DISASTER ROAMING METHOD, APPARATUS, AND SYSTEM

[0001] This application claims priority to Chinese Patent Application No. 202110185266.8, filed with the China National Intellectual Property Administration on February 10, 2021 and entitled "DISASTER ROAMING METHOD, APPARATUS, AND SYSTEM", which is incorporated herein by reference in its entirety.

[0002]

TECHNICAL FIELD

[0003] Embodiments of this application relate to the communication field, and more specifically, to a disaster roaming method, apparatus, and system.

BACKGROUND

[0004] In a conventional technology, when a disaster occurs, a home public land mobile network (home public land mobile network, HPLMN) of a terminal device (user equipment, UE) may fail to provide a service for the UE. In this case, a service of the UE is interrupted and cannot be recovered.

SUMMARY

[0005] Embodiments of this application provide a disaster roaming method, apparatus, and system, to reduce service interruption of a terminal device, minimize the service interruption, and improve user experience.

[0006] According to a first aspect, a disaster roaming method performed in a terminal device is provided. The method includes: determining a first public land mobile network PLMN based on stored information about a disaster roaming PLMN, where the information about the disaster roaming PLMN includes identification information of at least one PLMN that allows the terminal device to perform disaster roaming, and the first PLMN is a PLMN in the at least one PLMN;

sending a registration request message to the first PLMN, where the registration request message includes disaster roaming indication information, and the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration; and receiving a registration accept message sent by the first PLMN.

[0007] According to the method provided in this application, when a network service fault occurs due to a disaster, the terminal device performs disaster roaming to obtain a service. In this way, service interruption of the terminal device can be reduced, the service interruption can be minimized, and user experience can be improved.

[0008] With reference to the first aspect, in some implementations of the first aspect, the information about the disaster roaming PLMN further includes disaster roaming service time.

[0009] With reference to the first aspect, in some implementations of the first aspect, after the receiving registration accept information sent by the first PLMN, the method further includes: performing disaster roaming in the first PLMN in the disaster roaming service time.

[0010] With reference to the first aspect, in some implementations of the first aspect, the method further includes: notifying a user that the terminal device is performing disaster roaming.

[0011] With reference to the first aspect, in some implementations of the first aspect, the determining a first PLMN includes: obtaining information about available PLMNs in a current location area, and selecting, from the available PLMNs, a PLMN in the at least one PLMN as the first PLMN.

[0012] With reference to the first aspect, in some implementations of the first aspect, before the determining a first PLMN, the method further includes: learning that a PLMN that currently provides a service stops providing the service due to a disaster.

[0013] With reference to the first aspect, in some implementations of the first aspect, before the learning that a PLMN that currently provides a service stops providing the service due to a disaster, the method further includes: sending a first message to a second PLMN, where the first message includes capability information of supporting disaster roaming by the terminal device; receiving a second message sent by the second PLMN, where the second message includes the information about the disaster roaming PLMN; and storing the information about the disaster roaming PLMN based on the second message.

[0014] According to the method provided in this application, the terminal device performs capability negotiation with the second PLMN, the second PLMN delivers the information about

the disaster roaming PLMN, and the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[0015] With reference to the first aspect, in some implementations of the first aspect, the first message is a registration request message.

[0016] With reference to the first aspect, in some implementations of the first aspect, the second message is any one of the following: a registration accept message, a registration reject message, a downlink non-access stratum NAS transport message, or a configuration update command message.

[0017] With reference to the first aspect, in some implementations of the first aspect, the second message further includes indication information indicating that the terminal device is allowed to perform disaster roaming.

[0018] With reference to the first aspect, in some implementations of the first aspect, when the second message is registration reject information, the method further includes: storing identification information of the second PLMN in the information about the disaster roaming PLMN.

[0019] According to a second aspect, a disaster roaming method performed in a first network element is provided. The method includes: receiving a first message sent by a terminal device, where the first message includes capability information of supporting disaster roaming by the terminal device; obtaining, based on the capability information of supporting disaster roaming, information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device; and sending a second message to the terminal device, where the second message includes the information about the disaster roaming PLMN.

[0020] According to the method provided in this application, the terminal device performs capability negotiation with the second PLMN, the second PLMN delivers the information about the disaster roaming PLMN, and the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[0021] With reference to the second aspect, in some implementations of the second aspect, the

first message is a registration request message.

[0022] With reference to the second aspect, in some implementations of the second aspect, the second message is any one of the following: a registration accept message, a registration reject message, a downlink non-access stratum NAS transport message, or a configuration update command message.

[0023] With reference to the second aspect, in some implementations of the second aspect, the second message further includes indication information indicating that the terminal device is allowed to perform disaster roaming.

[0024] With reference to the second aspect, in some implementations of the second aspect, the obtaining information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device includes: determining the information about the disaster roaming PLMN based on a local configuration.

[0025] With reference to the second aspect, in some implementations of the second aspect, before the determining the information about the disaster roaming PLMN based on the local configuration, the method further includes: determining, based on the local configuration, to provide the disaster roaming service for the terminal device.

[0026] With reference to the second aspect, in some implementations of the second aspect, before the determining the information about the disaster roaming PLMN based on the local configuration, the method further includes: receiving indication information that indicates that disaster roaming needs to be performed and that is sent by a second network element, where the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

[0027] With reference to the second aspect, in some implementations of the second aspect, the obtaining information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device includes: receiving the information about the disaster roaming PLMN sent by a second network element.

[0028] With reference to the second aspect, in some implementations of the second aspect, the receiving the information about the disaster roaming PLMN sent by a second network element further includes: receiving indication that indicates that disaster roaming needs to be performed and that is sent by the second network element, where the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster

roaming service.

[0029] With reference to the second aspect, in some implementations of the second aspect, before the receiving indication information that indicates that disaster roaming needs to be performed and that is sent by a second network element or the receiving the information about the disaster roaming PLMN sent by a second network element, the method further includes: sending, to the second network element, the capability information of supporting disaster roaming by the terminal device.

[0030] With reference to the second aspect, in some implementations of the second aspect, the information about the disaster roaming PLMN includes: identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or disaster roaming service time; or identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

[0031] According to a third aspect, a disaster roaming method performed in a second network element is provided. The method includes: receiving capability information that is of supporting disaster roaming by a terminal device and that is sent by a first network element; determining, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service; and sending information about a disaster roaming PLMN of the terminal device to the first network element.

[0032] According to the method provided in this application, the first network element performs capability negotiation with the second network element by reporting the capability information of the terminal device, and the second network element delivers the information about the disaster roaming PLMN, so that the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[0033] With reference to the third aspect, in some implementations of the third aspect, the method further includes: sending, to the first network element, indication information indicating that disaster roaming needs to be performed, where the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

[0034] With reference to the third aspect, in some implementations of the third aspect, the

determining that the terminal device is allowed to obtain a disaster roaming service includes: determining, based on the capability information of supporting disaster roaming by the terminal device and a local configuration, that the terminal device is allowed to obtain the disaster roaming service.

[0035] With reference to the third aspect, in some implementations of the third aspect, before the sending information about a disaster roaming PLMN of the terminal device to the first network element, the method further includes: determining the information about the disaster roaming PLMN of the terminal device based on the local configuration.

[0036] With reference to the third aspect, in some implementations of the third aspect, the information about the disaster roaming PLMN includes: identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or disaster roaming service time; or identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

[0037] According to a fourth aspect, a disaster roaming method performed in a terminal device is provided. The method includes: receiving system information sent by a third PLMN, where the system information includes indication information indicating that disaster roaming is allowed; sending a registration request message to the third PLMN based on the system information, where the registration request message includes capability information of supporting disaster roaming by the terminal device and disaster roaming indication information; and receiving a registration accept message sent by the third PLMN, where the registration accept message includes disaster roaming service time provided by the third PLMN.

[0038] According to the method provided in this application, after a disaster occurs, the terminal device receives the system information sent by the third PLMN, and then selects the third PLMN to perform disaster roaming. In this way, a service can be obtained, service interruption of the terminal device can be reduced, the service interruption can be minimized, and user experience can be improved.

[0039] With reference to the fourth aspect, in some implementations of the fourth aspect, the method further includes: performing disaster roaming in the third PLMN in the disaster roaming service time.

[0040] With reference to the fourth aspect, in some implementations of the fourth aspect, the method further includes: notifying a user that the terminal device is performing disaster roaming.

[0041] With reference to the fourth aspect, in some implementations of the fourth aspect, before the receiving system information sent by a third PLMN, the method further includes: learning that a fourth PLMN stops providing a service due to a disaster, where the fourth PLMN is a PLMN that provides the service for the terminal device before the disaster.

[0042] With reference to the fourth aspect, in some implementations of the fourth aspect, after the learning that a fourth PLMN stops providing a service due to a disaster, the method further includes: obtaining information about available PLMNs in a current location area, and selecting, from the available PLMNs, a PLMN in at least one PLMN as the third PLMN.

[0043] With reference to the fourth aspect, in some implementations of the fourth aspect, the system information further includes identification information of the fourth PLMN.

[0044] According to a fifth aspect, a disaster roaming apparatus is provided. The apparatus has a function of implementing behavior in the method example of the first aspect. The function may be implemented by hardware, or may be implemented by hardware by executing corresponding software. The hardware or the software includes one or more modules corresponding to the foregoing function. In a possible design, the apparatus includes a transceiver unit and a processing unit. The processing unit is configured to determine a first public land mobile network PLMN based on stored information about a disaster roaming PLMN, where the information about the disaster roaming PLMN includes identification information of at least one PLMN that allows a terminal device to perform disaster roaming, and the first PLMN is a PLMN in the at least one PLMN. The transceiver unit is configured to send a registration request message to the first PLMN, where the registration request message includes disaster roaming indication information, and the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration. The transceiver unit is further configured to receive a registration accept message sent by the first PLMN.

