COMMUNICATION METHOD AND APPARATUS

[0001] This application claims priority to Chinese Patent Application No. 202410376220.8, filed with the China National Intellectual Property Administration on March 27, 2024 and entitled "COMMUNICATION METHOD AND APPARATUS", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

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

BACKGROUND

[0003] Transport layer protocols in wireless communication transmission include the user datagram protocol (User Datagram Protocol, UDP), which can provide simple communication transmission services. Quick UDP internet connections (Quick UDP Internet Connections, QUIC) is a reliable UDP transmission protocol that can provide secure, reliable, and low-delay communication transmission services. For example, in a media over QUIC (Media over QUIC, MoQ) transmission scenario, transmission of media data such as audio or video can be performed by using QUIC, to reduce latency and improve communication efficiency.

[0004] Currently, a QUIC connection may be established between a terminal and an application server to support media over QUIC data transmission. A control plane function in a network may allocate a user plane network element (User Plane Function, UPF) to the terminal based on a session requirement of the terminal and subscription data of the terminal, to establish a session, and establish a user plane connection between the terminal and the UPF. As a relay node between the server and the terminal, the UPF may not decode media data.

[0005] In an example scenario in which a plurality of terminals request same or different media data from a same application server, a UPF requests media data from a server of a first application and forwards the media data to a terminal 1; and subsequently, a terminal 2 requests the media data of the first application, and the UPF needs to request the media data from the server of the first application again and forwards the media data of the first application to the terminal 2. As a result, substantial network transmission resources are occupied for forwarding the large amount of data, a service processing delay is long, and communication efficiency is low.

SUMMARY

[0006] This application provides a communication method and apparatus, to resolve problems that, in a scenario in which a user plane network element transmits, to an application server, a large amount of media data requested by a terminal, substantial network transmission resources are occupied for forwarding the large amount of data, a service processing delay is long, and communication efficiency is low.

[0007] To achieve the foregoing objective, this application uses the following technical solutions.

[0008] According to a first aspect, a communication method is provided. The method may be performed by a first apparatus, or may be performed by a module (for example, a chip or a circuit) of the first apparatus. For example, the first apparatus may be a control plane function in a core network, for example, a session management function. The method includes: receiving a first message, where the first message includes that a terminal has a media over quick user datagram protocol internet connections QUIC data transmission requirement; and determining a second apparatus based on the first message, where the second apparatus supports a first function, the first function is a media over QUIC data transmission function, and the second apparatus is configured to: establish a first QUIC link with the terminal, and transmit media data over the first QUIC link.

[0009] In the foregoing implementation, for the terminal having the MoQ transmission requirement, a control plane function in a network, for example, the first apparatus, may select, for the terminal based on a media access requirement of the terminal, a user plane function having MoQ transmission capability, for example, the second apparatus, so that a QUIC connection between the terminal and the user plane function, for example, the second apparatus, can be established, and multimedia data can be transmitted to the terminal via the user plane function, without a need of transmitting the multimedia data via an application server of a media application, thereby improving MoQ transmission efficiency, avoiding occupation of network resources caused by forwarding of a large amount of data, and improving utilization of the network resources.

[0010] In an implementation, the first message includes a media data parameter requested by the terminal, and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

[0011] In the foregoing implementation, the first message may carry the MoQ media data parameter requested by the terminal, for example, an identifier of media content, so that the first apparatus may match and query for the second apparatus based on the media data parameter in the first message, specifically, querying for the second apparatus that stores the media data corresponding

to the media data parameter, or querying for the second apparatus capable of serving the media application corresponding to the media data parameter, to establish the QUIC connection between the terminal and the second apparatus, thereby improving communication efficiency.

[0012] In an implementation, the receiving the first message includes: receiving the first message from the terminal, where the first message is used to request session establishment; and the determining the second apparatus includes: sending a second message to a data management function, where the second message is used to request to obtain subscription data of the terminal; receiving a response message from the data management function, where the response message indicates that the terminal supports the first function, and the response message further includes a media data parameter supported by the terminal; and determining, based on the response message and from a node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal.

[0013] In the foregoing implementation, the first apparatus may request the subscription data of the terminal from the data management function, to determine whether the terminal supports the MoQ function and the supported media data parameter, so that the first apparatus may determine, from the node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal, thereby improving communication efficiency.

[0014] In an implementation, the first message includes first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link.

[0015] In an implementation, the receiving the first message includes: receiving the first message from an edge application server discovery function, where the first message includes domain name information corresponding to a domain name system DNS server, the first message indicates that the terminal supports the first function, and the first message includes the media data parameter requested by the terminal; and the determining the second apparatus includes: determining, based on the domain name information and from a node supporting the first function, the second apparatus that satisfies the media data parameter requested by the terminal.

[0016] In the foregoing implementation, an implementation of configuring a user plane function for the terminal based on a domain name system (Domain Name System, DNS) addressing procedure is supported. The edge application server discovery function may obtain, based on a domain name query request, information about a relay UPF supporting the MoQ function, for example, the second apparatus, and feed back the information to the terminal, so that a QUIC link between the terminal

and the user plane function, which is the second apparatus, can be established, and multimedia data can be transmitted to the terminal via the user plane function without a need of transmitting the multimedia data via an application server of a media application, thereby improving MoQ transmission efficiency, avoiding occupation of network resources caused by forwarding of a large amount of data, and improving utilization of the network resources.

[0017] In an implementation, the method includes: receiving second indication information from the second apparatus or a network repository function, where the second indication information indicates that the second apparatus supports the first function, and the second indication information further includes the media data parameter corresponding to the media data stored in the second apparatus.

