU session of the UE 2 that are used for the direct voice communication, and the SMF network element allocates the tunnel information to the PDU sessions of the UE 1 and the UE 2.

[00278] In a third implementation, when receiving the direct communication setup indication information, the SMF network element allocates the tunnel information to the PDU sessions of the UE 1 and the UE 2.

[00279] S424: The SMF network element sends N4 session request information to the S-UPF1 network element.

[00280] Correspondingly, the S-UPF1 network element receives the N4 session request information.

[00281] Specifically, the N4 session request information request requests to configure tunnel information for a PDU session used for the direct voice communication, and the N4 session request information includes QoS information used for the direct voice communication and tunnel information used for the direct voice communication in the S-UPF 1 and the S-UPF 2.

[00282] S425: Establish an internal tunnel between the gNB 1 and the S-UPF1 network element.

[00283] Specifically, after the S-UPF1 network element updates tunnel information, the gNB 1 needs to update the corresponding tunnel information, to establish the tunnel between the gNB 1 and the S-UPF1 network element.

[00284] It should be noted that, how to establish the tunnel between the gNB 1 and the S-UPF1

network element is not limited in this application. For example, the tunnel may be established through interaction between the SMF network element and the gNB 1, or the tunnel may be established through interaction between the gNB 1 and the S-UPF1 network element. Step S425 may alternatively be performed after step S426.

[00285] S426: The S-UPF1 network element sends N4 session response information to the SMF network element, where the N4 session response information is used to confirm that tunnel configuration is completed.

[00286] S427: The SMF network element sends N4 session request information to the S-UPF2 network element.

[00287] S428: Establish an internal tunnel between the gNB 2 and the S-UPF2 network element.

[00288] S429: The S-UPF2 network element sends N4 session response information to the SMF network element, where the N4 session response information is used to confirm that tunnel configuration is completed.

[00289] It should be noted that steps S427 to S429 are similar to steps S424 to S426. A difference lies in that, in steps S427 to S429, the S-UPF1 network element is changed to the S-UPF2 network element, and the gNB 1 is changed to the gNB 2. A sequence of performing steps S424 to S426 and steps S427 to S429 is not specifically limited in this application.

[00290] S430: The P-CSCF network element#1 sends first invitation response information to the UE 1.

[00291] Correspondingly, the UE 1 receives the first invitation response information, where the first invitation response information indicates that the direct voice communication is accepted.

[00292] It should be noted that the first invitation response information may further indicate that the direct voice communication is rejected.

[00293] In conclusion, as described in the embodiments shown in FIG. 4A and FIG. 4B, in the multi-IM CN scenario, the CSCF serving the UE 1 is different from the CSCF serving the UE 2, and the CSCF corresponding to the first terminal may determine, based on the access type information, the subscription information, and the network support capability information of the first terminal and the second terminal, and the media feature support information of the first terminal and the second terminal, whether to establish the direct voice communication for the first terminal and the second terminal, and then the SMF network element establishes a transmission path for the direct voice communication for the first terminal and the second terminal, so that the first terminal and the second terminal can perform the direct voice communication by using the established transmission path. This can avoid long voice communication duration caused because the voice data transmitted between the first terminal and the second terminal passes through the ground.

[00294] Based on the communication method provided in the foregoing embodiment, the following describes the method in this application in detail with reference to a specific embodiment. This embodiment is mainly used in a single-IM CN scenario, to implement direct voice communication performed by a terminal via a satellite. In this embodiment, UE 1 and UE 2 may respectively access networks by using corresponding satellites. To be specific, the UE 1 may access the network by using a first satellite, and the UE 2 may access the network by using a second satellite. Each satellite includes one base station and one UPF network element. In addition, the UE 1 and the UE 2 are served by a same call session control function CSCF network element, and the CSCF network element includes a P-CSCF network element, an I-CSCF network element, and an S-CSCF network element. Refer to FIG. 5. A specific implementation procedure of this embodiment is as follows:

[00295] S501: The terminal UE 1 sends first invitation request information to a P-CSCF#1 network element, where the first invitation request information requests to communicate with the second terminal UE 2.

[00296] For step S501, refer to step S401. Details are not described herein.

[00297] S502: The P-CSCF#1 network element initiates first authentication authorization request information to a PCF network element.

[00298] For step S502, refer to step S402. Details are not described herein.

