# SPECIFICATION

# TITLE OF INVENTION: HANDOVER METHOD AND APPARATUS

[0001] This application claims priority to Chinese Patent Application No. 202410358721.3, filed with the China National Intellectual Property Administration on March 25, 2024 and entitled "HANDOVER METHOD AND APPARATUS", which is incorporated herein by reference in its entirety.

## TECHNICAL FIELD

[0002] This application relates to the field of communication technologies, and in particular, to a handover method and apparatus.

## BACKGROUND

[0003] A non-terrestrial communication network (non-terrestrial network, NTN), including nodes such as satellite networks, high-altitude platforms, and uncrewed aerial vehicles, has significant advantages such as global coverage, long-distance transmission, flexible networking, convenient deployment, and independence from geographical conditions, and has been widely applied in a plurality of fields such as maritime communication, positioning and navigation, emergency and disaster relief, scientific research, video broadcasting, and earth observation. A 5G terrestrial network, a satellite network, and the like are integrated to complement each other, forming a global seamless communication network across sea, land, air, space, and ground, thereby meeting network requirements of ubiquitous services of users.

[0004] In a satellite communication system, movement of a satellite node may cause group handover or group reselection problems for users within a particular area (also referred to as a beam position). Due to the rapid movement of satellite nodes, distances between a plurality of base stations involved in group handover or group reselection are relatively large, and usually no interface exists between the base stations. Therefore, such group handover or group reselection needs to be performed via a relay node. In addition, in satellite communication scenarios, the frequency of group handover is high. Existing handover or reselection procedures are designed for

static relay nodes, resulting in high data transmission delay and being unsuitable for relay node mobility. Therefore, a new targeted design is required in mobile relay scenarios, to improve the effectiveness of mobility management.

## SUMMARY

[0005] This application provides a handover method and apparatus to improve handover efficiency.

[0006] According to a first aspect, an embodiment of this application provides a handover method. The method may be applied to a side of a relay node, for example, a relay node or a component (for example, a circuit, a chip, or a chip system) in a relay node. Using an example in which the method is applied to the relay node, the method includes: receiving relay information from a core network element, where the relay information includes a network device handover condition and an identifier of the relay node; performing handover from a first network device to a second network device based on the network device handover condition; and receiving a handover acknowledgement from the second network device, where the handover acknowledgement is sent by the second network device based on an authentication result after the second network device authenticates the identifier.

[0007] Based on the foregoing method, the dedicated identifier of the relay node can be authenticated, and network device handover can be performed based on the authentication result, to avoid signaling overheads caused by unnecessary user data transmission in an authentication process. In addition, handover is performed based on the network device handover condition, to simplify the handover procedure, thereby improving handover efficiency.

[0008] In a possible design, the network device handover condition includes at least one of the following: a clock of the relay node is located at a first time node; a distance between a location of the relay node and a preset reference location meets a first threshold; and signal quality between the relay node and the first network device is less than a second threshold and/or signal quality between the relay node and the second network device is greater than a third threshold.

[0009] Based on the foregoing method, a plurality of factors such as the location, the time, and the signal quality can be considered during handover, to avoid low network device handover efficiency caused by a single factor, thereby improving flexibility of network control.

[0010] In a possible design, after the receiving the relay information from the core network element, the method further includes: sending a configuration acknowledgement to the first network device.

[0011] In a possible design, after the receiving the handover acknowledgement sent by the

second network device after the second network device authenticates the identifier, the method further includes: completing, based on the handover acknowledgement, data transmission between a terminal device and the second network device; or rejecting, based on the handover acknowledgement, data transmission between a terminal device and the second network device.

[0012] In a possible design, the handover acknowledgement includes control signaling; and the completing, based on the handover acknowledgement, data transmission between the terminal device and the second network device includes: completing, based on the control signaling, data transmission between the terminal device and the second network device.

[0013] In a possible design, the relay node includes a first relay child node and a second relay child node.

[0014] In a possible design, the method further includes: receiving a service request from a terminal device; in response to the service request being a first-type service, storing and forwarding service data corresponding to the service request via the first relay child node; and/or in response to the service request being a second-type service, transparently forwarding the service data corresponding to the service request via the second relay child node.

[0015] Based on the foregoing method, corresponding forwarding modes can be used for different types of services by configuring the relay node, so that quality of service requirements of the services can be met, and data forwarding efficiency can also be improved.

[0016] In a possible design, the relay information is generated by the core network element based on a target access request; and before the receiving the relay information from the core network element, the method further includes: sending the target access request to the core network element.

[0017] In a possible design, the sending the target access request to the core network element includes: sending the target access request to the core network element via the first network device; and the receiving the relay information from the core network element includes: receiving the relay information from the core network element via the first network device,.

[0018] In a possible design, the target access request includes node capability information of the relay node, and the node capability information indicates whether the relay node supports simultaneous connection with a plurality of network devices.

[0019] Based on the foregoing method, the relay node may be adapted based on a capability of the relay node, to reduce a mobility interruption time.

[0020] In a possible design, the method further includes: updating configuration information of the first network device based on a type of a cell corresponding to the first network device; or updating configuration information of the second network device based on a type of a cell corresponding to the second network device.

[0021] Based on the foregoing method, different types of cells use corresponding types of configuration update manners, so that frequency of updating configuration information can be reduced.

[0022] In a possible design, the type of the cell is a non-terrestrial network cell or a terrestrial network cell; the updating the configuration information of the first network device based on the type of the cell corresponding to the first network device includes: in response to the cell type being the terrestrial network cell, updating the configuration information of the first network device based on event triggering; and in response to the cell type being the non-terrestrial network cell, updating the configuration information of the first network device based on a preset period and/or a neighboring cell activation status; and the updating the configuration information of the second network device based on the type of the cell corresponding to the second network device includes: in response to the cell type being the terrestrial network cell, updating the configuration information of the second network device based on event triggering; and in response to the cell type being the non-terrestrial network cell, updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status.

[0023] In a possible design, the method further includes: in response to updating the configuration information of the first network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of a system information block (for example, a SIB 1); or in response to updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of the system information block (for example, the SIB 1).

[0024] In a possible design, the target access request includes no session indication information.

[0025] According to a second aspect, an embodiment of this application provides a handover method. The method may be applied to a side of a second network device, for example, a second network device or a component (for example, a circuit, a chip, or a chip system) in a second network device. Using an example in which the method is applied to the second network device, the method includes: receiving an identifier of a relay node sent by a core network element; authenticating the identifier; and sending a handover acknowledgement to the relay node based on an authentication result.

[0026] Based on the foregoing method, the dedicated identifier of the relay node can be authenticated, and network device handover can be performed based on the authentication result, to avoid signaling overheads caused by unnecessary user data transmission in an authentication process. In addition, handover is performed based on the network device handover condition, to simplify the handover procedure, thereby improving handover efficiency.

[0027] In a possible design, after the sending the handover acknowledgement to the relay node based on the authentication result, the method further includes: sending a connection establishment acknowledgement to the core network element, where the connection establishment acknowledgement includes the identifier of the relay node.

[0028] In a possible design, the relay information further includes local network device authentication information; and the method further includes: in response to the second network device not being present in the local network device authentication information, sending a context update request to the core network element, where the context update request is configured to update the local network device authentication information and/or the identifier of the relay node; and receiving updated local network device authentication information and/or an updated identifier of the relay node sent by the core network element.

[0029] In a possible design, before the sending the context update request to the core network element, the method further includes: receiving a local authentication result notification from a side of the relay node, where the local authentication result notification indicates whether the second network device is present in the local network device authentication information.

[0030] According to a third aspect, an embodiment of this application provides a communication apparatus, used on a side of a relay node, and configured to perform the following steps: receiving relay information from a core network element, where the relay information includes a network device handover condition and an identifier of the relay node; performing handover from a first network device to a second network device based on the network device handover condition; and receiving a control signaling handover acknowledgement from the second network device, where the control signaling handover acknowledgement is sent by the second network device based on an authentication result after the second network device authenticates the identifier. For operations performed by the communication apparatus and beneficial effects, refer to the method and the beneficial effects in the first aspect.

[0031] In a possible design, the network device handover condition includes at least one of the following conditions: a clock of the relay node is located at a first time node; a distance between a location of the relay node and a preset reference location meets a first threshold; and signal quality between the relay node and the first network device is less than a second threshold and/or signal quality between the relay node and the second network device is greater than a third threshold.

[0032] In a possible design, the apparatus is further configured to send a configuration acknowledgement to the first network device.

[0033] In a possible design, the apparatus is further configured to: complete, based on the handover acknowledgement, data transmission between a terminal device and the second network

device; or reject, based on the handover acknowledgement, data transmission between a terminal device and the second network device.