[0045] These modules may perform corresponding functions in the method example in the first aspect. For details, refer to detailed descriptions in the method example. Details are not described herein again.

[0046] According to a sixth aspect, a disaster roaming apparatus is provided. The apparatus may be a core network device, or may be a chip used in the core network device. The apparatus has a function of implementing behavior in the method example of the second aspect. The function may be implemented by hardware, or may be implemented by hardware by executing

corresponding software. The hardware or the software includes one or more modules corresponding to the foregoing function. In a possible design, the apparatus includes a transceiver unit and a processing unit. The transceiver unit is configured to receive a first message sent by a terminal device, where the first message includes capability information of supporting disaster roaming by the terminal device. The processing unit is configured to obtain, based on the capability information of supporting disaster roaming, information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device. The transceiver unit is further configured to send a second message to the terminal device, where the second message includes the information about the disaster roaming PLMN.

[0047] These modules may perform corresponding functions in the method example in the second aspect. For details, refer to detailed descriptions in the method example. Details are not described herein again.

[0048] According to a seventh aspect, a disaster roaming apparatus is provided. The apparatus may be a core network device, or may be a chip used in the core network device. The apparatus has a function of implementing behavior in the method example of the third aspect. The function may be implemented by hardware, or may be implemented by hardware by executing corresponding software. The hardware or the software includes one or more modules corresponding to the foregoing function. In a possible design, the apparatus includes a transceiver unit and a processing unit. The transceiver unit is configured to receive capability information that is of supporting disaster roaming by a terminal device and that is sent by a first network element. The processing unit is configured to determine, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service. The transceiver unit is further configured to send information about a disaster roaming PLMN of the terminal device to the first network element.

[0049] These modules may perform corresponding functions in the method example in the third aspect. For details, refer to detailed descriptions in the method example. Details are not described herein again.

[0050] According to an eighth aspect, a disaster roaming apparatus is provided. The apparatus has a function of implementing behavior in the method example of the fourth aspect. The function may be implemented by hardware, or may be implemented by hardware by executing corresponding software. The hardware or the software includes one or more modules

corresponding to the foregoing function. In a possible design, the apparatus includes a transceiver unit and a processing unit. The transceiver unit is configured to receive system information sent by a third PLMN, where the system information includes indication information indicating that disaster roaming is allowed. The transceiver unit is further configured to send a registration request message to the third PLMN based on the system information, where the registration request message includes capability information of supporting disaster roaming by a terminal device and disaster roaming indication information. The transceiver unit is further configured to receive a registration accept message sent by the third PLMN, where the registration accept message includes disaster roaming service time provided by the third PLMN.

[0051] These modules may perform corresponding functions in the method example in the fourth aspect. For details, refer to detailed descriptions in the method example. Details are not described herein again.

[0052] According to a ninth aspect, a disaster roaming system is provided. The system includes a first network element and a second network element. The first network element is configured to send capability information of supporting disaster roaming by a terminal device. The second network element is configured to receive the capability information of supporting disaster roaming by the terminal device. The second network element is further configured to determine, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service. The second network element is further configured to send information about a disaster roaming PLMN of the terminal device. The first network element is further configured to receive the information about the disaster roaming PLMN of the terminal device.

[0053] According to this implementation, the first network element performs capability negotiation with the second network element by reporting the capability information of the terminal device, and the second network element delivers the information about the disaster roaming PLMN, so that the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[0054] With reference to the ninth aspect, in some implementations of the ninth aspect, the second network element is further configured to send indication information indicating that

disaster roaming needs to be performed. The first network element is further configured to receive the indication information indicating that disaster roaming needs to be performed, where the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

[0055] With reference to the ninth aspect, in some implementations of the ninth aspect, the second network element is configured to determine that the terminal device is allowed to obtain the disaster roaming service, and the second network element is specifically configured to determine, based on the capability information of supporting disaster roaming by the terminal device and a local configuration, that the terminal device is allowed to obtain the disaster roaming service.

[0056] With reference to the ninth aspect, in some implementations of the ninth aspect, before the second network element is configured to send the information about the disaster roaming PLMN of the terminal device, the second network element is further configured to determine the information about the disaster roaming PLMN of the terminal device based on the local configuration.

[0057] With reference to the ninth aspect, in some implementations of the ninth aspect, the information about the disaster roaming PLMN includes: identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or disaster roaming service time; or identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

[0058] According to a tenth aspect, an apparatus is provided. The apparatus includes a processor and a transceiver. The processor is connected to the transceiver. The processor is configured to execute instructions, and the transceiver is configured to communicate with another network element under control of the processor. When the processor executes the instructions, the execution enables the apparatus to perform the method in any one of the foregoing aspects or any possible implementation of any one of the foregoing aspects. The apparatus further includes a memory, and the memory is configured to store the instructions.

[0059] According to an eleventh aspect, a computer-readable medium is provided. The computer-readable medium stores a computer program (which may also be referred to as code or instructions). When the computer program is run on a computer, the computer is enabled to perform the method in any one of the foregoing aspects or any possible implementation of any one

of the foregoing aspects.

[0060] According to a twelfth aspect, a communication chip is provided. The communication chip stores instructions, and when the instructions are run on a computer device, the communication chip is enabled to perform the method in any one of the foregoing aspects or any possible implementation of any one of the foregoing aspects.

[0061] According to a thirteenth aspect, a computer program product including instructions is provided. When the instructions are run on a computer, the computer is enabled to perform the method in any one of the foregoing aspects or any possible implementation of any one of the foregoing aspects.

[0062] According to a fourteenth aspect, a chip system is provided. The chip system includes: an input interface, an output interface, at least one processor, and a memory. The input interface, the output interface, the processor, and the memory are connected through an internal connection path. The processor is configured to execute code in the memory, and when the code is executed, the processor is configured to perform the method in the foregoing aspects.

[0063] Based on the foregoing technical solutions, service interruption of the terminal device can be reduced, the service interruption can be minimized, and user experience can be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0064] FIG. 1 is a schematic diagram of an architecture of a 5G mobile communication system;

[0065] FIG. 2 is a schematic flowchart of a disaster roaming method according to this application;

[0066] FIG. 3 is a schematic flowchart of a disaster roaming method according to this application;

[0067] FIG. 4 is a schematic flowchart of a disaster roaming method according to this application;

[0068] FIG. 5 is a schematic flowchart of a disaster roaming method according to this application;

[0069] FIG. 6 is a schematic flowchart of a specific example of a disaster roaming method according to this application;

[0070] FIG. 7 is a schematic flowchart of a specific example of a disaster roaming method

according to this application;

[0071] FIG. 8 is a schematic flowchart of a specific example of a disaster roaming method according to this application;

[0072] FIG. 9 is a schematic flowchart of a specific example of a disaster roaming method according to this application;

[0073] FIG. 10 is a schematic flowchart of a specific example of a disaster roaming method according to this application;

[0074] FIG. 11 is a schematic flowchart of another disaster roaming method according to this application;

[0075] FIG. 12 is a schematic diagram of a structure of a disaster roaming apparatus according to this application; and

[0076] FIG. 13 is a schematic diagram of a structure of another disaster roaming apparatus according to this application.

DESCRIPTION OF EMBODIMENTS

[0077] The following describes the technical solutions of this application with reference to the accompanying drawings.

[0078] The technical solutions in embodiments of this application may be applied to various communication systems, for example, a global system for mobile communications (Global System for Mobile communications, GSM), a code division multiple access (Code Division Multiple Access, CDMA) system, a wideband code division multiple access (Wideband Code Division Multiple Access, WCDMA) system, a general packet radio service (General Packet Radio Service, GPRS), a long term evolution (Long Term Evolution, LTE) system, an LTE frequency division duplex (Frequency Division Duplex, FDD) system, an LTE time division duplex (Time Division Duplex, TDD) system, a universal mobile telecommunications system (Universal Mobile Telecommunications System, UMTS), a worldwide interoperability for microwave access (Worldwide Interoperability for Microwave Access, WiMAX) communication system, a future 5th generation (5th Generation, 5G) system or a new radio (New Radio, NR) system, and a communication system that evolves in the future.

[0079] FIG. 1 is a schematic diagram of a network architecture of a communication system to

which an embodiment of this application is applicable. The network architecture includes a terminal device, an access network device, an access management network element, a session management network element, a user plane network element, a policy control network element, a network slice selection network element, a network repository function network element, a network data analytics network element, a unified data management network element, a unified data storage network element, an authentication service function network element, a network exposure network element, an application function network element, and a data network (data network, DN) connected to an operator network. The terminal device may send service data to the data network and receive service data from the data network through the access network device and the user plane network element.

[0080] The terminal device is a device having a wireless transceiver function, and may be deployed on land, including an indoor device, an outdoor device, a handheld device, or a vehicle-mounted device; or may be deployed on water (for example, on a ship); or may be deployed in the air (for example, an aircraft, a balloon, or a satellite). The terminal device may communicate with a core network via a radio access network (radio access network, RAN), and exchange a voice and/or data with the RAN. The terminal device may be a mobile phone (mobile phone), a tablet computer (Pad), a computer having a wireless transceiver function, a mobile internet device (mobile internet device, MID), a wearable 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 wireless terminal in self-driving (self-driving), a wireless terminal in telemedicine (remote medical), 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), or the like. An application scenario is not limited in embodiments of this application. The terminal device may also be sometimes referred to as user equipment (user equipment, UE), a mobile station, a remote station, or the like. A specific technology, a device form, and a name used by the terminal device are not limited in embodiments of this application.