[00299] S503: The PCF network element sends first authentication authorization response information to the P-CSCF#1 network element.

[00300] For step S503, refer to step S403. Details are not described herein.

[00301] S504: The P-CSCF#1 network element sends second invitation request information to an S-CSCF#1 network element.

[00302] For step S504, refer to step S404. Details are not described herein.

[00303] S505: The S-CSCF#1 network element sends subscription data request information to a UDM network element.

[00304] For step S505, refer to step S405. Details are not described herein.

[00305] S506: The UDM network element sends subscription data response information to the S-CSCF#1 network element.

[00306] For step S506, refer to step S406. Details are not described herein.

[00307] It should be noted that steps S501 to S506 are roughly the same as steps S401 to S406, and a main difference lies in that direct communication support information of the UE 1 in the multi-IM CN scenario in FIG. 4A and FIG. 4B is changed to direct communication support information of the UE 1 and the UE 2 in the single-IM CN scenario. That is, in step S505, the subscription data request information requests the subscription data of the UE 1 and the UE 2.

[00308] S507: The S-CSCF#1 network element sends third invitation request information to the UE#2 network element.

[00309] It should be noted that, if the access type indication information in step S501 or step S503 indicates that the UE 1 accesses a network via a satellite, and the network direct communication capability information indicates that the network does not support direct inter-satellite communication, steps S507 to S519 are not performed, but step S520 is directly performed; or

if the access type indication information in step S501 or step S503 indicates that the UE 1 accesses a network via a satellite, and the direct communication support information of the UE 1 indicates that the UE 1 does not support direct voice communication, or the direct communication support information of the UE 2 indicates that the UE 2 does not support direct voice communication, steps S507 to S519 are not performed, but step S520 is directly performed.

[00310] S508: The UE 2 sends third invitation response information to the S-CSCF#1 network element.

[00311] For step S508, refer to step S415. Details are not described herein.

[00312] S509: The S-CSCF#1 network element determines to accept the direct voice communication.

[00313] For step S509, refer to step S419. Details are not described herein.

[00314] S510: The S-CSCF#1 network element sends second invitation response information to the P-CSCF#1 network element.

[00315] For step S509, refer to step S420. Details are not described herein.

[00316] S511: The P-CSCF#1 network element sends direct communication setup information to the PCF network element.

[00317] For step S511, refer to step S421. Details are not described herein.

[00318] S512: The PCF network element sends direct communication setup information to an SMF network element.

[00319] For step S512, refer to step S422. Details are not described herein.

[00320] S513: The SMF network element determines to accept the direct voice communication.

[00321] Further, the SMF network element allocates tunnel information used for the direct voice communication in an S-UPF1 network element and an S-UPF2 network element.

[00322] For step S513, refer to step S423. Details are not described herein.

[00323] S514: The SMF network element sends N4 session request information to the S-UPF1 network element.

[00324] For step S514, refer to step S424. Details are not described herein.

[00325] S515: Establish an internal tunnel between the gNB 1 and the S-UPF1 network element.

[00326] For step S515, refer to step S425. Details are not described herein.

[00327] S516: The S-UPF1 network element sends N4 session response information to the SMF network element, where the N4 session response information is used to confirm that tunnel configuration is completed.

[00328] For step S516, refer to step S426. Details are not described herein.

[00329] S517: The SMF network element sends N4 session request information to the S-UPF2 network element.

[00330] For step S517, refer to step S427. Details are not described herein.

[00331] S518: Establish an internal tunnel between a gNB 2 and the S-UPF2 network element.

[00332] For step S518, refer to step S428. Details are not described herein.

[00333] S519: The S-UPF2 network element sends N4 session response information to the SMF network element, where the N4 session response information is used to confirm that tunnel configuration is completed.

[00334] For step S519, refer to step S429. Details are not described herein.

[00335] S520: The P-CSCF network element#1 sends first invitation response information to the UE 1.

[00336] For step S520, refer to step S430. Details are not described herein.

[00337] It should be noted that steps S509 to S520 are roughly the same as steps S419 to S430 in the multi-IM CN scenario procedure, and a main difference lies in that, in step S519, the S-CSCF#1 network element does not receive invitation response information indicating that the direct voice communication is accepted or rejected.