[0034] In a possible design, the handover acknowledgement includes control signaling; and the completing, based on the handover acknowledgement, data transmission between the terminal device and the second network device includes: completing, based on the control signaling, data transmission between the terminal device and the second network device.

[0035] In a possible design, the relay node includes a first relay child node and a second relay child node.

[0036] In a possible design, the apparatus is further configured to: receive a service request from a terminal device; in response to the service request being a first-type service, store and forward service data corresponding to the service request via the first relay child node; and/or in response to the service request being a second-type service, transparently forward the service data corresponding to the service request via the second relay child node.

[0037] In a possible design, the relay information is generated by the core network element based on a target access request; and the apparatus is further configured to: send the target access request to the core network element.

[0038] In a possible design, the apparatus is further configured to: send the target access request to the core network element via the first network device; and the receiving the relay information from the core network element includes: receiving the relay information from the core network element via the first network device.

[0039] In a possible design, the target access request includes node capability information of the relay node, and the node capability information indicates whether the relay node supports simultaneous connection with a plurality of network devices.

[0040] In a possible design, the apparatus is further configured to: update configuration information of the first network device based on a type of a cell corresponding to the first network device; or update configuration information of the second network device based on a type of a cell corresponding to the second network device.

[0041] In a possible design, the type of the cell is a non-terrestrial network cell or a terrestrial network cell; and the apparatus is further configured to: in response to the cell type being the terrestrial network cell, update the configuration information of the first network device based on event triggering; in response to the cell type being the non-terrestrial network cell, update the configuration information of the first network device based on a preset period and/or a neighboring cell activation status; in response to the cell type being the terrestrial network cell, update the configuration information of the second network device based on event triggering; and in response to the cell type being the non-terrestrial network cell, update the configuration information of the

second network device based on the preset period and/or the neighboring cell activation status.

[0042] In a possible design, the apparatus is further configured to: in response to updating the configuration information of the first network device based on the preset period and/or the neighboring cell activation status, skip triggering an update of a system information block SIB; or in response to updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status, skip triggering an update of the system information block SIB1.

[0043] In a possible design, the target access request includes no session indication information.

[0044] According to a fourth aspect, an embodiment of this application further provides a communication apparatus, used on a side of a second network device, and configured to perform the following steps: receiving an identifier of a relay node sent by a core network element; authenticating the identifier; and sending a handover acknowledgement to the relay node based on an authentication result. For operations performed by the communication apparatus and beneficial effects, refer to the method and the beneficial effects in the second aspect.

[0045] In a possible design, the apparatus is further configured to: send a connection establishment acknowledgement to the core network element, where the connection establishment acknowledgement includes the identifier of the relay node.

[0046] In a possible design, the relay information further includes local network device authentication information; and the apparatus is further configured to: in response to the second network device not being present in the local network device authentication information, send a context update request to the core network element, where the context update request is configured to update the local network device authentication information and/or the identifier of the relay node; and receive updated local network device authentication information and/or an updated identifier of the relay node sent by the core network element.

[0047] In a possible design, the apparatus is further configured to: receive a local authentication result notification from a side of the relay node, where the local authentication result notification indicates whether the second network device is present in the local network device authentication information.

[0048] According to a fifth aspect, this application provides a communication apparatus. The communication apparatus may perform the method according to the first aspect. The communication apparatus has functions for implementing the first aspect. For example, the communication apparatus includes a corresponding module or unit or means (means) for performing an operation in the first aspect. The module or unit or means may be specifically implemented by using software, or may be implemented by using hardware, or may be

implemented by using a combination of software and hardware. For operations performed by the communication apparatus and beneficial effects, refer to the method and the beneficial effects in the first aspect. In a possible design, the communication apparatus includes a processing unit.

[0049] In a possible design, the communication apparatus further includes a transceiver unit.

[0050] In a possible design, the communication apparatus further includes a storage unit.

[0051] In a possible design, the communication apparatus further includes a transceiver unit and a storage unit.

[0052] According to a sixth aspect, this application provides a communication apparatus. The communication apparatus may perform the method according to the second aspect. The communication apparatus has functions for implementing the second aspect. For example, the communication apparatus includes a corresponding module or unit or means (means) for performing an operation in the second aspect. The module or unit or means may be specifically implemented by using software, or may be implemented by using hardware, or may be implemented by using a combination of software and hardware. For operations performed by the communication apparatus and beneficial effects, refer to the method and the beneficial effects in the second aspect.

[0053] In a possible design, the communication apparatus includes a processing unit.

[0054] In a possible design, the communication apparatus further includes a transceiver unit.

[0055] In a possible design, the communication apparatus further includes a storage unit.

[0056] In a possible design, the communication apparatus further includes a transceiver unit and a storage unit.

[0057] According to a seventh aspect, this application provides a communication apparatus. The communication apparatus includes a memory and one or more processors. The memory is configured to store a part or all of necessary computer programs or instructions for implementing the function in the first aspect. The one or more processors may execute the computer programs or instructions, and when the computer programs or instructions are executed, the communication apparatus is enabled to implement the method in any possible design or implementation of the first aspect.

[0058] In a possible design, the communication apparatus may further include an interface circuit, and the processor is configured to communicate with another apparatus or component through the interface circuit.

[0059] In a possible design, the communication apparatus may further include the memory.

[0060] The communication apparatus may be a terminal, a communication module in the terminal, or a chip that is responsible for a communication function in the terminal, for example, a modem chip (also referred to as a baseband chip), or a SoC or SIP chip that includes a modem

module.

[0061] According to an eighth aspect, this application provides a communication apparatus. The communication apparatus includes a memory and one or more processors. The memory is configured to store a part or all of necessary computer programs or instructions for implementing the function in the second aspect. The one or more processors may execute the computer programs or instructions, and when the computer programs or instructions are executed, the communication apparatus is enabled to implement the method in any possible design or implementation of the second aspect.

[0062] According to a ninth aspect, this application provides a communication system, including the apparatus according to the third aspect and the apparatus according to the fourth aspect; or including the apparatus according to the fifth aspect and the apparatus according to the sixth aspect; or including the apparatus according to the seventh aspect and the apparatus according to the eighth aspect.

[0063] According to a tenth aspect, this application provides a computer-readable storage medium, where the computer-readable storage medium stores instructions or a program, and when the instructions or the program is run on a communication apparatus, the communication apparatus is enabled to execute the instructions of the method in the first aspect, the second aspect, any possible implementation of the first aspect, or any possible implementation of the second aspect.

[0064] According to an eleventh aspect, this application provides a computer program product, where the computer program product includes a computer program or instructions, and when the computer program or the instructions are run on a computer, the computer is enabled to execute the instructions of the method in the first aspect, the second aspect, any possible implementation of the first aspect, or any possible implementation of the second aspect.

## BRIEF DESCRIPTION OF DRAWINGS

[0065] FIG. 1 is a diagram of a network architecture according to an embodiment of this application;

[0066] FIG. 2 is a diagram of an NCR-based network architecture according to an embodiment of this application;

[0067] FIG. 3 is a schematic flowchart of a network device handover method according to an embodiment of this application;

[0068] FIG. 4 is a schematic flowchart of NCR node handover according to an embodiment of this application;

[0069] FIG. 5A is a diagram of data transmission during NCR soft handover according to an

embodiment of this application;

[0070] FIG. 5B is a diagram of data transmission during NCR hard handover according to an embodiment of this application;

[0071] FIG. 6A is a diagram of data transmission of an NCR node according to an embodiment of this application;

[0072] FIG. 6B is another diagram of data transmission of an NCR node according to an embodiment of this application;

[0073] FIG. 7 is a schematic flowchart of another network device handover method according to an embodiment of this application;

[0074] FIG. 8 is a diagram of a structure of a communication system according to an embodiment of this application;

[0075] FIG. 9 is a diagram of a structure of another communication apparatus according to an embodiment of this application; and

[0076] FIG. 10 is a diagram of a structure of another communication apparatus according to an embodiment of this application.

## DESCRIPTION OF EMBODIMENTS

[0077] Embodiments of this application provide a network device handover method, a communication apparatus, a system, a storage medium, and a computer program product, to ensure normal access of a mobile relay device. The following describes technical solutions of embodiments in this application with reference to accompanying drawings.