[0081] The access network device is a device that is in a network and that is configured to connect the terminal device to a wireless network. The access network device may be a node in a radio access network, may also be referred to as a base station, or may be referred to as a radio access network (radio access network, RAN) node (or device). The access network device may

include an evolved base station (NodeB or eNB or e-NodeB, evolved NodeB) in a long term evolution (long term evolution, LTE) system or an LTE-advanced system (LTE-Advanced, LTE-A), such as a conventional macro base station eNB and a micro base station eNB in a heterogeneous network scenario. Alternatively, the access network device may include a next generation NodeB (next generation NodeB, gNB) in a 5th generation mobile communication technology (5th generation, 5G) new radio (new radio, NR) system. Alternatively, the access network device may further include a radio network controller (radio network controller, RNC), a NodeB (NodeB, NB), a base station controller (base station controller, BSC), a base transceiver station (base transceiver station, BTS), a transmission reception point (transmission reception point, TRP), a home evolved NodeB, (for example, home evolved NodeB, or home NodeB, HNB), a baseband unit (base band unit, BBU), a baseband pool BBU pool, or a Wi-Fi access point (access point, AP), or the like. Alternatively, the access network device may further include a central unit (central unit, CU) and a distributed unit (distributed unit, DU) in a cloud radio access network (cloud radio access network, Cloud RAN) system. This is not limited in embodiments of this application. In a scenario in which the CU and the DU included in the access network device are separately deployed, the CU supports protocols such as radio resource control (radio resource control, RRC), a packet data convergence protocol (packet data convergence protocol, PDCP), and a service data adaptation protocol (service data adaptation protocol, SDAP). The DU mainly supports a radio link control layer (radio link control, RLC) protocol, a media access control layer (media access control, MAC) protocol, and a physical layer protocol.

[0082] The access management network element is mainly used for attachment, mobility management, and a tracking area update process of a terminal in a mobile network. The access management network element terminates a non-access stratum (non-access stratum, NAS) message, completes registration management, connection management, and reachability management, allocates a tracking area list (tracking area list, TA list), completes mobility management and the like, and transparently routes a session management (session management, SM) message to the session management network element. In a 5th generation (5th generation, 5G) communication system, the access management network element may be an access and mobility management function (access and mobility management function, AMF). In a future communication system (for example, a 6G communication system), the mobility management network element may still be an AMF network element, or may have another name. This is not

limited in this application.

[0083] The session management network element is mainly used for session management in the mobile network, for example, session establishment, modification, and release. A specific function is, for example, allocating an internet protocol (internet protocol, IP) address to the terminal or selecting a user plane network element that provides a packet forwarding function. In a 5G communication system, the session management network element may be a session management function (session management function, SMF). In a future communication system (for example, a 6G communication system), the session management network element may still be an SMF network element, or may have another name. This is not limited in this application.

[0084] The user plane network element is mainly configured to process a user packet, where the processing is, for example, forwarding, charging, or lawful interception. The user plane network element may also be referred to as a protocol data unit (protocol data unit, PDU) session anchor (PDU session anchor, PSA). In a 5G communication system, the user plane network element may be a user plane function (user plane function, UPF). In a future communication system (for example, a 6G communication system), the user plane network element may still be a UPF network element, or may have another name. This is not limited in this application.

[0085] The policy control network element includes a subscriber subscription data management function, a policy control function, a charging policy control function, quality of service (quality of service, QoS) control, and the like. In a 5G communication system, the policy control network element may be a policy control function (policy control function, PCF). In a future communication system (for example, a 6G communication system), the policy control network element may still be a PCF network element, or may have another name. This is not limited in this application.

[0086] The network slice selection function network element is mainly configured to select an appropriate network slice for a service of the terminal device. In a 5G communication system, the network slice selection network element may be a network slice selection function (network slice selection function, NSSF) network element. In a future communication system (for example, a 6G communication system), the network slice selection network element may still be an NSSF network element, or may have another name. This is not limited in this application.

[0087] The network repository function network element is mainly configured to provide a registration and discovery function of a network element or a service provided by the network

element. In a 5G communication system, the network repository function network element may be a network repository function (network repository function, NRF). In a future communication system (for example, a 6G communication system), the network repository function network element may still be an NRF network element, or may have another name. This is not limited in this application.

[0088] The network data analytics network element may collect data from each network function (network function, NF), for example, the policy control network element, the session management network element, the user plane network element, the access management network element, and the application function network element (through the network exposure function network element), and perform analysis and prediction. In a 5G communication system, the network data analytics network element may be a network data analytics function (network data analytics function, NWDAF). In a future communication system (for example, a 6G communication system), the network data analytics network element may still be an NWDAF network element, or may have another name. This is not limited in this application.

[0089] The unified data management network element is mainly configured to manage subscription information of the terminal device. In a 5G communication system, the unified data management network element may be a unified data management (unified data management, UDM). In a future communication system (for example, a 6G communication system), the unified data management network element may still be a UDM network element, or may have another name. This is not limited in this application.

[0090] The unified data storage network element is mainly configured to store structured data information, including subscription information, policy information, and network data or service data defined in a standard format. In a 5G communication system, the unified data storage network element may be a unified data repository (unified data repository, UDR). In a future communication system (for example, a 6G communication system), the unified data storage network element may still be a UDR network element, or may have another name. This is not limited in this application.

[0091] The authentication service function network element is mainly configured to perform security authentication on the terminal device. In a 5G communication system, the authentication service function network element may be an authentication server function (authentication server function, AUSF). In a future communication system (for example, a 6G communication system),

the authentication service function network element may still be an AUSF network element, or may have another name. This is not limited in this application.

[0092] The network exposure network element may expose some functions of a network to an application in a controlled manner. In a 5G communication system, the network exposure network element may be a network exposure function (network exposure function, NEF). In a future communication system (for example, a 6G communication system), the network exposure network element may still be an NEF network element, or may have another name. This is not limited in this application.

[0093] The application function network element may provide service data of various applications to a control plane network element of a communication network of an operator, or obtain data information and control information of a network from a control plane network element of a communication network. In a 5G communication system, the application function network element may be an application function (application function, AF). In a future communication system (for example, a 6G communication system), the application function network element may still be an AF network element, or may have another name. This is not limited in this application.

[0094] The data network is mainly configured to provide data transmission services for terminal devices. The data network may be a private network, such as a local area network, or may be a public data network (public data network, PDN) network, such as the internet (Internet), or may be a private network jointly deployed by operators, such as a configured IP multimedia network subsystem (IP multimedia core network subsystem, IMS) service.

[0095] It should be understood that the foregoing network element or function may be a network element in a hardware device, may be a software function run on dedicated hardware, or may be a virtualization function instantiated on a platform (for example, a cloud platform). Optionally, the foregoing network elements or the functions may be implemented by one device, may be implemented by a plurality of devices, or may be one functional module in one device. This is not specifically limited in embodiments of this application.

[0096] For ease of description, an example in which the access management network element is an AMF network element and the unified data management network element is a UDM network element is used subsequently for description in this application. Further, an AMF network element is referred to as an AMF for short, and a UDM network element is referred to as a UDM for short. In other words, all AMFs described subsequently in this application may be replaced with access

management network elements, and all UDMs may be replaced with unified data management network elements.

[0097] The 3rd Generation Partnership Project (3rd Generation Partnership Project, 3GPP) defines a network feature of minimization of service interruption (minimization of service interruption, MINT) in Release 17 (Release 17). The network feature of MINT mainly means that when a disaster condition (disaster condition) occurs, a user in the communication system may perform disaster roaming (disaster roaming), so that a network service obtained by the user is not interrupted, that is, service interruption and failures caused by the disaster condition are reduced. The user may be referred to as a disaster roaming user (disaster inbound roaming).

[0098] It should be understood that the disaster condition refers to a condition in which the government decides to initiate or terminate. That is, the condition is controlled by the government. For example, the disaster condition includes natural disasters, including earthquakes, tsunamis, fire, lightning strikes, and floods. For another example, the disaster condition includes man-made disasters, including: terrorist attacks and wars. The disaster condition may alternatively be a disaster scenario, or may be a disaster. In this application, for ease of description, a disaster is used for detailed description.

[0099] It should be understood that disaster roaming refers to a special roaming policy applicable to a disaster. The disaster roaming user refers to a user that cannot obtain a service from a public land mobile network (public land mobile network, PLMN) that usually serves the user due to a disaster, and may register with another PLMN to continue to obtain the service, for example, a voice service or a data service.

[00100] This application provides a disaster roaming method, apparatus, and system, so that a terminal device performs disaster roaming and obtains a service when a network service fault occurs due to a disaster. Therefore, service interruption of the terminal device can be reduced, the service interruption can be minimized, and user experience can be improved.

[00101] FIG. 2 is a schematic flowchart of a disaster roaming method 200 according to this application. The method includes the following steps.

[00102] S201. A terminal device determines a first PLMN based on stored information about a disaster roaming PLMN, where the information about the disaster roaming PLMN includes identification (PLMN identity, PLMN ID) information of at least one PLMN that allows the terminal device to perform disaster roaming, and the first PLMN is a PLMN in the at least one

PLMN.

[00103] Specifically, in this embodiment of this application, the terminal device may select a PLMN in the at least one PLMN as the first PLMN based on the stored identification information of the at least one PLMN.

[00104] In this embodiment of this application, a procedure in which the terminal device selects the PLMN is as follows: The terminal device obtains information about available PLMNs in a current location area based on the stored information about the disaster roaming PLMN, and selects, from the available PLMNs, the PLMN in the at least one PLMN as the first PLMN. For example, the terminal device obtains the information about available PLMNs in the current location area through cell scanning, and then selects, from the available PLMNs, a PLMN with a highest priority in the at least one PLMN as the first PLMN.