[00338] In conclusion, as described in the embodiment shown in FIG. 5, in the single-IM CN scenario, the CSCF serving the UE 1 is the same as the CSCF serving the UE 2, and the CSCF corresponding to the first terminal may determine, based on the access type information, the subscription information, and the network support capability information of the first terminal and the second terminal, and the media feature support information of the first terminal and the second terminal, whether to establish the direct voice communication for the first terminal and the second terminal, and then the SMF network element establishes a transmission path for the direct voice communication for the first terminal and the second terminal, so that the first terminal and the second terminal can perform the direct voice communication by using the established transmission path. This can prevent the voice data transmitted between the first terminal and the second terminal from passing through the ground, thereby reducing duration of the voice communication between the first terminal and the second terminal, and greatly improving user experience.

[00339] Based on a same technical concept, an embodiment of this application provides a communication apparatus. The device may include one-to-one corresponding modules or units for

performing the methods/operations/steps/actions described in the call session control function network element in the first method embodiment. The modules or the units may be implemented by a hardware circuit, software, or a combination of a hardware circuit and software. The apparatus may have the structure shown in FIG. 6.

[00340] As shown in FIG. 6, the communication apparatus 600 may include a receiving unit 601, a processing unit 602, and a sending unit 603. The following describes the units in detail.

[00341] The receiving unit 601 receives first invitation request information of a first terminal, where the first invitation request information requests to communicate with a second terminal; the receiving unit 601 is further configured to obtain first access information and second access information, where the first access information indicates that the first terminal accesses a network via a satellite, and the second access information indicates that the second terminal accesses a network via a satellite; the processing unit 602 is configured to determine, based on the first access information and the second access information, to establish direct communication for the first terminal and the second terminal, where the direct communication means that data of an internet protocol multimedia subsystem IMS service between the first terminal and the second terminal is directly transmitted between a first satellite through which the first terminal accesses the network and a second satellite through which the second terminal accesses the network; and the sending unit 603 is configured to send first request information to a first network element, where the first request information indicates to establish the direct communication between the first terminal and the second terminal.

[00342] In a possible implementation, when obtaining the first access information, the receiving unit 601 may be specifically configured to obtain the first access information from the first terminal or a policy control function network element corresponding to a session of the first terminal, where the session of the first terminal is used for transmission of the data of the IMS service.

[00343] In a possible implementation, when obtaining the second access information, the receiving unit may be specifically configured to obtain the second access information from the second terminal, a policy control function network element corresponding to a session of the second terminal, or a call session control function network element corresponding to the second terminal, where the session of the second terminal is used for transmission of the data of the IMS service.

[00344] In a possible implementation, the receiving unit 601 may be further configured to: before the processing unit 602 determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, obtain first network direct communication capability information, where the first network direct communication capability information indicates that a first network supports the

direct communication, and the first terminal and the second terminal access the first network.

[00345] In a possible implementation, the receiving unit 601 may be further configured to: before the processing unit 602 determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, receive first direct communication subscription information and second direct communication subscription information, where the first direct communication subscription information indicates that the first terminal is allowed to perform the direct communication, and the second direct communication subscription information indicates that the second terminal is allowed to perform the direct communication.

[00346] In a possible implementation, the receiving unit 601 may be further configured to: before the processing unit 602 determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, obtain first media feature support information and second media feature support information, where the first media feature support information indicates a media feature used by the first terminal for the IMS service, and the second media feature support information indicates a media feature used by the second terminal for the IMS service.

[00347] In a possible implementation, the first invitation request information includes direct communication request indication information, and the direct communication request indication information indicates that the first terminal expects to perform the direct communication with the second terminal.

[00348] In a possible implementation, the first request information includes identification information of the first terminal and identification information of the second terminal.

[00349] In a possible implementation, the first request information includes quality of service QoS information used for the direct communication.

[00350] In a possible implementation, the sending unit 603 may be further configured to send first invitation response information to the first terminal, where the first invitation response information indicates that the direct communication between the first terminal and the second terminal is accepted.

[00351] Based on a same inventive concept, an embodiment of this application further provides a communication device. The communication device performs the steps performed by the call session control function network element in the method provided in the embodiments corresponding to FIG. 3A, FIG. 3B, FIG. 4A, FIG. 4B, and FIG. 5, and may be a device that is the same as the communication apparatus 600 shown in FIG. 6. Refer to FIG. 7. The communication device 700 includes a transceiver 701, a processor 702, and a memory 703. The transceiver 701, the processor 702, and the memory 703 are connected through a bus 704, to implement data

exchange.