[0078] The technical solutions of this application may be applied to a terrestrial network (terrestrial network, TN), a non-terrestrial network (non-terrestrial network, NTN), or an NTN-TN integration scenario. An NTN system may be, for example, a satellite communication system, a high altitude platform station (high altitude platform station, HAPS) communication system, or a global navigation satellite system (global navigation satellite system, GNSS). A TN system may be, for example, a 4th generation (4th generation, 4G) communication system (for example, a long term evolution (long term evolution, LTE) system), a worldwide interoperability for microwave access (worldwide interoperability for microwave access, WiMAX) communication system, a 5th generation (5th generation, 5G) communication system (for example, a new radio (new radio, NR) system), a 6th generation mobile communication (6th generation mobile communication, 6G) system, or a future mobile communication system.

[0079] To better understand embodiments of this application, the following first describes a network architecture in embodiments of this application. Refer to FIG. 1. FIG. 1 is a diagram of a

network architecture according to an embodiment of this application. As shown in FIG. 1, the network architecture may include a terminal device, a relay device, a network device, and a core network element. FIG. 1 shows only a case of one terminal device, one relay device, and one network device. A link between the terminal device and the relay device is an access link, a link between the relay device and the network device is a backhaul link, and both the access link and the backhaul link are wireless links. The relay device is configured to: provide a wireless access service for the terminal device, and connect to the network device through the wireless backhaul link to transmit service data of a user. The network device is configured to connect to a core network element through a wired link.

[0080] The terminal device may be referred to as user (user equipment, UE), a mobile station, a mobile station (mobile station, MS), a mobile terminal (mobile terminal, MT), or the like, and is a device that provides voice and/or data connectivity for a user. The terminal device may be a mobile phone (mobile phone), a handheld terminal, customer premises equipment (customer premises equipment, CPE), a notebook computer, a subscriber unit (subscriber unit), a cellular phone (cellular phone), a smartphone (smartphone), a compute device, a wireless data card, a personal digital assistant (personal digital assistant, PDA) computer, a tablet computer, a computer having a wireless transceiver function, a wireless modem (modem), a tactile terminal device, a handheld (handheld) device, a laptop computer (laptop computer), a session initiation protocol (session initiation protocol, SIP) phone, a cordless phone (cordless phone), or a wireless local loop (wireless local loop, WLL) station, a machine type communication (machine type communication, MTC) terminal, a wearable device (for example, a smart watch, a smart band, or a pedometer), an in-vehicle terminal device (for example, a car, a bicycle, an electric vehicle, an airplane, a ship, a train, or a high-speed train), an extended reality (extended reality, XR) terminal device, a virtual reality (virtual reality, VR) terminal device, an augmented reality (augmented reality, AR) terminal device, a wireless terminal in industrial control (industrial control), a smart home device (for example, a refrigerator, a TV, an air conditioner, or an electric meter), a smart robot, a workshop device, a wireless terminal in self-driving (self-driving), a wireless terminal in remote medical surgery (remote medical surgery), a wireless data card, a wireless terminal in a smart grid (smart grid), a wireless terminal in transportation safety (transportation safety), a wireless terminal in a smart city (smart city), a wireless terminal in a smart home (smart home), a flight device (for example, a smart robot, a hot air balloon, an uncrewed aerial vehicle, or an airplane), or another device that can access a network.

[0081] In addition, the terminal device may alternatively be a terminal device in a future communication system (for example, a 6th generation (6th generation, 6G) communication system), a terminal device in a future evolved public land mobile network (public land mobile

network, PLMN), or the like. For example, a 6G network may further extend a form and a function of a terminal device of 5G communication, and a 6G terminal device includes but is not limited to a vehicle, a cellular network terminal device (integrating a function of a satellite terminal), an uncrewed aerial vehicle, and an internet of things (internet of things, IoT).

[0082] The relay device is configured to provide the wireless access service for the terminal device, and service data of the terminal device is transmitted by the relay device to the network device through the wireless backhaul link. The relay device may also be referred to as a mobile relay (mobile relay, MR) device, such as a vehicle-mounted mobile relay or a satellite relay. The relay device may be a fixed relay device, or may be a mobile (mobile) relay device. A location of the fixed relay device is fixed, and a location of the mobile relay device may change with time. The network device may include an access network element in which a central unit (central unit, CU) and a distributed unit (distributed unit, DU) are separated. The network device may include an evolved NodeB (evolved NodeB, eNB, or eNodeB) in long term evolution. The access network device may further include a next generation NodeB (next generation NodeB, gNB) or a transmission reception point (transmission reception point, TRP) in a 5G network, a next generation base station in a 6th generation (6th generation, 6G) mobile communication system, or a base station in a future mobile communication system. The access network device may further include a base station evolved from a 3rd generation partnership project (3rd generation partnership project, 3GPP), a base station in a future evolved PLMN, a broadband network gateway (broadband network gateway, BNG), a 3GPP aggregation switch or a non-3GPP access device, an access point (access point, AP) in a wireless fidelity (wireless fidelity, Wi-Fi) system, a transmission point (transmission point, TP), a mobile switching center, or the like, or may be a device that functions as a base station in device-to-device (device-to-device, D2D), vehicle-to-everything (vehicle-to-everything, V2X), or machine-to-machine (machine-to-machine, M2M) communication. The network device may be a macro base station, or may be a micro base station, an indoor base station, or the like.

[0083] The core network element is a device in a core network (core network, CN) that provides service support for the terminal device, and is mainly responsible for registration, call connection, charging, mobility management, and providing functions such as user connection, user management, and service bearer completion, data processing, and routing. The core network element may correspond to different devices in different communication systems, for example, in a 4th generation (4th generation, 4G) communication system, may correspond to one or more of a mobility management entity (mobility management entity, MME), a serving gateway (serving gateway, S-GW), and the like. For another example, in a 5G communication system, the core network element may correspond to one or more network elements of 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 user plane function (user plane function, UPF) network element, and the like. In a next generation communication system or a future communication system, the core network element may be one or more network elements, devices, or entities that provide service support for the terminal device.

[0084] It should be noted that the network architecture shown in FIG. 1 is not limited to the terminal device, the relay node, the network device, and the core network element shown in the figure, and may further include other terminal devices, relay devices, network devices, and core network elements that are not shown in the figure. Details are not listed herein in this application.

[0085] For example, a network-controlled repeater (Network-Controlled Repeater, NCR) is a relay device, and is configured to amplify and forward a signal when a terminal device accesses a base station, and includes two parts: an NCR-MT (Mobile Terminal) and an NCR-FWD (Forwarding).

[0086] FIG. 2 is a diagram of an NCR-based network architecture according to this application. As shown in FIG. 2, the NCR-MT is connected to a base station gNB, for example, may be connected through an LTE Uu interface (User to Network Interface-Universal, Uu) interface, and receive control information of the base station gNB through a control link. The NCR-MT controls the NCR by using a control link C-link (control link). For example, the NCR may receive control information (that is, side control information (Side Control Information)) of the base station through the control link, including a direction of a backhaul link (Backhaul link), a backhaul beam, or a control link beam, to implement switch-on/switch-off and power control of the NCR. The NCR-FWD supports transparent forwarding (Amplify and forwarding) of data between the base station and the UE through the backhaul link and an access link (Access link).

[0087] For example, the NCR may be disposed in a non-terrestrial network system such as a satellite communication system, a high altitude platform station (high altitude platform station, HAPS) communication system, or an uncrewed aerial vehicle, for example, an integrated communication and navigation (integrated communication and navigation, ICAN) system, a global navigation satellite system (global navigation satellite system, GNSS), or an ultra-dense low-earth orbit satellite communication system. The satellite communication system may be integrated with a conventional mobile communication system. For example, the mobile communication system may be a 4th generation (4th generation, 4G) communication system (for example, a long term evolution (long term evolution, LTE) system), a worldwide interoperability for microwave access (worldwide interoperability for microwave access, WiMAX) communication system, a 5th generation (5th generation, 5G) communication system (for example, a new radio (new radio, NR) system), a 6th generation (6th generation, 6G) communication system,

a future mobile communication system, or the like.

[0088] The satellite communication system includes user equipment (UE) and a network device. The user equipment may also be referred to as a user terminal, a mobile station, or the like. The network device may include one or more satellites and ground station equipment. The ground station equipment may also be referred to as a core network device. The core network device includes a core network element. The satellite may be a low-earth orbit (low-earth orbit, LEO) satellite, a non-geostationary earth orbit (non-geostationary earth orbit, NGEO) satellite, or the like.

[0089] For ease of understanding of related content of embodiments of this application, the following further explains and describes some terms and procedures in embodiments of this application. This part is merely for ease of understanding, and cannot be considered as a disclosure or a specific limitation on the technical solutions of this application.