[00105] In this embodiment of this application, the information about the disaster roaming PLMN may further include disaster roaming service time. Optionally, the disaster roaming service time is stored by the terminal device based on a local configuration, or may be stored by the terminal device based on allocation information received from a network, or may be stored by the terminal device based on allocation information received from a network and a local configuration. When both the allocation information received from the network and the local configuration exist, which one is used as the disaster roaming service time is based on different implementations of the terminal device. This is not limited in the present invention. Further, optionally, at least one type of disaster roaming service time is determined by the terminal device based on the allocation information received from the network. For example, there is only one type of disaster roaming service time, to be specific, for different disaster roaming PLMNs, the terminal device can obtain same disaster roaming service time. For another example, for different disaster roaming PLMNs, the terminal device may obtain different disaster roaming service time.

[00106] S202. The terminal device sends a registration request message to the first PLMN, where the registration request message includes disaster roaming indication information, and the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration. Correspondingly, the first PLMN receives the registration request message.

[00107] Specifically, in this embodiment of this application, the terminal device may send a registration request message to an access management network element of the first PLMN. The

registration request message includes the disaster roaming indication information, and the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration. That is, the terminal device requests the first PLMN to provide a service, and in particular, requests a disaster roaming service.

[00108] Optionally, the disaster roaming indication information may be a registration type, or may be an information element, or may be a value field (value field) in the information element.

[00109] S203. The first PLMN sends a registration accept message to the terminal device, and correspondingly, the terminal device receives the registration accept message.

[00110] Therefore, according to the foregoing method for requesting the disaster roaming service from the network by the terminal device, the terminal device performs disaster roaming when a network service fault is caused by a disaster. In this way, a service can be obtained, service interruption of the terminal device can be reduced, the service interruption can be minimized, and user experience can be improved.

[00111] Optionally, after the terminal device receives the registration accept message, the method 200 further includes the following steps S204 to S206.

[00112] S204. After the terminal device receives the registration accept message sent by the first PLMN, the terminal device performs disaster roaming in the first PLMN in the disaster roaming service time.

[00113] Specifically, in this implementation of this application, when the terminal device receives the registration accept message sent by the first PLMN, indicating that the first PLMN agrees to provide the disaster roaming service for the terminal device, the terminal device may perform disaster roaming through the first PLMN, and the first PLMN provides the service for the terminal device in the disaster roaming service time. Beyond the disaster roaming service time, the terminal device re-performs steps S201 to S203, to be specific, the terminal device re-performs PLMN selection to leave the first PLMN.

[00114] It should be understood that there may be the following two specific implementations in which the terminal device performs disaster roaming in the first PLMN in the disaster roaming service time after the terminal device receives the registration accept message sent by the first PLMN. Certainly, this application is not limited thereto.

[00115] Manner 1: The terminal device starts a timer based on the disaster roaming service time, to perform disaster roaming in a time period indicated by the disaster roaming service time.

Beyond the time period, the terminal device re-performs PLMN selection to leave the first PLMN.

[00116] Manner 2: The terminal device records time for performing disaster roaming, to perform disaster roaming in a time period indicated by the disaster roaming service time. Beyond the time period, the terminal device re-performs PLMN selection to leave the first PLMN.

[00117] S205. The terminal device notifies a user that the terminal device is performing disaster roaming.

[00118] Specifically, in this embodiment of this application, the terminal device may output a notification, so that the user learns that disaster roaming is currently being performed.

[00119] S206. Before the terminal device determines the first PLMN, the terminal device learns that a PLMN that currently provides a service stops providing the service due to a disaster.

[00120] Optionally, for the information about the disaster roaming PLMN stored by the terminal device, before the terminal device learns that the PLMN that currently provides the service stops providing the service due to a disaster, the terminal device stores the information about the disaster roaming PLMN by exchanging information with a second PLMN. In other words, this application further provides a disaster roaming method 300. FIG. 3 is a schematic flowchart of the method 300. It should be understood that a PLMN that currently provides a service may be the same as or different from a second PLMN. This is not limited in this application.

[00121] The method 300 includes the following steps.

[00122] S301. A terminal device sends a first message to the second PLMN, where the first message includes capability information of supporting disaster roaming by the terminal device. Correspondingly, the second PLMN receives the first message.

[00123] Specifically, in this embodiment of this application, the first message is a registration request message, that is, the registration request message includes the capability information of supporting disaster roaming by the terminal device.

[00124] It should be understood that the capability information of supporting disaster roaming by the terminal device may be capability information of the terminal device supporting minimization of service interruption MINT, and the two pieces of capability information may be used interchangeably.

[00125] S302. The second PLMN sends a second message to the terminal device, where the second message includes information about a disaster roaming PLMN. Correspondingly, the terminal device receives the second message.

[00126] In this embodiment of this application, the second message may be a registration accept message, or may be a registration reject message, or may be a downlink non-access stratum NAS transport message, or may be a configuration update command message.

[00127] Optionally, the second message further includes indication information indicating that the terminal device is allowed to perform disaster roaming (disaster roaming allowed), and the indication information indicating that the terminal device is allowed to perform disaster roaming indicates that UE may perform disaster roaming when a disaster occurs in the PLMN that currently provides the service.

[00128] S303. The terminal device stores the information about the disaster roaming PLMN based on the second message.

[00129] Optionally, the terminal device may store the information about the disaster roaming PLMN in a universal subscriber identity module (universal subscriber identity module, USIM), or may store the information about the disaster roaming PLMN in a non-volatile memory (non-volatile memory) of the terminal device.

[00130] Therefore, in this application, the terminal device performs capability negotiation with the second PLMN, the second PLMN delivers the information about the disaster roaming PLMN, and the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[00131] Optionally, the method further includes S304 as follows:

[00132] When the second message is the registration reject message, the terminal device stores identification information of the second PLMN in the information about the disaster roaming PLMN.

[00133] Specifically, in this embodiment of this application, when the second message is the registration reject message, that is, the second PLMN rejects a registration request of the terminal device, the terminal device marks the second PLMN as the disaster roaming PLMN, and stores the identification information of the second PLMN in the information about the disaster roaming PLMN.

[00134] The identification information of the second PLMN is stored in the information about the disaster roaming PLMN, so that the terminal device maintains original information about the

disaster roaming PLMN of the terminal device. In this way, it is ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[00135] Optionally, the second PLMN may include a first network element and a second network element. The following uses the first network element and the second network element as an example to describe the foregoing method 300 in detail with reference to schematic flowcharts of methods 400 and 500 shown in FIG. 4 and FIG. 5.

[00136] It should be noted that, some steps mentioned below are the same as those in the foregoing method 300. Related details are not described herein again. For a specific process, refer to related steps in the method 300.

[00137] S401. A terminal device sends a first message to a first network element, where the first message includes capability information of supporting disaster roaming by the terminal device. Correspondingly, the first network element receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00138] S402. The first network element obtains, based on the capability information of supporting disaster roaming, information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device.

[00139] For example, in a specific implementation in which the first network element obtains the information about the disaster roaming PLMN, the following manner 1 or 2 may be used for implementation. Certainly, the specific implementation is not limited to these manners.

[00140] Manner 1: The first network element determines the information about the disaster roaming PLMN based on a local configuration.

[00141] In an optional embodiment of the manner 1, before the first network element determines the information about the disaster roaming PLMN based on the local configuration, the first network element may determine, based on the local configuration or indication information that indicates that disaster roaming needs to be performed and that is sent by a second network element, to provide the disaster roaming service for the terminal device. The indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

[00142] Manner 2: A second network element sends the information about the disaster roaming PLMN, and the first network element receives the information about the disaster roaming PLMN

sent by the second network element.

[00143] In an optional embodiment of the manner 2, for a process in which the first network element receives the information about the disaster roaming PLMN sent by the second network element, the first network element receives indication information that indicates that disaster roaming needs to be performed and that is sent by the second network element, where the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service. To be specific, the indication information indicating that disaster roaming needs to be performed and the information about the disaster roaming PLMN may be transmitted simultaneously, or the indication information indicating that disaster roaming needs to be performed may be transmitted first, and then the information about the disaster roaming PLMN is transmitted.

[00144] For the foregoing manner 2, optionally, before the first network element receives the indication information that indicates that disaster roaming needs to be performed and that is sent by the second network element or the information about the disaster roaming PLMN sent by the second network element, the first network element sends the capability information of supporting disaster roaming by the terminal device to the second network element.

[00145] For a specific implementation of the manner 2, refer to the following detailed descriptions of the method 500.

[00146] S403. The first network element sends a second message to the terminal device, where the second message includes the information about the disaster roaming PLMN. The terminal device receives the second message. Correspondingly, the terminal device receives the second message. For a specific process of this step, refer to S302 in the method 300.

[00147] Optionally, the second message further includes indication information indicating that the terminal device is allowed to perform disaster roaming.

[00148] In this embodiment of this application, there are three possible cases for content of the foregoing information about the disaster roaming PLMN.

[00149] Case 1: The information about the disaster roaming PLMN includes identification information of at least one PLMN that allows the terminal device to perform disaster roaming.

[00150] Case 2: The information about the disaster roaming PLMN includes disaster roaming service time.

[00151] Case 3: The information about the disaster roaming PLMN includes identification

information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

[00152] S404. The terminal device stores the information about the disaster roaming PLMN based on the second message. For a specific process of this step, refer to S303 in the method 300.

[00153] Therefore, in this application, the terminal device performs capability negotiation with the first network element, the first network element delivers the information about the disaster roaming PLMN, and the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[00154] FIG. 5 is the schematic flowchart of the disaster roaming method 500 according to this application. The method 500 includes the following steps.