[00352] It should be understood that the transceiver 701 in the communication device 700 includes functions of the receiving unit 601 and the sending unit 603 in the communication apparatus 600. The transceiver 701 is configured to support the communication apparatus 700 in performing information sending and receiving between a core network element and a terminal in the foregoing embodiments. The core network element may include a policy control function network element, a unified data management network element, and the like. The memory 703 is configured to store program code and data of the communication apparatus 700. The processor 702 is configured to invoke the program code and the data stored in the memory 703, to perform processing processes related to the call session control function network element in the methods shown in FIG. 3A, FIG. 3B, FIG. 4A, FIG. 4B, and FIG. 5, and/or another process of the technology described in this application.

[00353] In addition, the communication apparatus 700 may further include another interface, for example, an optical fiber link interface, an Ethernet interface, a microwave link interface, or a copper wire interface, to implement interaction between the communication apparatus 700 and another device (for example, an access network device and a UPF on a satellite, or a core network element on the ground).

[00354] Optionally, the processor 702 may be a central processing unit, an ASIC, an FPGA, or a CPLD.

[00355] It should be noted that the communication apparatus 700 shown in FIG. 7 includes only one transceiver 701, one processor 702, and one memory 703. During actual implementation, there may be one or more transceivers 701, processors 702, and memories 703.

[00356] Based on a same concept as that in the foregoing method embodiment, an embodiment of this application further provides a computer-readable storage medium. The computer-readable storage medium stores some instructions. When the instructions are invoked and executed by a computer, the computer may be enabled to complete the method in the foregoing method embodiment and any possible design of the method embodiment. In embodiments of this application, the computer-readable storage medium is not limited. For example, the computer-readable storage medium may be a RAM (random access memory, random access memory) or a ROM (read-only memory, read-only memory).

[00357] Based on a same concept as that in the foregoing method embodiment, this application further provides a computer program product. When being invoked and executed by a computer, the computer program product may implement the method in the method embodiment and any possible design of the method embodiment.

[00358] Based on a same concept as that in the foregoing method embodiment, this application

further provides a chip. The chip may include a processor and an interface circuit, to complete the method in the method embodiment and any possible implementation of the method embodiment. "Coupling" means that two components are joined directly or indirectly to each other, and the combination may be fixed or movable. Such combination may allow flowing liquid, electrical, electrical or other type of signal to communicate between the two components.

[00359] It should be noted that "at least one" in embodiments of this application includes one or more, and "a plurality of" means two or more than two. In addition, it should be understood that, in description of this application, terms such as "first" and "second" are merely used for distinguishing and description, but should not be understood as indicating or implying relative importance, or should not be understood as indicating or implying a sequence.

[00360] Terms used in the following embodiments are merely intended to describe specific embodiments, but are not intended to limit this application. The terms "one", "the", "the foregoing", "this", and "the one" of singular forms used in this specification and the appended claims of this application are also intended to include expressions such as "one or more", unless otherwise specified in the context clearly. It should be further understood that, in embodiments of this application, "one or more" means one or more than two (including two); and "and/or" describes an association relationship between associated objects, and indicates that three relationships may exist. For example, A and/or B may indicate the following cases: Only A exists, both A and B exist, and only B exists, where A and B may be singular or plural. The character "/" generally indicates an "or" relationship between the associated objects.

[00361] Reference to "an embodiment", "some embodiments", or the like described in this specification indicates that one or more embodiments of this application include a specific feature, structure, or characteristic described with reference to the embodiment. Therefore, statements such as "in an embodiment", "in some embodiments", "in some other embodiments", and "in other embodiments" that appear at different places in this specification do not necessarily mean referring to a same embodiment. Instead, the statements mean "one or more but not all of embodiments", unless otherwise specifically emphasized in another manner. The terms "include", "have", and their variants all mean "include but are not limited to", unless otherwise specifically emphasized in another manner.

[00362] Division into the modules in embodiments of this application is an example, is merely division into logical functions, and may be other division during actual implementation. In addition, functional modules in embodiments of this application may be integrated into one processor, or each of the modules may exist alone physically, or two or more modules may be integrated into one module. The integrated module may be implemented in a form of hardware, or may be implemented in a form of a software functional module.