[0090] 1. Staring (earth-fixed or quasi-earth fixed) and non-staring

[0091] In a satellite communication system, based on a working mode of payload (such as a beam), satellite communication systems may be classified into staring (earth-fixed or quasi-earth fixed) and non-staring (earth-moving) satellite communication systems. In a specific time period in the non-staring satellite communication system, a coverage area of a satellite beam moves with a satellite. In a specific time period in the staring satellite communication system, the satellite dynamically adjusts a beam direction, so that the beam approximately covers a same area on the ground.

[0092] In the non-staring LEO satellite communication system, movement of a satellite node causes group handover (for connected-mode UEs) or group reselection (for idle-mode UEs) problems for users within a particular area (which may include one or more beam positions). Group handover is used as an example. A UE cluster in a single beam position in a particular area is served by one or more beams of a first satellite within a first time range. In a second time range, due to movement of the first satellite, the wave position cannot be served, and one or more beams of a second satellite replace a service of the UE cluster, that is, group handover occurs in the UE cluster.

[0093] 2. Mobility management

[0094] Mobility management mainly includes cell handover, cell reselection, registration update, and tracking area update. Using cell handover as an example, an existing handover procedure mainly includes the following steps:

[0095] (1) Cell handover measurement: A network delivers measurement configurations corresponding to a plurality of cells (including a serving cell and a neighboring cell) to UE, and the UE measures cell signal quality (for example, reference signal received power (Reference

Signal Received Power, RSRP) and/or reference signal received quality (Reference Signal Received Quality, RSRQ)) based on the measurement configurations. For example, a measurement signal may be a synchronization signal and PBCH block (Synchronization Signal and PBCH Block, SSB) signal or a CSI-RS (Channel State Information Reference Signal, channel state information reference signal) signal.

[0096] (2) Measurement result reporting: The UE reports a measurement result to the network. The reporting may be periodic reporting or event-triggered reporting. In the event-triggered reporting, a reporting condition is usually configured as that signal quality of a serving cell is less than a threshold 1 and/or signal quality of a neighboring cell is greater than a threshold 2.

[0097] (3) Handover decision: The network selects a proper neighboring cell based on the reported result, and exchanges user handover related information such as context information, admission control, and resource reservation.

[0098] (4) Handover execution: The UE receives handover-related control information from the serving cell, and completes an access procedure in a new cell.

[0099] 3. Near-far effect

[00100] Because a distance between a user and a base station changes randomly, if a transmit power of each user is the same, strengths of signals reaching the base station are different. Signals near the base station are strong, and signals far away from the base station are weak. This exacerbates nonlinearity of a communication system. This type of phenomenon is usually referred to as the near-far effect.

[00101] However, an existing communication protocol supports only a static NCR node, and does not support mobility of an NCR node. In a scenario of moving an NCR node, group handover triggered mainly by network movement becomes normal. However, an overall procedure of existing mobility management is complex, and NCR node handover generally does not relate to a data plane, and is a special type of handover. Therefore, if the existing procedure is reused, signaling overheads are large, and a communication interruption time is prolonged.

[00102] To improve communication efficiency of an NCR-based network architecture in a mobile scenario, and support service continuity of an NCR node during node handover, at least one embodiment of this application provides a network device handover method.

[00103] FIG. 3 is a schematic flowchart of a network device handover method according to at least one embodiment of this application. The method is applied to a side of a relay node. As shown in FIG. 3, the method includes steps S301 to S303.

[00104] Step S301: Receive relay information from a core network element, where the relay information includes a network device handover condition and an identifier of the relay node.

[00105] For example, the side of the relay node may include the relay device described above,

or a part such as a chip, a chip system, a circuit, a module, or a unit that provides a radio access service in a relay device. The core network element may be an AMF, or another network element that can implement a function related to registration management, security, access management, or service authorization. The identifier of the relay node may be a radio network temporary identifier (Radio Network Temporary Identifier, NCR-RNTI) or an identifier of a device related to the relay node, for example, a satellite identifier (satellite-ID, SAT-ID).

[00106] In a possible implementation, before receiving the relay information from the core network element, the relay node may further send a target access request to the core network element. For example, the relay information may be generated by the core network element based on the target access request. For example, the relay node may send the target access request to the core network element by using a first network device. For example, the relay node sends an initial access request to the first network device, and then the first network device sends access information of a terminal device to the core network element, where the access information of the terminal device includes the initial access request, and the relay node may receive, for example, the relay information from the core network element via the first network device.

[00107] For example, the target access request includes no session indication information. For example, the no session indication information may include no protocol data unit session indication (NO Protocol Data Unit Session Indication, NO PDU Session Indication) information, or other information that may indicate that the relay node does not generate user data. By reducing session indications, a handover procedure is simplified, and a data transmission delay is reduced, so as to enhance service continuity of the relay node.

[00108] For example, after receiving the relay information from the core network element, the relay node may further send a configuration acknowledgement to the first network device. For example, after the core network element sends the relay information to the first network device, the first network device puts the relay information into radio resource control (Radio Resource Control, RRC) reconfiguration information, and then sends the RRC reconfiguration information to the relay node. In response to receiving the RRC reconfiguration information, the relay node notifies the first network device by sending a reconfiguration acknowledgement.

[00109] In a possible implementation, the network device handover condition includes at least one of the following: a clock of the relay node is located at a first time node; a distance between a location of the relay node and a preset reference location meets a first threshold; and signal quality between the relay node and the first network device is less than a second threshold and/or signal quality between the relay node and the second network device is greater than a third threshold. For example, the first network device is a base station corresponding to a cell on which the terminal device served by the relay node currently camps, and the second network device may be, for

example, a base station corresponding to a neighboring cell of the cell on which the terminal device currently camps.

[00110] It may be understood that, because near-far effect in the NTN is not obvious (that is, a signal quality difference between a cell center and an edge is not obvious), efficiency of cell handover or reselection implemented based on signal quality is low. In view of this, in this application, location-assisted handover and reselection enhancement technologies are considered, so that mobility management in an NTN network can be implemented based on a time, a timer, UE location information (for example, a distance between the UE and the reference location of the cell corresponding to the first network device is greater than a first threshold, and a distance between the UE and the reference location of the cell corresponding to the second network device is less than a second threshold), a combination of the timer and signal quality, a combination of the location information and the signal quality, and other manners, to help improve accuracy of determining-related criteria in cell handover or reselection procedures, thereby improving communication efficiency of cell handover or reselection. In addition, the relay node may select thresholds and/or thresholds in the network handover condition based on an actual connection status between the relay node and the network device, to improve flexibility of network control.

[00111] Step S302: Perform handover from the first network device to the second network device based on the network device handover condition.

[00112] For example, when the relay node meets one or a combination of the foregoing network device handover conditions, efficiency of communication between the relay node and the first network device is lower than efficiency of communication between the relay node and the second network device. Therefore, the relay node switches from a state in which the relay node is connected to the first network device to a state in which the relay node is connected to the second network device.

[00113] S303: Receive a handover acknowledgement from the second network device, where the handover acknowledgement is sent by the second network device based on an authentication result after the second network device authenticates the identifier of the relay node.

[00114] For example, after receiving the initial access request sent by the relay node, and before the network device handover condition of the relay node is met, the core network element may pre-configure the identifier of the relay node, for example, the NCR-RNTI or the SAT-ID, for the second network device, and may pre-establish an NG connection between the core network and the second network device. After receiving the handover acknowledgement sent by the second network device after the second network device authenticates the identifier of the relay node, the relay node may further complete, based on the handover acknowledgement, data transmission between the terminal device and the second network device; or reject, based on the handover

acknowledgement, data transmission between a terminal device and the second network device.

[00115] In a possible implementation, when the relay node performs handover of a connection from the first network device to the second network device, the second network device may authenticate the identifier of the relay node. If the authentication fails, the second network device may send, to the relay node, a handover acknowledgement (for example, negative acknowledgement (Negative Acknowledgement, NACK) information) indicating that the authentication fails. After receiving the handover acknowledgement indicating that the authentication fails, the relay node rejects transmission, to the second network device, of data uploaded by the terminal device. If the authentication succeeds, the second network device may send, to the relay node, a handover acknowledgement indicating that the authentication succeeds. After receiving the authentication success acknowledgement, the relay node allows the data uploaded by the terminal device to be transmitted to the second network device.

[00116] In a possible implementation, the handover acknowledgement includes control signaling; and the completing, based on the handover acknowledgement, data transmission between the terminal device and the second network device includes: completing, based on the control signaling, data transmission between the terminal device and the second network device. For example, the control signaling may be the side control information described above.