[00155] S501. A first network element sends capability information of supporting disaster roaming by a terminal device to a second network element. Correspondingly, the second network element receives the capability information of supporting disaster roaming by the terminal device.

[00156] S502. The second network element determines, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service.

[00157] In this embodiment of this application, the second network element determines, based on the capability information of supporting disaster roaming by the terminal device and the local configuration, that the terminal device is allowed to obtain the disaster roaming service.

[00158] S503. The second network element sends information about a disaster roaming PLMN of the terminal device to the first network element. Correspondingly, the first network element receives the information about the disaster roaming PLMN of the terminal device.

[00159] Specifically, in this embodiment of this application, after determining the information about the disaster roaming PLMN of the terminal device based on the local configuration, the second network element sends the information about the disaster roaming PLMN to the first network element.

[00160] Optionally, the second network element may further send, to the first network element, indication information indicating that disaster roaming needs to be performed. The indication information indicating that disaster roaming needs to be performed indicates the first network

element to perform the disaster roaming service.

[00161] In this embodiment of this application, there are also three possible cases for content of the foregoing information about the disaster roaming PLMN.

[00162] Case 1: The information about the disaster roaming PLMN includes identification information of at least one PLMN that allows the terminal device to perform disaster roaming.

[00163] Case 2: The information about the disaster roaming PLMN includes disaster roaming service time.

[00164] Case 3: The information about the disaster roaming PLMN includes identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

[00165] It should be understood that, for the "local configuration" mentioned in the foregoing methods 400 and 500, the local configuration may be an operator policy, or may be a network configuration, or may be an operator policy and a network configuration.

[00166] It should be further understood that, the terminal device that performs the foregoing method may alternatively be a chip or a chip system disposed in the terminal device. The first network element that performs the foregoing method may alternatively be a chip or a chip system disposed in the first network element. The second network element that performs the foregoing method may alternatively be a chip or a chip system disposed in the second network element. This is not limited in embodiments of this application. The chip system may include an input interface, an output interface, at least one processor, and a memory. The input interface, the output interface, the processor, and the memory communicate with each other through an internal connection path. The processor is configured to execute code in the memory.

[00167] Therefore, in this application, the first network element performs capability negotiation with the second network element by reporting the capability information of the terminal device, and the second network element delivers the information about the disaster roaming PLMN, so that the terminal device stores the information about the disaster roaming PLMN. In this way, it can be ensured that disaster roaming is performed when a subsequent disaster occurs, to further reduce service interruption of the terminal device, minimize the service interruption, and improve user experience.

[00168] Optionally, for the terminal device, the first network element, and the second network element in the foregoing methods, the terminal device may be UE, the first network element may

be an AMF, and the second network element may be a UDM.

[00169] For ease of understanding of the disaster roaming methods 300, 400, and 500 provided in this application, by way of example and not limitation, the following uses an example in which the terminal device is UE, the first network element is an AMF, and the second network element is a UDM to describe a plurality of implementations of the foregoing methods in detail with reference to the following methods 600, 700, 800, 900, and 1000.

[00170] It should be noted that, some steps mentioned below are the same as those in the foregoing methods 300, 400, and 500. Related details are not described herein again. For a specific process, refer to related steps in the foregoing methods.

[00171] FIG. 6 is a schematic flowchart of the specific example method 600 of a disaster roaming method according to this application.

[00172] S601. The UE sends a first message to the AMF, where the first message includes capability information of supporting disaster roaming by the UE. Correspondingly, the AMF receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00173] S602. The AMF determines, based on a local configuration, to provide a disaster roaming service for the UE.

[00174] S603. The AMF determines information about a disaster roaming PLMN based on the local configuration.

[00175] S604. The AMF sends a second message to the UE, where the second message includes the information about the disaster roaming PLMN. Correspondingly, the UE receives the second message. For a specific process of this step, refer to S302 in the method 300.

[00176] S605. The UE stores the information about the disaster roaming PLMN based on the second message. For a specific process of this step, refer to S303 in the method 300.

[00177] FIG. 7 is a schematic flowchart of the specific example method 700 of a disaster roaming method according to this application.

[00178] S701. The UE sends a first message to the AMF, where the first message includes capability information of supporting disaster roaming by the UE. Correspondingly, the AMF receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00179] S702. The AMF sends the capability information of supporting disaster roaming by the UE to the UDM. Correspondingly, the UDM receives the capability information of supporting disaster roaming by the UE.

[00180] S703. The UDM determines, based on the capability information of supporting disaster roaming by the UE and a local configuration, that the UE is allowed to obtain a disaster roaming service.

[00181] S704. The UDM determines information about a disaster roaming PLMN of the UE based on the local configuration.

[00182] S705. The UDM sends the information about the disaster roaming PLMN of the UE to the AMF. Correspondingly, the AMF receives the information about the disaster roaming PLMN of the UE.

[00183] Specifically, in an implementation, the UDM encapsulates the information about the disaster roaming PLMN in a container (container), and transparently transmits the information to the UE through the AMF. The container is transparent and invisible to the AMF.

[00184] S706. The AMF sends a second message to the UE, where the second message includes the information about the disaster roaming PLMN. Correspondingly, the UE receives the second message. For a specific process of this step, refer to S302 in the method 300.

[00185] S707. The UE stores the information about the disaster roaming PLMN based on the second message. For a specific process of this step, refer to S303 in the method 300.

[00186] FIG. 8 is a schematic flowchart of the specific example method 800 of a disaster roaming method according to this application.

[00187] S801. The UE sends a first message to the AMF, where the first message includes capability information of supporting disaster roaming by the UE. Correspondingly, the AMF receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00188] S802. The AMF sends capability information of supporting disaster roaming by the UE to the UDM. Correspondingly, the UDM receives the capability information of supporting disaster roaming by the UE.

[00189] S803. The UDM determines, based on the capability information of supporting disaster roaming by the UE and a local configuration, that the UE is allowed to obtain a disaster roaming service.

[00190] S804. The UDM sends, to the AMF, indication information indicating that disaster roaming needs to be performed, where the indication information indicating that disaster roaming needs to be performed indicates the AMF to perform the disaster roaming service. Correspondingly, the AMF receives the indication information indicating that disaster roaming needs to be

performed.

[00191] S805. The AMF determines information about a disaster roaming PLMN based on the local configuration.

[00192] S806. The AMF sends a second message to the UE, where the second message includes the information about the disaster roaming PLMN. Correspondingly, the UE receives the second message. For a specific process of this step, refer to S302 in the method 300.

[00193] S807. The UE stores the information about the disaster roaming PLMN based on the second message. For a specific process of this step, refer to S303 in the method 300.

[00194] FIG. 9 is a schematic flowchart of the specific example method 900 of a disaster roaming method according to this application.

[00195] S901. The UE sends a first message to the AMF, where the first message includes capability information of supporting disaster roaming by the UE. Correspondingly, the AMF receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00196] S902. The AMF sends capability information of supporting disaster roaming by the UE to the UDM. Correspondingly, the UDM receives the capability information of supporting disaster roaming by the UE.

[00197] S903. The UDM determines, based on the capability information of supporting disaster roaming by the UE and a local configuration, that the UE is allowed to obtain a disaster roaming service.

[00198] S904. The UDM sends, to the AMF, indication information indicating that disaster roaming needs to be performed, where the indication information indicating that disaster roaming needs to be performed indicates the AMF to perform a disaster roaming service. Correspondingly, the AMF receives the indication information indicating that disaster roaming needs to be performed.

[00199] S905. The AMF sends a second message to the UE, where the second message includes indication information indicating that the terminal device is allowed to perform disaster roaming. Correspondingly, the UE receives the second message. For a specific process of this step, refer to S302 in the method 300.

[00200] S906. The UDM determines information about a disaster roaming PLMN of the UE based on the local configuration.

[00201] S907. The UDM sends a third message to the AMF, where the third message includes

the information about the disaster roaming PLMN. Correspondingly, the AMF receives the third message.

[00202] In this embodiment of this application, step S907 may be a subscriber data management notification (subscriber data management notification) service operation (service operation) provided by the UDM.

[00203] Specifically, when the second message in S905 is a registration accept message, that is, when the UE is successfully registered, step S907 is a UDM UE parameter update (UE parameter update) procedure initiated by the UDM. The UDM encapsulates the information about the disaster roaming PLMN in a container (container) in the third message, and transparently transmits the information to the UE through the AMF. The container is transparent and invisible to the AMF.

[00204] S908. The AMF sends a fourth message, where the fourth message includes the information about the disaster roaming PLMN. Correspondingly, the UE receives the fourth message.

[00205] Specifically, in this embodiment of this application, the fourth message includes the container received from the third message in step S907, and the container includes the information about the disaster roaming PLMN.

[00206] In this embodiment of this application, the fourth message may be a downlink non-access stratum NAS transport message, or may be a configuration update command message.

[00207] S909. The UE stores the information about the disaster roaming PLMN based on the fourth message.

[00208] Specifically, in this embodiment of this application, the UE includes the information about the disaster roaming PLMN based on the information about the disaster roaming PLMN included in the fourth message.

[00209] For a specific process of this step, refer to S303 in the method 300. The "second message" may be replaced with the "fourth message".

[00210] FIG. 10 is a schematic flowchart of the specific example method 1000 of a disaster roaming method according to this application.

[00211] S1001. The UE sends a first message to the AMF, where the first message includes capability information of supporting disaster roaming by the UE. Correspondingly, the AMF receives the first message. For a specific process of this step, refer to S301 in the method 300.

[00212] S1002. The AMF sends the capability information of supporting disaster roaming by

the UE to the UDM. Correspondingly, the UDM receives the capability information of supporting disaster roaming by the UE.