[00363] Through descriptions of the foregoing implementations, a person skilled in the art may clearly understand that embodiments of this application may be implemented by hardware, firmware or a combination thereof. When the software is used for implementation, the foregoing functions may be stored in a computer-readable medium or transmitted as one or more instructions or code in the computer-readable medium. The computer-readable medium includes a computer storage medium and a communication medium, where the communication medium includes any medium that enables a computer program to be transmitted from one place to another. The storage medium may be any available medium accessible to a computer. Examples of the computer-readable medium include but are not limited to: a RAM, a ROM, an electrically erasable programmable read only memory (electrically erasable programmable read only memory, EEPROM), a compact disc read-only memory (compact disc read-only memory, CD-ROM) or another optical disc storage, a disk storage medium or another disk storage device, or any other medium that can be used to carry or store expected program code in an instruction or data structure form and can be accessed by a computer. In addition, any connection may be properly defined as a computer-readable medium. For example, if software is transmitted from a website, a server, or another remote source by using a coaxial cable, an optical fiber and optical cable, a twisted pair, a digital subscriber line (digital subscriber line, DSL), or wireless technologies such as infrared, radio, and microwave, the coaxial cable, the optical fiber and optical cable, the twisted pair, the DSL, or the wireless technologies such as infrared, radio, and microwave are included in a definition of a medium to which the coaxial cable, the optical fiber and optical cable, the twisted pair, the DSL, or the wireless technologies such as the infrared ray, the radio, and the microwave belong. For example, a disk (disk) and a disc (disc) used in embodiments of this application include a compact disc (compact disc, CD), a laser disc, an optical disc, a digital video disc (digital video disc, DVD), a floppy disk and a Blu-ray disc. The disk generally copies data by a magnetic means, and the disc copies data optically by a laser means. The foregoing combination should also be included in the protection scope of the computer-readable medium.

[00364] In summary, the foregoing descriptions are merely embodiments of this application, and are not intended to limit the protection scope of this application. Any modification, equivalent substitution, and improvement made based on the disclosure of this application shall fall within the protection scope of this application.

CLAIMS

1. A communication method, comprising:

receiving, by a call session control function network element, first invitation request information of a first terminal, wherein the first invitation request information requests to communicate with a second terminal;

obtaining, by the call session control function network element, first access information and second access information, wherein the first access information indicates that the first terminal accesses a network via a satellite, and the second access information indicates that the second terminal accesses a network via a satellite;

determining, by the call session control function network element based on the first access information and the second access information, to establish direct communication for the first terminal and the second terminal, wherein the direct communication means that data of an internet protocol multimedia subsystem (IMS) service between the first terminal and the second terminal is directly transmitted between a first satellite through which the first terminal accesses the network and a second satellite through which the second terminal accesses the network; and

sending, by the call session control function network element, first request information to a first network element, wherein the first request information indicates to establish the direct communication between the first terminal and the second terminal.

2. The method according to claim 1, wherein obtaining, by the call session control function network element, the first access information comprises:

obtaining, by the call session control function network element, the first access information from the first terminal or a policy control function network element corresponding to a session of the first terminal, wherein the session of the first terminal is used for transmission of the data of the IMS service.

3. The method according to claim 1, wherein obtaining, by the call session control function network element, the second access information comprises:

obtaining, by the call session control function network element, the second access information from the second terminal, a policy control function network element corresponding to a session of the second terminal, or a call session control function network element corresponding to the second terminal, wherein the session of the second terminal is used for transmission of the data of the IMS service.

4. The method according to any one of claims 1 to 3, wherein before determining, by the call session control function network element based on the first access information and the second access information, to establish the direct communication for the first terminal and the second

terminal, the method further comprises:

obtaining, by the call session control function network element, first network direct communication capability information, wherein the first network direct communication capability information indicates that a first network supports the direct communication, and the first terminal and the second terminal access the first network.

5. The method according to any one of claims 1 to 3, wherein before determining, by the call session control function network element based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further comprises:

receiving, by the call session control function network element, first direct communication subscription information and second direct communication subscription information, wherein the first direct communication subscription information indicates that the first terminal is allowed to perform the direct communication, and the second direct communication subscription information indicates that the second terminal is allowed to perform the direct communication.

6. The method according to any one of claims 1 to 3, wherein before determining, by the call session control function network element based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, the method further comprises:

obtaining, by the call session control function network element, first media feature support information and second media feature support information, wherein the first media feature support information indicates a media feature used by the first terminal for the IMS service, and the second media feature support information indicates a media feature used by the second terminal for the IMS service.