[00117] An example in which an NCR node is used as the relay node, base stations are used as the first network device and the second network device, and an AMF is used as the core network element is used below to describe a process in which the NCR node performs handover of a connection from the first network device to the second network device. FIG. 4 is a schematic flowchart of NCR node handover according to at least one embodiment of this application. For ease of description, in the following, the first network device is represented by a source base station, and the second network device is represented by a target base station. As shown in FIG. 4, the handover process includes all or some of steps S401 to S409.

[00118] S401: The NCR node initiates an initial access request to the source base station, where access request information may carry a capability indication of the NCR node, the capability indication information includes NO PDU Session Indication indication information, and the NO PDU Session Indication indicates that the NCR node does not generate user data.

[00119] S402: The source base station sends a UE initial access message to the core network element AMF, where the UE initial access message includes the initial access request or includes content in the initial access request.

[00120] S403: The AMF delivers NCR authentication information, a dedicated identifier (the NCR-RNTI or the SAT-ID) in a current AMF registration area, and an NCR handover condition in a subsequent period of time to the source base station, where the handover condition includes one

or more of S403-1 to S403-3:

[00121] S403-1: A clock of the NCR node is located in [t1, t2].

[00122] S403-2: A distance between an NCR location and a reference location is greater than a first threshold, or a distance between the NCR location and a first reference location is greater than a first threshold, and a distance between the NCR location and a second reference location is less than a second threshold.

[00123] S403-3: Signal quality between the NCR and the source base station is less than a third threshold and/or signal quality between the NCR and the target base station is greater than a fourth threshold.

[00124] S404: Before the NCR handover condition is met, the AMF pre-configures, for the target base station, the dedicated identifier (the NCR-RNTI or the SAT-ID) corresponding to the NCR, and pre-establishes an NG connection to the target base station.

[00125] S405: The source base station sends an RRC reconfiguration message to the NCR node, where the reconfiguration message includes the handover condition of the NCR node.

[00126] S406: The NCR node returns an RRC reconfiguration acknowledgement to the source base station.

[00127] S407: When the handover condition is met (the NCR performs handover evaluation (HO (HandOver) Evaluation)), the NCR performs handover of a connection to the target base station or a cell corresponding to the target base station.

[00128] S408: The target base station authenticates (NCR Authentication) the NCR-MT based on the dedicated identifier delivered by the AMF; and if the authentication succeeds, returns a handover acknowledgement to the NCR, and delivers control signaling (side control information) of the new gNB; or if the authentication fails, returns NACK (failure acknowledgement) information to the NCR.

[00129] S409: The target base station returns an NG establishment completion acknowledgement to the core network, where the acknowledgement message includes the NCR-RNTI or the SAT-ID.

[00130] It should be noted that steps S401 to S409 are an example of a network device handover process, and specific names of involved devices, nodes, and the like are also examples. In an actual network device handover process, performed steps may include all or some of the foregoing steps S401 to S409.

[00131] In this embodiment of this application, the identifier of the relay node is authenticated, and connection handover between the relay node and different network devices is completed based on an authentication result, to reduce data transmission and signaling overheads. In addition, the NO PDU Session Indication indication information is added to avoid additional session indication

information, so that an NCR node handover procedure is simplified.

[00132] In a satellite communication scenario, as described above, the relay node NCR may include two parts: the NCR-MT and the NCR-FWD, which respectively undertake different functions. The NCR-FWD may undertake, for example, a function of transparently transmitting data, and the NCR-MT may control, for example, based on the handover acknowledgement from the second network device, signal transmission or control whether the NCR-FWD performs data transparent transmission.

[00133] In a possible implementation, the relay node includes a first relay child node and a second relay child node.

[00134] For example, the first relay child node may be an NCR-MT, and the second relay child node may be an NCR-FWD.

[00135] In a possible implementation, the target access request includes node capability information of the relay node, and the node capability information indicates whether the relay node supports simultaneous connection with a plurality of network devices.

[00136] For example, reporting of the node capability information may be carried by using signaling related to an initial access procedure, for example, a message (Message, MSG) 3, an MSG 5, or RRC reconfiguration information.

[00137] For example, the first relay child node configures the second relay child node to be in a first handover mode or a second handover mode based on the node capability information.

[00138] When the second relay child node is in the first handover mode, the first relay child node supports simultaneous connection with a plurality of network devices (for example, the first network device and the second network device). When the second relay child node is in the second handover mode, the first relay child node does not support simultaneous connection with a plurality of network devices. For example, at a same moment, the relay child node can be connected to only one network device (for example, the first network device or the second network device).

[00139] In response to the second relay child node being in the first handover mode, control signaling corresponding to the second network device is activated; and/or

[00140] in response to the second relay child node being in the second handover mode, after communication with the first network device is interrupted, the control signaling corresponding to the second network device is activated.

[00141] Because NCR-MTs in relay nodes on different satellites support different modes of connection with network devices, NCR-MTs on some satellites support SoftHO (soft handover), that is, the NCR-MTs support establishment of communication connection with both the first network device and the second network device; and NCR-MTs on some satellites support only

HardHO (hard handover), that is, the NCR-MTs do not support establishment of communication connection with both the first network device and the second network device.

[00142] Before the NCR node performs handover of the connection from the first base station to the second base station based on the network device handover condition, the NCR-MT configures a handover mode of the NCR-FWD based on whether the NCR-MT supports SoftHO (node capability information). When the NCR-MT supports SoftHO, the NCR-FWD is configured to be in the first handover mode; or when the NCR-MT does not support SoftHO, the NCR-FWD is configured to be in the second handover mode.

[00143] FIG. 5A is a diagram of data transmission during NCR soft handover according to at least one embodiment of this application. FIG. 5B is a diagram of data transmission during NCR hard handover according to at least one embodiment of this application. As shown in FIG. 5A, in the first handover mode, when the NCR performs handover of the connection from the first network device to the second network device, the NCR-MT may be connected to control links of both the first network device and the second network device, and may directly activate a configuration corresponding to control signaling sent by the second network device, so as to complete data transmission between the terminal device (UE-1 and UE-2 in the figure) and the network devices through the backhaul link and the access link. As shown in FIG. 5B, in the second handover mode, when the NCR performs handover of the connection from the first network device to the second network device, the connection to the first network device needs to be first disconnected (a red cross in the figure), and then the control link to the second network device is activated based on a requirement. Before the connection between the NCR-MT and the second network device is activated, data transmission of the terminal device may be interrupted. In this embodiment of this application, a mobility interruption time can be reduced by adapting a capability of the NCR node.

[00144] Because the NCR-MT has a particular data processing capability, a working mode of the NCR may be dynamically configured for different types of services. FIG. 6A is a diagram of data transmission of an NCR node according to at least one embodiment of this application. FIG. 6B is another diagram of data transmission of an NCR node according to at least one embodiment of this application. The following describes, with reference to FIG. 6A and FIG. 6B, how to dynamically configure different types of services according to an embodiment of this application.

[00145] In a possible implementation, the network device handover method further includes: receiving a service request from a terminal device; in response to the service request being a first-type service, storing and forwarding service data corresponding to the service request via the first relay child node; and/or in response to the service request being a second-type service, transparently forwarding the service data corresponding to the service request via the second relay

child node.

[00146] For example, the first-type service is a delay-insensitive type service, for example, a non-real-time IoT service. As shown in FIG. 6A, terminal devices upload a data packet to the NCR-MT through an access link, and the NCR-MT stores the data packet and then forwards the data packet to a network device through a control link. The data packet may be, for example, generated by packaging local data by the terminals. In this case, service data is stored and forwarded (Store-and-forward, SF) by using the NCR-MT.

[00147] For example, the second-type service is a delay-sensitive type service, and has a high requirement on a data transmission delay, for example, an eMBB (enhanced mobile broadband) service. As shown in FIG. 6B, terminal devices (UE-1 and UE-2 in the figure) upload real-time data to the NCR-MT through an access link, and the NCR-FWD transparently transmits the data packet and forwards the data packet to a network device through a control link. In this case, the service data is amplified and forwarded (Amplify-and-forward, AF) by the NCR-FWD.

[00148] For example, when determining whether the service type is the first-type service or the second-type service, the NCR may perform determining based on a type of a terminal device that sends data. For example, data sent by a non-real-time IoT device is delay-insensitive type data, that is, a corresponding service type is the first-type service; or may perform determining based on a network slice identifier (network slice ID) included in the service data. Different slices (that is, AF slices or SF slices) are used in different times, frequencies, spaces, and polarization domains (corresponding to at least one of polarization manners such as linear polarization, circular polarization, and elliptical polarization), and support for different service types is improved by using different NCR modes.