[00213] S1003. The UDM determines, based on the capability information of supporting disaster roaming by the UE and a local configuration, that the UE is allowed to obtain a disaster roaming service.

[00214] S1004. The UDM sends, to the AMF, indication information indicating that disaster roaming needs to be performed and disaster roaming service time, where the indication information indicating that disaster roaming needs to be performed indicates the AMF to perform the disaster roaming service. Correspondingly, the AMF receives the indication information indicating that disaster roaming needs to be performed and the disaster roaming service time.

[00215] S1005. The AMF sends a second message to the UE, where the second message includes indication information indicating that the terminal device is allowed to perform disaster roaming and the disaster roaming service time. Correspondingly, the AMF receives the second message.

[00216] Specifically, the second message is a registration reject message. To be specific, in this case, a network rejects a registration request of the UE.

[00217] For a specific process of this step, refer to S302 in the method 300.

[00218] S1006. The UE stores the information about the disaster roaming PLMN based on the second message.

[00219] Specifically, after the network rejects the registration request of the UE, the UE may mark the network as the disaster roaming PLMN, and store identification information and disaster roaming service time of the network.

[00220] For a specific process of this step, refer to S303 in the method 300.

[00221] In addition to the foregoing method, this application further provides another disaster roaming method 1100.

[00222] FIG. 11 is a schematic flowchart of the another disaster roaming method 1100 according to this application. The method includes the following steps.

[00223] S1101. A third PLMN sends system information to a terminal device, where the system information includes indication information indicating that disaster roaming is allowed. Correspondingly, the terminal device receives the system information.

[00224] It should be understood that the third PLMN is a PLMN that can provide a disaster

roaming service for the terminal device.

[00225] It should be understood that, in this embodiment of this application, due to impact of a disaster, after a PLMN that provides a service for the terminal device before the disaster occurs stops providing the service due to the disaster, the PLMN that provides the service for the terminal device before the disaster occurs sends identification information of the PLMN and information about a location area affected by the disaster to an available disaster roaming PLMN. Therefore, the available disaster roaming PLMN obtains the identification information of the PLMN that stops providing the service due to the disaster. It should be further understood that an existing standardized interface or a private interface may exist between the PLMN that provides the service for the terminal device before the disaster occurs and the available disaster roaming PLMN. Therefore, messages may be exchanged between the two PLMNs.

[00226] Specifically, in this embodiment of this application, the third PLMN broadcasts the system information. The system information includes the identification information of the PLMN that stops providing the service due to the disaster and the indication information indicating that disaster roaming is allowed. That is, the terminal device may learn whether a PLMN that provides a service for the terminal device exists in PLMNs that stop providing services due to the disaster. In addition, the indication information indicating that disaster roaming is allowed is used by the terminal device to learn that the third PLMN can provide a disaster roaming service for the terminal device. Therefore, the terminal device may perform a next operation S1102.

[00227] S1102. The terminal device sends a registration request message to the third PLMN based on the system information, where the registration request message includes capability information of supporting disaster roaming by the terminal device and disaster roaming indication information. Correspondingly, the third PLMN receives the registration request message.

[00228] It should be understood that the capability information of supporting disaster roaming by the terminal device may be capability information of the terminal device supporting minimization of service interruption MINT. It should be further understood that the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration.

[00229] Specifically, in this embodiment of this application, the terminal device may perform cell scanning, select a cell with a strongest signal to physically camp on, and read system information broadcast in the selected cell, to learn that the third PLMN is available in the currently

selected cell.

[00230] S1103. The third PLMN sends a registration accept message to the terminal device, where the registration accept message includes disaster roaming service time provided by the third PLMN. Correspondingly, the terminal device receives the registration accept message.

[00231] Therefore, after a disaster occurs, the terminal device receives and reads the system information broadcast by the third PLMN, and then selects the third PLMN to perform disaster roaming. In this way, a service can be obtained, service interruption of the terminal device can be reduced, the service interruption of the terminal device can be minimized, and user experience can be improved.

[00232] Optionally, the method further includes steps S1104 to S1107.

[00233] S1104. The terminal device performs disaster roaming in the third PLMN in the disaster roaming service time.

[00234] It should be understood that after the terminal device receives the registration accept message, because the registration accept message includes the disaster roaming service time, the disaster roaming service time indicates that the third PLMN may be a PLMN that can provide the disaster roaming service for the terminal device.

[00235] S1105. The terminal device notifies a user that the terminal device is performing disaster roaming.

[00236] Specifically, in this embodiment of this application, the terminal device may output a notification, so that the user learns that disaster roaming is currently being performed.

[00237] S1106. Before the terminal device receives the system information sent by the third PLMN, the terminal device learns that a fourth PLMN stops providing a service due to a disaster, where the fourth PLMN is a PLMN that provides the service to the terminal device before the disaster occurs.

[00238] S1107. After the terminal device learns that the fourth PLMN stops providing the service due to the disaster, the terminal device obtains information about available PLMNs in a current location area, and selects, from the available PLMNs, a PLMN in at least one PLMN as the third PLMN.

[00239] Specifically, in this embodiment of this application, the terminal device may perform cell scanning, select a cell with a strongest signal to physically camp on, and read system information broadcast in the selected cell, to learn that the third PLMN is available in the currently

selected cell.

[00240] Optionally, for the system information, the system information may include identification information of the fourth PLMN.

[00241] It should be understood that, optionally, for the foregoing method 1100, the third PLMN may further be an access network device in the third PLMN, for example, a RAN, and the terminal device may be UE.

[00242] It should be further understood that, the terminal device that performs the foregoing method may alternatively be a chip or a chip system disposed in the terminal device. The third PLMN that performs the foregoing method may alternatively be a chip or a chip system disposed in the third PLMN. This is not limited in embodiments of this application. The chip system may include an input interface, an output interface, at least one processor, and a memory. The input interface, the output interface, the processor, and the memory communicate with each other through an internal connection path. The processor is configured to execute code in the memory.

[00243] FIG. 12 and FIG. 13 are schematic diagrams of structures of possible disaster roaming apparatuses according to embodiments of this application. These apparatuses can implement functions of the terminal device or any network element in the foregoing method embodiments, and therefore can also achieve beneficial effects of the foregoing method embodiments. In embodiments of this application, the apparatus may be a terminal device, may be a first network element, may be a second network element, or may be a module (such as a chip) used in the terminal device, the first network element, or the second network element.

[00244] FIG. 12 is a schematic diagram of a structure of a disaster roaming apparatus 1200 according to an embodiment of this application. The apparatus 1200 may include a transceiver unit 1201 and a processing unit 1202.

[00245] When the apparatus 1200 is configured to implement a function of the terminal device in the method embodiment in FIG. 2 or FIG. 3, the processing unit is configured to determine a first public land mobile network PLMN based on stored information about a disaster roaming PLMN, where the information about the disaster roaming PLMN includes identification information of at least one PLMN that allows the terminal device to perform disaster roaming, and the first PLMN is a PLMN in the at least one PLMN. The transceiver unit is configured to send a registration request message to the first PLMN, where the registration request message includes disaster roaming indication information, and the disaster roaming indication information indicates

that the terminal device requests to perform disaster roaming registration. The transceiver unit is further configured to receive a registration accept message sent by the first PLMN.

[00246] When the apparatus 1200 is configured to implement a function of the first network element in the method embodiment in FIG. 4, the transceiver unit is configured to receive a first message sent by a terminal device, where the first message includes capability information of supporting disaster roaming by the terminal device. The processing unit is configured to obtain, based on the capability information of supporting disaster roaming, information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device. The transceiver unit is further configured to send a second message to the terminal device, where the second message includes the information about the disaster roaming PLMN.

[00247] When the apparatus 1200 is configured to implement a function of the second network element in the method embodiment in FIG. 5, the transceiver unit is configured to receive capability information that is of a terminal device supporting disaster roaming and that is sent by a first network element. The processing unit is configured to determine, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service. The transceiver unit is further configured to send information about a disaster roaming PLMN of the terminal device to the first network element.

[00248] When the apparatus 1200 is configured to implement a function of the terminal device in the method embodiment in FIG. 11, the transceiver unit is configured to receive system information sent by a third PLMN, where the system information includes indication information indicating that disaster roaming is allowed. The transceiver unit is further configured to send a registration request message to the third PLMN based on the system information, where the registration request message includes capability information of supporting disaster roaming by the terminal device and disaster roaming indication information. The transceiver unit is further configured to receive a registration accept message sent by the third PLMN, where the registration accept message includes disaster roaming service time provided by the third PLMN.

[00249] For more detailed descriptions of the transceiver unit 1201 and the processing unit 1202, refer to related descriptions in the foregoing method embodiments. Details are not described herein again.

[00250] FIG. 13 is a schematic block diagram of an apparatus 1300 to which an embodiment of this application is applied. Any network element in any one of the method 200 to the method 1100

may be implemented by the apparatus shown in FIG. 13.

[00251] It should be understood that the apparatus 1300 may be a physical device, may be a component (for example, an integrated circuit or a chip) in the physical device, or may be a functional module in the physical device.

[00252] As shown in FIG. 13, the apparatus 1300 includes: one or more processors 1301. The processor 1301 may store executable instructions used to perform the method in embodiments of this application. Optionally, the processor 1301 may invoke an interface to implement receiving and sending functions. The interface may be a logical interface or a physical interface. This is not limited. For example, the interface may be a transceiver circuit or an interface circuit. The transceiver circuit and the interface circuit configured to implement the receiving and sending functions may be separated, or may be integrated together. The transceiver circuit or the interface circuit may be configured to read or write code/data, or the transceiver circuit or the interface circuit may be configured to transmit or transfer a signal.