7. The method according to claim 1, wherein the first invitation request information comprises direct communication request indication information, and the direct communication request indication information indicates that the first terminal expects to perform the direct communication with the second terminal.

8. The method according to any one of claims 1 to 6, wherein the first request information comprises identification information of the first terminal and identification information of the second terminal.

9. The method according to any one of claims 1 to 6, wherein the first request information comprises quality of service QoS information used for the direct communication.

10. The method according to any one of claims 1 to 9, wherein the method further comprises:

sending, by the call session control function network element, first invitation response information to the first terminal, wherein the first invitation response information indicates that

the direct communication between the first terminal and the second terminal is accepted.

11. A call session control function network element, comprising a receiving unit, a processing unit, and a sending unit, wherein

the receiving unit is configured to receive first invitation request information of a first terminal, wherein the first invitation request information requests to communicate with a second terminal;

the receiving unit is further configured to obtain first access information and second access information, wherein the first access information indicates that the first terminal accesses a network via a satellite, and the second access information indicates that the second terminal accesses a network via a satellite;

the processing unit is configured to determine, based on the first access information and the second access information, to establish direct communication for the first terminal and the second terminal, wherein the direct communication means that data of an internet protocol multimedia subsystem (IMS) service between the first terminal and the second terminal is directly transmitted between a first satellite through which the first terminal accesses the network and a second satellite through which the second terminal accesses the network; and

the sending unit is configured to send first request information to a first network element, wherein the first request information indicates to establish the direct communication between the first terminal and the second terminal.

12. The call session control function network element according to claim 11, wherein when obtaining the first access information, the receiving unit is specifically configured to obtain the first access information from the first terminal or a policy control function network element corresponding to a session of the first terminal, wherein the session of the first terminal is used for transmission of the data of the IMS service.

13. The call session control function network element according to claim 11, wherein when obtaining the second access information, the receiving unit is specifically configured to obtain the second access information from the second terminal, a policy control function network element corresponding to a session of the second terminal, or a call session control function network element corresponding to the second terminal, wherein the session of the second terminal is used for transmission of the data of the IMS service.

14. The call session control function network element according to any one of claims 11 to 13, wherein the receiving unit is further configured to: before the processing unit determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, obtain first network direct communication capability information, wherein the first network direct communication capability

information indicates that a first network supports the direct communication, and the first terminal and the second terminal access the first network.

15. The call session control function network element according to any one of claims 11 to 13, wherein the receiving unit is further configured to: before the processing unit determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, receive first direct communication subscription information and second direct communication subscription information, wherein the first direct communication subscription information indicates that the first terminal is allowed to perform the direct communication, and the second direct communication subscription information indicates that the second terminal is allowed to perform the direct communication.

16. The call session control function network element according to any one of claims 11 to 13, wherein the receiving unit is further configured to: before the processing unit determines, based on the first access information and the second access information, to establish the direct communication for the first terminal and the second terminal, obtain first media feature support information and second media feature support information, wherein the first media feature support information indicates a media feature used by the first terminal for the IMS service, and the second media feature support information indicates a media feature used by the second terminal for the IMS service.

17. The call session control function network element according to claim 11, wherein the first invitation request information comprises direct communication request indication information, and the direct communication request indication information indicates that the first terminal expects to perform the direct communication with the second terminal.

18. The call session control function network element according to any one of claims 11 to 16, wherein the first request information comprises identification information of the first terminal and identification information of the second terminal.

19. The call session control function network element according to any one of claims 11 to 16, wherein the first request information comprises quality of service QoS information used for the direct communication.

20. The call session control function network element according to any one of claims 11 to 19, wherein the sending unit is further configured to send first invitation response information to the first terminal, wherein the first invitation response information indicates that the direct communication between the first terminal and the second terminal is accepted.

21. A non-volatile computer-readable storage medium, storing a computer program, wherein the computer program is loaded by a processor to perform the method according to any one of claims 1 to 10.

22. A communication apparatus, comprising:

a processor, wherein the processor is coupled to a memory, and the processor is configured to invoke computer program instructions stored in the memory, to perform the method according to any one of claims 1 to 10.

23. A computer program product, wherein the computer program product stores instructions, and when the instructions are run on a computer, the computer is enabled to perform the method according to any one of claims 1 to 10.