[00149] In a communication system, cells corresponding to different network devices are classified into two types, including quasi-static cells (for example, a TN (Terrestrial Network, terrestrial network) cell) and dynamic cells (for example, an NTN NCR cell). The two types of cells correspond to different beam change frequencies, and using a same neighboring cell management method increases signaling overheads. The following describes how to configure a neighboring cell relationship between the two different types of cells in this application.

[00150] In a possible implementation, the network device handover method further includes: updating configuration information of the first network device based on a type of a cell corresponding to the first network device; or updating configuration information of the second network device based on a type of a cell corresponding to the second network device.

[00151] For example, cell types corresponding to the first network device and the second network device may be quasi-static (terrestrial network) cells or dynamic (non-terrestrial network) cells described above. Selecting different neighboring cell configuration update manners based on

different cell types can reduce a neighboring cell update frequency and adapt to different types of neighboring cells.

[00152] In a possible implementation, the type of the cell is a non-terrestrial network cell or a terrestrial network cell;

[00153] updating the configuration information of the first network device based on the type of the cell corresponding to the first network device includes:

[00154] in response to the cell type being the terrestrial network cell, updating the configuration information of the first network device based on event triggering;

[00155] in response to the cell type being the non-terrestrial network cell, updating the configuration information of the first network device based on a preset period and/or a neighboring cell activation status; and

[00156] updating the configuration information of the second network device based on the type of the cell corresponding to the second network device includes:

[00157] in response to the cell type being the terrestrial network cell, updating the configuration information of the second network device based on event triggering; and

[00158] in response to the cell type being the non-terrestrial network cell, updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status.

[00159] For example, a beam corresponding to the terrestrial network cell is stable, and a neighboring cell relationship configuration may be updated in an event-triggered manner to reduce an update frequency. A beam corresponding to the non-terrestrial network cell frequently changes due to a high-speed movement characteristic of a satellite, and a neighboring cell relationship configuration may be updated in a periodic update manner or an activation status design manner to adapt to the constantly changing beam.

[00160] Neighboring cell relationships of different cell types may be shown in the following table:

| **Neighboring cell type** | **Neighboring cell identifier** | **Neighboring cell status** | **Neighboring cell validity period** |
|---|---|---|---|
| **Type 1** | Cell-T2 | NA | NA |
| **Type 1** | Cell-T3 | NA | NA |
| **Type 2** | Cell-N1 | Inactive | NA |
| **Type 2** | Cell-N2 | Active | T1-T2 |

[00161] Type 1 represents the terrestrial network cell, Type 2 represents the non-terrestrial network cell, the neighboring cell identifier is identification information of a corresponding cell, NA in the neighboring cell status and the neighboring cell validity period indicates that no configuration is performed, T1 represents the first time node, and T2 represents the second time node. For example, for the non-terrestrial network cell, the neighboring cell status or validity period may be configured, and the neighboring cell may be activated from a given configuration set based on a time or a location.

[00162] For example, in a network device handover process, a network device for handover may be selected based on the neighboring cell status. For example, if a status of Cell-N2 is active, the relay node may perform handover to a network device corresponding to the cell Cell-N2; or if a status of Cell-N1 is inactive, the relay node may not perform handover to a network device corresponding to the cell Cell-N1, and may select, based on the neighboring cell validity period, a time for handover to the network device corresponding to the cell Cell-N2. For example, the handover is completed in a time period from T1 to T2. In addition, this is not limited to network device handover. Cell reselection may also be performed based on the neighboring cell status and the neighboring cell validity period, and different cells may exchange information related to the neighboring cell status and the neighboring cell validity period.

[00163] In a possible implementation, the network device handover method further includes:

[00164] in response to updating the configuration information of the first network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of a system information block (System Information Block, SIB); or

[00165] in response to updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of the system information block SIB.

[00166] For example, two types of neighboring cell relationship configuration update information are carried in different SIB messages, and the change of the neighboring cell relationship configuration of the non-terrestrial network cell does not trigger the change of the SIB 1, so as to reduce the change frequency of the SIB 1 message.

[00167] FIG. 7 is a schematic flowchart of another network device handover method according to at least one embodiment of this application. The method is applied to a side of a second network device. As shown in FIG. 7, the method includes steps S701 to S703.

[00168] S701: Receive an identifier of a relay node sent by a core network element.

[00169] S702: Authenticate the identifier of the relay node.

[00170] S703: Send a handover acknowledgement to the relay node based on an authentication

result.

[00171] For example, after receiving an initial access request sent by the relay node, and before a network device handover condition of the relay node is met, the core network element may pre-configure the identifier of the relay node, for example, an NCR-RNTI or a SAT-ID, for a second network device, and may pre-establish an NG connection between the core network and the second network device.

[00172] For example, the second network device may determine whether the NCR-RNTI or the SAT-ID is an authorized identifier. If the NCR-RNTI or the SAT-ID is an authorized identifier, the authentication succeeds, and the second network device may alternatively authenticate the identifier of the relay node in another manner. This is not limited in this application.

[00173] After sending the handover acknowledgement to the relay node based on the authentication result, the relay node completes data transmission between the terminal device and the network device based on the handover acknowledgement sent by the second network device.

[00174] In this embodiment of this application, the identifier of the relay node is authenticated, and connection handover between the relay node and different network devices is completed based on the authentication result, thereby avoiding additional session indication information and reducing data transmission and signaling overhead.

[00175] In a possible implementation, after sending the handover acknowledgement to the relay node based on the authentication result, the network device handover method further includes:

[00176] sending a connection establishment acknowledgement to the core network element, where the connection establishment acknowledgement includes the identifier of the relay node.

[00177] For example, after completing authentication on the relay node, the second network device may perform reporting to the core network, and return an NG connection establishment completion acknowledgement.

[00178] In a possible implementation, the relay information further includes local network device authentication information; and

[00179] the network device handover method further includes:

[00180] in response to the second network device not being present in the local network device authentication information, sending a context update request to the core network element, where the context update request is configured to update the local network device authentication information and/or the identifier of the relay node; and

[00181] receiving updated local network device authentication information and/or an updated identifier of the relay node sent by the core network element.

[00182] For example, the local network device authentication information may include a network device list, for example, a network device list. The network device list includes

information about network devices such as a network device-1, a network device-2, ..., and a network device-N. A network device in the list has a local authentication function. When determining that the second network device is in the list, the relay node may directly establish a connection to the second network device and receive the handover acknowledgement sent by the second network device. It should be noted that the local network device authentication information may also be in a form other than the list, for example, a data packet or a real-time data stream. This is not limited in this application.

[00183] In a possible implementation, before sending the context update request to the core network element, the network device handover method further includes:

[00184] receiving a local authentication result notification from a side of the relay node, where the local authentication result notification indicates whether the second network device is present in the local network device authentication information.

[00185] For example, when determining that the second network device is not in the local network device authentication information, the relay node sends information to the second network device, to notify the second network device to send a UE context update request to the core network. The core network returns new local network device authentication information and the identifier of the relay node to the second network device and/or the relay node. By using a local authentication function, the second base station initiates an authentication area update procedure, to support mobility of the NCR node.

[00186] It should be noted that the foregoing plurality of embodiments may be combined, and a combined solution is implemented. Optionally, some operations in procedures of the foregoing method embodiments are randomly combined, and/or a sequence of some operations is randomly changed. In addition, an execution sequence of steps of each procedure is merely an example, and does not constitute a limitation on an execution sequence of the steps. The steps may be performed in another execution sequence. This is not intended to indicate that the execution sequence is the only sequence in which these operations can be performed. A person of ordinary skill in the art may figure out a plurality of manners to reorder the operations described in this specification. In addition, it should be noted that process details related to a specific embodiment in this specification are also applicable to another embodiment in a similar manner, or different embodiments may be used in combination.

[00187] FIG. 8 is a diagram of a structure of a communication system according to at least one embodiment of this application. As shown in FIG. 8, the communication system 30 includes a relay node 31 and a second network device 32. The relay node 31 is configured to perform a function of a side of the relay node in any one of the foregoing network device handover methods.

[00188] The second network device 32 is configured to perform a function of a side of the

second network device in any one of the foregoing network device handover methods.

[00189] FIG. 9 is a diagram of a structure of a communication apparatus according to at least one embodiment of this application. As shown in FIG. 9, the communication apparatus may be configured to implement any possible function in the foregoing method embodiments, and therefore can also implement beneficial effects of the foregoing method embodiments.

[00190] As shown in FIG. 9, the communication apparatus 900 includes a processing unit 910.

[00191] In a possible implementation, the communication apparatus 900 may further include a transceiver unit 920.

[00192] In a possible implementation, the communication apparatus 900 may further include a storage unit 930.

[00193] In a possible implementation, the communication apparatus 900 may further include a transceiver unit 920 and a storage unit 930.