[00253] Optionally, the interface may be implemented by a transceiver. Optionally, the apparatus 1300 may further include a transceiver 1303. The transceiver 1303 may be referred to as a transceiver unit, a transceiver device, a transceiver circuit, a transceiver, or the like, and is configured to implement the receiving and sending functions.

[00254] Optionally, the apparatus 1300 may further include a memory 1302. A specific deployment location of the memory 1302 is not specifically limited in this embodiment of this application. The memory may be integrated into the processor, or may be independent of the processor. When the apparatus 1300 does not include a memory, the apparatus 1300 may have a processing function, and the memory may be deployed at another location (for example, in a cloud system).

[00255] The processor 1301, the memory 1302, and the transceiver 1303 communicate with each other through an internal connection path, to transmit a control signal and/or a data signal.

[00256] It may be understood that, although not shown, the apparatus 1300 may further include another apparatus, for example, an input apparatus, an output apparatus, or a battery.

[00257] Optionally, in some embodiments, the memory 1302 may store execution instructions used to perform the method in embodiments of this application. The processor 1301 may execute the instructions stored in the memory 1302, to complete, in combination with other hardware (for example, the transceiver 1303), steps to be performed in the following methods. For a specific

working process and beneficial effect, refer to descriptions in the following method embodiments.

[00258] The method disclosed in embodiments of this application may be applied to the processor 1301, or may be implemented by the processor 1301. The processor 1301 may be an integrated circuit chip and has a signal processing capability. In an implementation process, steps in the foregoing methods can be implemented by a hardware integrated logic circuit in the processor, or by instructions in a form of software. The foregoing processor may be a 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 discrete gate or a transistor logic device, or a discrete hardware component. The processor may implement or perform the methods, the steps, and logical block diagrams that are disclosed in embodiments of this application. The general-purpose processor may be a microprocessor, or the processor may be any conventional processor or the like. Steps of the methods disclosed with reference to embodiments of this application may be directly performed and accomplished through a hardware decoding processor, or may be performed and accomplished by a combination of hardware and software modules in the decoding processor. The software module may be located in a mature storage medium in the art, such as a random access memory (random access memory, RAM), a flash memory, a read-only memory (read-only memory, ROM), a programmable read-only memory, an electrically erasable programmable memory, or a register. The storage medium is located in the memory, and the processor reads instructions in the memory, and completes the steps of the foregoing methods in combination with hardware of the processor.

[00259] It may be understood that the memory 1302 may be a volatile memory or a non-volatile memory, or may include both a volatile memory and a non-volatile memory. The non-volatile memory may be a read-only memory ROM, a programmable read-only memory (programmable ROM, PROM), an erasable programmable read-only memory (erasable PROM, EPROM), an electrically erasable programmable read-only memory (electrically EPROM, EEPROM) or a flash memory. The volatile memory may be a random access memory RAM, which serves as an external cache. Through illustrative but not limited description, many forms of RAMs may be used, for example, a static random access memory (static RAM, SRAM), a dynamic random access memory (dynamic RAM, DRAM), a synchronous dynamic random access memory (synchronous DRAM, SDRAM), a double data rate synchronous dynamic random access memory (double data rate

SDRAM, DDR SDRAM), an enhanced synchronous dynamic random access memory (enhanced SDRAM, ESDRAM), a synchronous link dynamic random access memory (synchlink DRAM, SLDRAM), and a direct rambus random access memory (direct rambus RAM, DR RAM). It should be noted that the memory of the system and the method described in this specification includes but is not limited to these memories and any memory of another appropriate type.

[00260] In addition, in this application, the apparatus 1200 is presented in a form of a functional module. The "module" herein may be an application-specific integrated circuit ASIC, a circuit, a processor and a memory that execute one or more software or firmware programs, an integrated logic circuit, and/or another device that can provide the foregoing functions. In a simple embodiment, a person skilled in the art may figure out that the apparatus 1200 may be in a form shown in FIG. 12. The processing unit 1202 may be implemented by the processor 1301 shown in FIG. 13. Optionally, if the computer device shown in FIG. 13 includes the memory 1302, the processing unit 1202 may be implemented by the processor 1301 and the memory 1302. The transceiver unit 1201 may be implemented by the transceiver 1303 shown in FIG. 13. The transceiver 1303 includes the receiving function and the sending function. Specifically, the processor is implemented by executing a computer program stored in the memory. Optionally, when the apparatus 1200 is a chip, a function and/or an implementation process of the transceiver unit 1201 may alternatively be implemented by a pin, a circuit, or the like. Optionally, the memory may be a storage unit in the chip, for example, a register or a cache. Alternatively, the storage unit may be a storage unit that is in the computer device and that is outside the chip, such as the memory 1302 shown in FIG. 13. Alternatively, the storage unit may be a storage unit deployed in another system or device, not within the computer device. A person of ordinary skill in the art may be aware that, in combination with the examples described in embodiments disclosed in this specification, units and algorithm steps can be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraints of the technical solutions. A person skilled in the art may use different methods to implement the described functions of each particular application, but it should not be considered that the implementation goes beyond the scope of this application.

[00261] Various aspects or features of this application may be implemented as methods, apparatuses, or articles using standard programming and/or engineering techniques. The term

"product" used in this application covers a computer program that can be accessed from any computer-readable component, carrier, or medium. For example, a computer-readable medium may include but is not limited to: a magnetic storage component (for example, a hard disk, a floppy disk, or a magnetic tape), an optical disc (for example, a compact disc (compact disc, CD) or a digital versatile disc (digital versatile disc, DVD)), a smart card, and a flash memory component (for example, an erasable programmable read-only memory (erasable programmable read-only memory, EPROM), a card, a stick, or a key drive). In addition, various storage media described in this specification may represent one or more devices and/or other machine-readable media that are configured to store information. The term "machine-readable media" may include but is not limited to a radio channel, and various other media that can store, contain and/or carry instructions and/or data.

[00262] This application further provides a computer-readable medium storing a computer program. When the computer program is executed by a computer, a function of any one of the foregoing method embodiments is implemented.

[00263] This application further provides a computer program product. When the computer program product is executed by a computer, a function of any one of the foregoing method embodiments is implemented. All or some of the foregoing embodiments may be implemented by 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 instructions. When the computer instructions are loaded and executed on the computer, the procedures or functions according to embodiments of this application are all or partially generated. The computer may be a general-purpose computer, a dedicated computer, a computer network, or other programmable apparatuses. The computer 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 instructions may be transmitted from a website, computer, server, or data center to another website, computer, server, or data center in a wired (for example, a coaxial cable, an optical fiber, or a digital subscriber line (digital subscriber line, DSL)) or wireless (for example, infrared, radio, or microwave) manner. The computer-readable storage medium may be any usable medium accessible 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), an optical medium (for example, a high-density digital video disc (digital video disc, DVD)), a semiconductor medium (for example, a solid state disk (solid state disk, SSD)), or the like.

[00264] It should be understood that, "an embodiment" mentioned in the entire specification means that particular features, structures, or characteristics related to the embodiment are included in at least one embodiment of this application. Therefore, embodiments in the entire specification do not necessarily refer to a same embodiment. In addition, these particular features, structures, or characteristics may be combined in one or more embodiments in any appropriate manner. It should be understood that sequence numbers of the foregoing processes do not mean execution sequences in various embodiments of this application. The execution sequences of the processes should be determined based on functions and internal logic of the processes, and should not be construed as any limitation on the implementation processes of embodiments of this application.

[00265] In addition, it should also be understood that, in this application, the terms "when" and "if" mean that UE or a base station may perform corresponding processing in an objective case, but are not intended to limit time, do not require the UE or the base station to perform a determining action during implementation, and do not mean any other limitation.

[00266] In addition, the terms "system" and "network" may be used interchangeably in this specification. The term "and/or" in this specification is merely an association relationship for describing associated objects, and indicates that three relationships may exist. For example, A and/or B may represent the following three cases. Only A exists, both A and B exist, and only B exists.

[00267] In this specification, the term "at least one of" indicates all or any combination of listed items. For example, "at least one of A, B, and C" may represent the following six cases. Only A exists, only B exists, only C exists, both A and B exist, both B and C exist, and both A, B, and C exist.

[00268] In this application, unless otherwise specified, "at least one" means one or more, and "a plurality of" means two or more.

[00269] It should be understood that in embodiments of this application, "B corresponding to A" indicates that B is associated with A, and B may be determined based on A. However, it should be further understood that determining B based on A does not mean that B is determined based

only on A. B may alternatively be determined based on A and/or other information.

[00270] A person of ordinary skill in the art may be aware that, in combination with the examples described in embodiments disclosed in this specification, units and algorithm steps can be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraints of the technical solutions. A person skilled in the art may use different methods to implement the described functions of each particular application, but it should not be considered that the implementation goes beyond the scope of this application.

[00271] It may be clearly understood by a person skilled in the art that, for convenient and brief description, for a detailed working process of the foregoing system, apparatus, and units, refer to a corresponding process in the foregoing method embodiments, and details are not described herein again.

[00272] In the several embodiments provided in this application, it should be understood that the disclosed systems, apparatuses, and methods may be implemented in other manners. For example, the described apparatus embodiment is merely an example. For example, division into the units is merely logical function division and may be other 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 by some interfaces. The indirect couplings or communication connections between the apparatuses or units may be implemented in electronic, mechanical, or other forms.

[00273] 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 at one position, or may be distributed on a plurality of network units. Some or all of the units may be selected based on actual requirements to achieve the objectives of the solutions of embodiments.

[00274] In addition, functional units in embodiments of this application may be integrated into one processing unit, or each of the units may exist alone physically, or two or more units are integrated into one unit.