[00194] In this embodiment of this application, the communication apparatus 900 may be the relay node 31 shown in FIG. 8, or may be a module (for example, a chip) used in the relay node 31, or the communication apparatus 900 may be the second network device 32 shown in FIG. 8, or may be a module (for example, a chip) used in the second network device 32.

[00195] When the communication apparatus 900 is configured to implement the function of the side of the relay node described above, the transceiver unit 920 is configured to receive relay information from a core network element, where the relay information includes a network device handover condition and an identifier of the relay node; the processing unit 910 is configured to perform handover from a first network device to a second network device based on the network device handover condition; and the transceiver unit 920 is further configured to receive a control signaling handover acknowledgement from the second network device, where the control signaling handover acknowledgement is sent by the second network device based on an authentication result after the second network device authenticates the identifier.

[00196] In a possible implementation, the network device handover condition includes at least one of the following conditions:

[00197] a clock of the relay node is located at a first time node;

[00198] a distance between a location of the relay node and a preset reference location meets a first threshold; and

[00199] signal quality between the relay node and the first network device is less than a second threshold and/or signal quality between the relay node and the second network device is greater than a third threshold.

[00200] In a possible implementation, the transceiver unit 920 is further configured to send a configuration acknowledgement to the first network device.

[00201] In a possible implementation, the processing unit 910 is further configured to: complete, based on the handover acknowledgement, data transmission between a terminal device and the second network device; or

[00202] reject, based on the handover acknowledgement, data transmission between a terminal device and the second network device.

[00203] In a possible implementation, the handover acknowledgement includes control signaling; and

[00204] the completing, based on the handover acknowledgement, data transmission between the terminal device and the second network device includes:

[00205] completing, based on the control signaling, data transmission between the terminal device and the second network device.

[00206] In a possible implementation, the relay node includes a first relay child node and a second relay child node.

[00207] In a possible implementation, the transceiver unit 920 is further configured to:

[00208] receive a service request from a terminal device;

[00209] in response to the service request being a first-type service, store and forward service data corresponding to the service request via the first relay child node,; and/or

[00210] in response to the service request being a second-type service, transparently forward the service data corresponding to the service request via the second relay child node.

[00211] In a possible implementation, the relay information is generated by the core network element based on a target access request; and

[00212] the transceiver unit 920 is further configured to:

[00213] send the target access request to the core network element.

[00214] In a possible implementation, the transceiver unit 920 is specifically configured to:

[00215] send the target access request to the core network element via the first network device; and

[00216] the receiving the relay information from the core network element includes:

[00217] receiving the relay information from the core network element via the first network device.

[00218] In a possible implementation, the target access request includes node capability information of the relay node, and the node capability information indicates whether the relay node supports simultaneous connection with the first network device and the second network device.

[00219] In a possible implementation, the processing unit 910 is further configured to:

[00220] update configuration information of the first network device based on a type of a cell corresponding to the first network device; or

[00221] update configuration information of the second network device based on a type of a cell corresponding to the second network device.

[00222] In a possible implementation, the type of the cell is a non-terrestrial network cell or a terrestrial network cell; and

[00223] the processing unit 910 is further configured to:

[00224] in response to the cell type being the terrestrial network cell, update the configuration information of the first network device based on event triggering;

[00225] in response to the cell type being the non-terrestrial network cell, update the configuration information of the first network device based on a preset period and/or a neighboring cell activation status; and

[00226] in response to the cell type being the terrestrial network cell, update the configuration information of the second network device based on event triggering; and

[00227] in response to the cell type being the non-terrestrial network cell, update the configuration information of the second network device based on the preset period and/or the neighboring cell activation status.

[00228] In a possible implementation, the processing unit 910 is further configured to:

[00229] in response to updating the configuration information of the first network device based on the preset period and/or the neighboring cell activation status, skip triggering an update of a system information block SIB; or

[00230] in response to updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of the system information block SIB.

[00231] When the communication apparatus 900 is configured to implement the function of the side of the second network device described above, the transceiver unit 920 is configured to receive an identifier of a relay node sent by a core network element; the processing unit 910 is configured to authenticate the identifier; and the transceiver unit 920 is further configured to send a handover acknowledgement to the relay node based on an authentication result.

[00232] In a possible implementation, the transceiver unit 920 is further configured to:

[00233] send a connection establishment acknowledgement to the core network element, where the connection establishment acknowledgement includes the identifier of the relay node.

[00234] In a possible implementation, the relay information further includes local network device authentication information; and

[00235] the transceiver unit 920 is further configured to:

[00236] in response to the second network device not being present in the local network device authentication information, send a context update request to the core network element, where the

context update request is configured to update the local network device authentication information and/or the identifier of the relay node; and

[00237] receive updated local network device authentication information and/or an updated identifier of the relay node sent by the core network element.

[00238] In a possible implementation, the transceiver unit 920 is further configured to:

[00239] receive a local authentication result notification from a side of the relay node, where the local authentication result notification indicates whether the second network device is present in the local network device authentication information.

[00240] The storage unit 930 is configured to store any data, computer instruction, and/or computer program that may be used in embodiments of this application. For example, the storage unit 930 is configured to store a data packet from a terminal device. For more detailed descriptions about the processing unit 910 and the transceiver unit 920, refer to related descriptions in the method embodiment shown in FIG. 4. The processing unit 910 and the transceiver unit 920 may further perform other steps. For a specific implementation, refer to the method embodiments. Details are not described herein again.

[00241] Optionally, the transceiver unit 920 may be a transceiver. The transceiver may include an antenna, a radio frequency circuit, and the like.

[00242] The processing unit 910 may be a processor (or a processing circuit), for example, a baseband processor. The baseband processor may include one or more CPUs.

[00243] FIG. 10 is a diagram of a structure of a communication apparatus according to this application. The communication apparatus may be configured to implement any possible function in the foregoing method embodiments, and therefore can also achieve beneficial effects of the foregoing method embodiments.

[00244] As shown in FIG. 10, the communication apparatus 1000 includes at least one processor 1010. In a possible implementation, the communication apparatus 1000 may further include an interface circuit 1020.

[00245] In a possible implementation, the communication apparatus 1000 may further include a memory 1030.

[00246] In a possible implementation, the communication apparatus 1000 may further include a memory 1030 and an interface circuit 1020.

[00247] In some embodiments, the processor 1010 and the memory 1030 are coupled to each other; and/or the processor 1010 and the interface circuit 1020 are coupled to each other. It may be understood that the interface circuit 1020 may be a transceiver or an input/output interface. The memory 1030 may be configured to: store computer instructions to be executed by the processor 1010, store input data required for running the computer instructions by the processor 1010, or

store data generated after the processor 1010 runs the computer instructions.

[00248] When the communication apparatus 1000 is configured to implement the method shown in FIG. 3, the processor 1010 is configured to implement a function of the processing unit 1010, and the interface circuit 1020 is configured to implement a function of the transceiver unit 920.

[00249] The communication apparatuses shown in FIG. 9 and FIG. 10 are merely examples. In actual application, the communication apparatus may have more or fewer components than those shown in FIG. 9 and FIG. 10, may combine two or more components, or may have different component configurations. In FIG. 9 and FIG. 10, the processing unit may also be referred to as a processing module or a processor; the transceiver unit may also be referred to as a transceiver module or a transceiver; and the storage unit may also be referred to as a storage module or a memory. It should be understood that division into units in the foregoing apparatus is merely logical function division and may be another division during actual implementation. For example, a plurality of units or components may be combined or integrated into another system, or some features may be ignored or not performed. In addition, the displayed or discussed mutual couplings or direct couplings or communication connections may be implemented through some interfaces, indirect couplings or communication connections between the apparatuses or units, or electrical connections, mechanical connections, or connections in other forms. The units described as separate parts may or may not be physically separate, and parts displayed as units may or may not be physical units, may be located in one position, or may be distributed on a plurality of network units. Some or all of the units may be selected based on an actual requirement to implement the technical effects of the solutions provided in embodiments of this application.

[00250] It may be understood that, the processor in embodiments of this application may be a central processing unit (central processing unit, CPU), or may be another general-purpose processor, a digital signal processor (digital signal processor, DSP), an application-specific integrated circuit (application-specific integrated circuit, ASIC), a field programmable gate array (field programmable gate array, FPGA) or another programmable logic device, a transistor logic device, a hardware component, or any combination thereof. The general-purpose processor may be a microprocessor, or may be any conventional processor.

[00251] The method steps in embodiments of this application may be implemented in hardware, or may be implemented in software instructions that may be executed by the processor. The software instructions may include a corresponding software module. The software module may be stored in a random access memory, a flash memory, a read-only memory, a programmable read-only memory, an erasable programmable read-only memory, an electrically erasable programmable read-only memory, a register, a hard disk, a removable hard disk, a CD-ROM, or

any other form of storage medium well-known in the art. An example storage medium is coupled to the processor, so that the processor can read information from the storage medium and write information into the storage medium. The storage medium may alternatively be a component of the processor. The processor and the storage medium may be located in an ASIC. In addition, the ASIC may be located in the network device or the terminal. Alternatively, the processor and the storage medium may exist in a network device or a terminal as discrete components.

[00252] All or some of the foregoing embodiments may be implemented by using software, hardware, firmware, or any combination thereof. When software is used to implement the embodiments, all or some of the embodiments may be implemented in a form of a computer program product. The computer program product includes one or more computer programs or instructions. When the computer programs or the instructions are loaded and executed on a computer, the procedures or functions in embodiments of this application are all or partially executed. The computer may be a general-purpose computer, a dedicated computer, a computer network, a network device, user equipment, or another programmable apparatus. The computer program or instructions may be stored in a computer-readable storage medium, or may be transmitted from a computer-readable storage medium to another computer-readable storage medium. For example, the computer program or instructions may be transmitted from a website, computer, server, or data center to another website, computer, server, or data center in a wired or wireless manner. The computer-readable storage medium may be any usable medium that can be accessed by the computer, or a data storage device, for example, a server or a data center, integrating one or more usable media. The usable medium may be a magnetic medium, for example, a floppy disk, a hard disk, or a magnetic tape; or may be an optical medium, for example, a digital video disc; or may be a semiconductor medium, for example, a solid-state drive. The computer-readable storage medium may be a volatile or non-volatile storage medium, or may include two types of storage media: a volatile storage medium and a non-volatile storage medium.

[00253] In embodiments of this application, unless otherwise specified or a logical conflict occurs, terms and/or descriptions between different embodiments are consistent and may be mutually referenced, and technical features in different embodiments may be combined based on an internal logical relationship thereof, to form a new embodiment.

[00254] In this application, that an entity A sends information to an entity B may be that A directly sends the information to B, or may be that A indirectly sends the information to B through another entity. Similarly, that the entity B receives information from the entity A may be that the entity B directly receives the information sent by the entity A, or may be that the entity B indirectly receives, through another entity, the information sent by the entity A. The entities A and B herein each may be a RAN node or a terminal, or may be a module in a RAN node or a terminal.

Information sending and receiving may be information exchange between a RAN node and a terminal, for example, information exchange between a base station and a terminal. Information sending and receiving may alternatively be information exchange between two RAN nodes, for example, information exchange between a CU and a DU. Information sending and receiving may alternatively be information exchange between different modules in an apparatus, for example, information exchange between a chip in a terminal and another module in the terminal, or information exchange between a chip in a base station and another module in the base station.

[00255] In this application, "at least one" means one or more, and "a plurality of" means two or more. The term "and/or" describes an association relationship between associated objects, and represents that three relationships may exist. For example, A and/or B may represent the following cases: Only A exists, both A and B exist, and only B exists, where A and B may be singular or plural. In the text descriptions of this application, the character "/" represents an "or" relationship between the associated objects. In a formula in this application, the character "/" represents a "division" relationship between the associated objects. "Including at least one of A, B, and C" may represent: including A; including B; including C; including A and B; including A and C; including B and C; and including A, B, and C.

[00256] It may be understood that various numeric numbers in embodiments of this application are merely distinguishing for ease of description, and are not intended to limit the scope of embodiments of this application. Sequence numbers of the foregoing processes do not mean an execution sequence, and the execution sequence of the processes should be determined based on functions and internal logic of the processes.

# CLAIMS

[1] A network device handover method, applied to a side of a relay node and comprising:

receiving relay information from a core network element, wherein the relay information comprises a network device handover condition and an identifier of the relay node;

performing handover from a first network device to a second network device based on the network device handover condition; and

receiving a handover acknowledgement from the second network device, wherein the handover acknowledgement is sent by the second network device based on an authentication result after the second network device authenticates the identifier.

[2] The method according to claim 1, wherein the network device handover condition comprises at least one of the following:

a clock of the relay node is located at a first time node;

a distance between a location of the relay node and a preset reference location meets a first threshold; and

signal quality between the relay node and the first network device is less than a second threshold and/or signal quality between the relay node and the second network device is greater than a third threshold.

[3] The method according to claim 1, wherein after the receiving the relay information from the core network element, the method further comprises:

sending a configuration acknowledgement to the first network device.

[4] The network device handover method according to claim 1, wherein after the receiving the handover acknowledgement sent by the second network device after the second network device authenticates the identifier, the method further comprises:

completing, based on the handover acknowledgement, data transmission between a terminal device and the second network device; or

rejecting, based on the handover acknowledgement, data transmission between a terminal device and the second network device.

[5] The network device handover method according to claim 4, wherein the handover acknowledgement comprises control signaling; and

the completing, based on the handover acknowledgement, data transmission between the terminal device and the second network device comprises:

completing, based on the control signaling, data transmission between the terminal device and the second network device.

[6] The method according to claim 1, wherein the relay node comprises a first relay child node

and a second relay child node.

[7] The method according to claim 6, wherein the method further comprises:

receiving a service request from a terminal device;

in response to the service request being a first-type service, storing and forwarding service data corresponding to the service request via the first relay child node; and/or

in response to the service request being a second-type service, transparently forwarding the service data corresponding to the service request via the second relay child node.

[8] The method according to claim 1, wherein the relay information is generated by the core network element based on a target access request; and

before the receiving the relay information from the core network element, the method further comprises:

sending the target access request to the core network element.

[9] The method according to claim 8, wherein the sending the target access request to the core network element comprises:

sending the target access request to the core network element via the first network device; and

the receiving the relay information from the core network element comprises:

receiving the relay information from the core network element via the first network device.

[10] The method according to claim 8, wherein the target access request comprises node capability information of the relay node, and the node capability information indicates whether the relay node supports simultaneous connection with a plurality of network devices.

[11] The method according to claim 1, wherein the method further comprises:

updating configuration information of the first network device based on a type of a cell corresponding to the first network device; or

updating configuration information of the second network device based on a type of a cell corresponding to the second network device.

[12] The method according to claim 11, wherein the type of the cell is a non-terrestrial network cell or a terrestrial network cell;

the updating the configuration information of the first network device based on the type of the cell corresponding to the first network device comprises:

in response to the cell type being the terrestrial network cell, updating the configuration information of the first network device based on event triggering; and

in response to the cell type being the non-terrestrial network cell, updating the configuration information of the first network device based on a preset period and/or a neighboring cell activation status; and

the updating the configuration information of the second network device based on the type of the cell corresponding to the second network device comprises:

in response to the cell type being the terrestrial network cell, updating the configuration information of the second network device based on event triggering; and

in response to the cell type being the non-terrestrial network cell, updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status.

[13] The method according to claim 12, wherein the method further comprises:

in response to updating the configuration information of the first network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of a system information block, SIB; or

in response to updating the configuration information of the second network device based on the preset period and/or the neighboring cell activation status, skipping triggering an update of the SIB.

[14] The method according to claim 8, wherein the target access request comprises no session indication information.

[15] A network device handover method, applied to a side of a second network device and comprising:

receiving an identifier of a relay node sent by a core network element;

authenticating the identifier; and

sending a handover acknowledgement to the relay node based on an authentication result.

[16] The method according to claim 15, wherein after the sending the handover acknowledgement to the relay node based on the authentication result, the method further comprises:

sending a connection establishment acknowledgement to the core network element, wherein the connection establishment acknowledgement comprises the identifier of the relay node.

[17] The method according to claim 15, wherein the relay information further comprises local network device authentication information; and

the method further comprises:

in response to the second network device not being present in the local network device authentication information, sending a context update request to the core network element, wherein the context update request is configured to update the local network device authentication information and/or the identifier of the relay node; and

receiving updated local network device authentication information and/or an updated identifier of the relay node sent by the core network element.

[18] The method according to claim 17, wherein before the sending the context update request to

the core network element, the method further comprises:

receiving a local authentication result notification from a side of the relay node, wherein the local authentication result notification indicates whether the second network device is present in the local network device authentication information.

[19] A communication apparatus configured to perform the method according to any one of claims 1 to 14, or perform the method according to any one of claims 15 to 18.

[20] A computer program product, wherein the computer program product comprises a computer program or instructions, and when the computer program or the instructions are run on a computer, the computer is enabled to perform the network device handover method according to any one of claims 1 to 14 or the network device handover method according to any one of claims 15 to 18.