[00275] When the functions are implemented in the form of a software functional unit and sold or used as an independent product, the functions may be stored in a computer-readable storage medium. Based on such an understanding, the technical solutions of this application essentially, or

the part contributing to the conventional technology, or some of the technical solutions may be implemented in a form of a software product. The computer software product is stored in a storage medium, and includes several instructions for instructing a computer device (which may be a personal computer, a server, a network device, or the like) to perform all or some of the steps of the methods described in embodiments of this application. The foregoing storage medium includes: any medium that can store program code, such as a USB flash drive, a removable hard disk, a ROM, a RAM, a magnetic disk, or an optical disc.

[00276] The foregoing descriptions are merely specific implementations of this application, but are not intended to limit the protection scope of this application. Any variation or replacement readily figured out by a person skilled in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

CLAIMS

What is claimed is:

1. A disaster roaming method performed in a terminal device, comprising:

determining a first public land mobile network PLMN based on stored information about a disaster roaming PLMN, wherein the information about the disaster roaming PLMN comprises identification information of at least one PLMN that allows the terminal device to perform disaster roaming, and the first PLMN is a PLMN in the at least one PLMN;

sending a registration request message to the first PLMN, wherein the registration request message comprises disaster roaming indication information, and the disaster roaming indication information indicates that the terminal device requests to perform disaster roaming registration; and

receiving a registration accept message sent by the first PLMN.

2. The method according to claim 1, wherein the information about the disaster roaming PLMN further comprises disaster roaming service time.

3. The method according to claim 1 or 2, wherein after the receiving registration accept message sent by the first PLMN, the method further comprises:

performing disaster roaming in the first PLMN in the disaster roaming service time.

4. The method according to any one of claims 1 to 3, wherein the method further comprises:

notifying a user that the terminal device is performing disaster roaming.

5. The method according to any one of claims 1 to 4, wherein the determining a first PLMN comprises:

obtaining information about available PLMNs in a current location area, and selecting, from the available PLMNs, the PLMN in the at least one PLMN as the first PLMN.

6. The method according to any one of claims 1 to 5, wherein before the determining a first PLMN, the method further comprises:

learning that a PLMN that currently provides a service stops providing the service due to a disaster.

7. The method according to any one of claims 1 to 6, wherein before the learning that a PLMN that currently provides a service stops providing the service due to a disaster, the method further comprises:

sending a first message to a second PLMN, wherein the first message comprises capability information of supporting disaster roaming by the terminal device;

receiving a second message sent by the second PLMN, wherein the second message comprises the information about the disaster roaming PLMN; and

storing the information about the disaster roaming PLMN based on the second message.

8. The method according to claim 7, wherein the first message is a registration request message.

9. The method according to claim 7, wherein the second message is any one of the following:

a registration accept message, a registration reject message, a downlink non-access stratum NAS transport message, or a configuration update command message.

10. The method according to any one of claims 7 to 9, wherein the second message further comprises indication information indicating that the terminal device is allowed to perform disaster roaming.

11. The method according to any one of claims 7 to 10, wherein when the second message is the registration reject message, the method further comprises:

storing identification information of the second PLMN in the information about the disaster roaming PLMN.

12. A disaster roaming method performed in a first network element, comprising:

receiving a first message sent by a terminal device, wherein the first message comprises capability information of supporting disaster roaming by the terminal device;

obtaining, based on the capability information of supporting disaster roaming, information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device; and

sending a second message to the terminal device, wherein the second message comprises the information about the disaster roaming PLMN.

13. The method according to claim 12, wherein the first message is a registration request message.

14. The method according to claim 12, wherein the second message is any one of the following:

a registration accept message, a registration reject message, a downlink non-access stratum NAS transport message, or a configuration update command message.

15. The method according to any one of claims 12 to 14, wherein the second message further comprises indication information indicating that the terminal device is allowed to perform disaster roaming.

16. The method according to claim 12, wherein the obtaining information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device comprises:

determining the information about the disaster roaming PLMN based on a local configuration.

17. The method according to claim 16, wherein before the determining the information about the disaster roaming PLMN based on a local configuration, the method further comprises:

determining, based on the local configuration, to provide the disaster roaming service for the terminal device.

18. The method according to claim 16, wherein before the determining the information about the disaster roaming PLMN based on a local configuration, the method further comprises:

receiving indication information that indicates that disaster roaming needs to be performed and that is sent by a second network element, wherein the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

19. The method according to claim 12, wherein the obtaining information about a disaster roaming PLMN that provides a disaster roaming service for the terminal device comprises:

receiving the information about the disaster roaming PLMN sent by a second network element.

20. The method according to claim 19, wherein the receiving the information about the disaster roaming PLMN sent by a second network element further comprises:

receiving indication information that indicates that disaster roaming needs to be performed and that is sent by the second network element, wherein the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

21. The method according to claim 18 or 19, wherein before the receiving indication information that indicates that disaster roaming needs to be performed and that is sent by a second network element or the receiving the information about the disaster roaming PLMN sent by a second network element, the method further comprises:

sending, to the second network element, the capability information of supporting disaster

roaming by the terminal device.

22. The method according to any one of claims 12 to 21, wherein the information about the disaster roaming PLMN comprises:

identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or

disaster roaming service time; or

identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

23. A disaster roaming method performed in a second network element, comprising:

receiving capability information that is of supporting disaster roaming by a terminal device and that is sent by a first network element;

determining, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service; and

sending information about a disaster roaming PLMN of the terminal device to the first network element.

24. The method according to claim 23, wherein the method further comprises: sending, to the first network element, indication information indicating that disaster roaming needs to be performed, wherein the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

25. The method according to claim 23 or 24, wherein the determining that the terminal device is allowed to obtain a disaster roaming service comprises:

determining, based on the capability information of supporting disaster roaming by the terminal device and a local configuration, that the terminal device is allowed to obtain the disaster roaming service.

26. The method according to any one of claims 23 to 25, wherein before the sending information about a disaster roaming PLMN of the terminal device to the first network element, the method further comprises:

determining the information about the disaster roaming PLMN of the terminal device based on the local configuration.

27. The method according to any one of claims 23 to 26, wherein the information about the disaster roaming PLMN comprises:

identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or

disaster roaming service time; or

identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

28. A disaster roaming method performed in a terminal device, comprising:

receiving system information sent by a third PLMN, wherein the system information comprises indication information indicating that disaster roaming is allowed;

sending a registration request message to the third PLMN based on the system information, wherein the registration request message comprises capability information of supporting disaster roaming by the terminal device and disaster roaming indication information; and

receiving a registration accept message sent by the third PLMN, wherein the registration accept message comprises disaster roaming service time provided by the third PLMN.

29. The method according to claim 28, wherein the method further comprises:

performing disaster roaming in the third PLMN in the disaster roaming service time.

30. The method according to claim 28 or 29, wherein the method further comprises:

notifying a user that the terminal device is performing disaster roaming.

31. The method according to any one of claims 28 to 30, wherein before the receiving system information sent by a third PLMN, the method further comprises:

learning that a fourth PLMN stops providing a service due to a disaster, wherein the fourth PLMN is a PLMN that provides the service for the terminal device before the disaster.

32. The method according to claim 31, wherein after the learning that a fourth PLMN stops providing a service due to a disaster, the method further comprises:

obtaining information about available PLMNs in a current location area, and selecting, from the available PLMNs, a PLMN in at least one PLMN as the third PLMN.

33. The method according to any one of claims 28 to 32, wherein the system information further comprises identification information of the fourth PLMN.

34. A disaster roaming apparatus, wherein the apparatus is configured to: perform the method according to any one of claims 1 to 11; or

perform the method according to any one of claims 12 to 22; or

perform the method according to any one of claims 23 to 27; or

perform the method according to any one of claims 28 to 33.

35. A disaster roaming system, wherein the system comprises a first network element and a second network element, wherein

the first network element is configured to send capability information of supporting disaster roaming by a terminal device;

the second network element is configured to receive the capability information of supporting disaster roaming by the terminal device;

the second network element is further configured to determine, based on the capability information of supporting disaster roaming by the terminal device, that the terminal device is allowed to obtain a disaster roaming service;

the second network element is further configured to send information about a disaster roaming PLMN of the terminal device; and

the first network element is further configured to receive the information about the disaster roaming PLMN of the terminal device.

36. The system according to claim 35, wherein the second network element is further configured to send indication information indicating that disaster roaming needs to be performed; and

the first network element is further configured to receive the indication information indicating that disaster roaming needs to be performed, wherein

the indication information indicating that disaster roaming needs to be performed indicates the first network element to perform the disaster roaming service.

37. The system according to claim 35 or 36, wherein the second network element is configured to determine that the terminal device is allowed to obtain the disaster roaming service, and the second network element is specifically configured to:

determine, based on the capability information of supporting disaster roaming by the terminal device and a local configuration, that the terminal device is allowed to obtain the disaster roaming service.

38. The system according to any one of claims 35 to 37, wherein before the second network element is configured to send the information about the disaster roaming PLMN of the terminal device, the second network element is further configured to:

determine the information about the disaster roaming PLMN of the terminal device based on

the local configuration.

39. The system according to any one of claims 35 to 38, wherein the information about the disaster roaming PLMN comprises:

identification information of at least one PLMN that allows the terminal device to perform disaster roaming; or

disaster roaming service time; or

identification information of at least one PLMN that allows the terminal device to perform disaster roaming and disaster roaming service time.

40. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, and when the computer program is run, the method according to any one of claims 1 to 11 is implemented; or

the method according to any one of claims 12 to 22 is implemented; or

the method according to any one of claims 23 to 27 is implemented; or

the method according to any one of claims 28 to 33 is implemented.

41. A chip, comprising: a processor, configured to read instructions stored in a memory, wherein when the processor executes the instructions, the chip is enabled to implement the method according to any one of claims 1 to 33.