[0018] In the foregoing implementation, the user plane function in the network, for example, the second apparatus, may report, by sending the second indication information to the first apparatus, that the second apparatus supports the first function, and the second indication information may further carry the media data parameter stored in the second apparatus, so that the first apparatus stores capability information of the second apparatus. When the terminal requests the MoQ function, the UPF that supports the MoQ transmission requirement may be matched for the terminal based on capability of the second apparatus, to establish a QUIC link, thereby improving communication efficiency.

[0019] In an implementation, the method further includes: receiving third indication information from the second apparatus, where the third indication information indicates that the second apparatus does not support the media data parameter requested by the terminal.

[0020] In the foregoing implementation, if the user plane function, which is the second apparatus, allocated by the network to the terminal can satisfy only some media requests of the terminal, the third indication information may be sent to the first apparatus, to indicate that the second apparatus does not support the media data parameter requested by the terminal, so that a connection between the application server and the terminal can be subsequently established, thereby improving flexibility of communication transmission.

[0021] In an implementation, the method includes: sending a third message to an application function entity through a capability exposure interface, where the third message includes the media data parameter requested by the terminal and information about the second apparatus, and the third message is used to request an application server to establish a second QUIC link with the second apparatus, for transmission of media data over the second QUIC link.

[0022] In the foregoing implementation, when the second apparatus cannot satisfy all media data requests of the terminal, the first apparatus may send the media data parameter requested by the terminal and the information about the current second apparatus (UPF) to the application function, to request the application server that can support the media data parameter requested by the terminal to establish a connection with the terminal, thereby implementing media data transmission and improving communication efficiency and flexibility.

[0023] In an implementation, the method includes: sending a fourth message to the data management function, where the fourth message includes the media data parameter requested by the terminal, and the fourth message is used to request to obtain information about a corresponding application server supporting the media data parameter requested by the terminal; receiving a response message from the data management function, where the response message includes information about a first application server, the first application server is configured to: establish a third QUIC link with the second apparatus, and transmit media data over the third QUIC link; and sending the information about the first application server to the second apparatus.

[0024] In the foregoing implementation, when the second apparatus cannot satisfy all media data requests of the terminal, the first apparatus may send the media data parameter requested by the terminal to the data management function, to request to obtain the information about the application server that can support the media data parameter requested by the terminal, so that the first application server may establish a connection with the terminal, thereby implementing media data transmission and improving communication efficiency and flexibility.

[0025] According to a second aspect, a communication method is provided. The method may be performed by a terminal, or may be performed by a module (for example, a chip or a circuit) of the terminal. The method includes: sending a first message to a first apparatus, where the first message includes first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link; and establishing a first QUIC link with a second apparatus, and transmitting, over the first QUIC link, media data corresponding to a media data parameter.

[0026] In an implementation, the first message further includes the media data parameter requested by the terminal, and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

[0027] According to a third aspect, a communication method is provided. For example, the

method may be performed by a data management function, or may be performed by a module (for example, a chip or a circuit) of the data management function. The method includes: receiving a second message from a first apparatus, where the second message is used to request to obtain subscription data of a terminal; determining, based on the second message and stored subscription data corresponding to at least one terminal, the subscription data corresponding to the terminal, where the subscription data includes supporting a first function by the terminal, and the first function is a media over QUIC data transmission function; and sending a response message to the first apparatus, where the response message indicates that the terminal supports the first function, and the response message further includes a media data parameter supported by the terminal.

[0028] In an implementation, the data management function stores the media data parameter supported by the terminal.

[0029] In an implementation, the method further includes: obtaining, through a capability exposure interface, information about an application server and a media data parameter whose transmission is supported by the application server based on the first function.

[0030] According to a fourth aspect, a communication method is provided. The method may be performed by a second apparatus, or may be performed by a module (for example, a chip or a circuit) of the second apparatus. For example, the second apparatus may be a user plane function in a core network, for example, a user plane function (user plane function, UPF). The method includes: sending second indication information to a network repository function, where the second indication information indicates that a first function is supported, and the first function is a media over QUIC data transmission function; or establishing a node-level connection with a first apparatus, and sending the second indication information to the first apparatus.

[0031] In an implementation, the second indication information further includes a media data parameter corresponding to media data stored in the second apparatus.

[0032] According to a fifth aspect, a communication apparatus is provided, including a processor. The processor is configured to: after being coupled to a memory and reading instructions in the memory, perform the method according to any one of the foregoing aspects based on the instructions. The communication apparatus may be the first apparatus in the first aspect, or the terminal in the second aspect, or the data management function in the third aspect, or the second apparatus in the fourth aspect, or a node or device including the first apparatus, the second apparatus, the terminal, or the data management function, or a module in the first apparatus, the second apparatus, the terminal, or the data management function, such as a chip, a chip system, or a circuit, or a logical node, a logical

module, or software that can implement some or all functions.

[0033] With reference to the fifth aspect, in a possible implementation, the communication apparatus further includes the memory. The memory is configured to store necessary program instructions and data.

[0034] With reference to the fifth aspect, in a possible implementation, the communication apparatus is a chip or a chip system. Optionally, when the communication apparatus is the chip system, the communication apparatus may include a chip, or may include a chip and another discrete device.

[0035] According to a sixth aspect, a communication apparatus is provided, including a processor and an interface circuit. The interface circuit is configured to: receive a computer program or instructions, and transmit the computer program or the instructions to the processor. The processor is configured to execute the computer program or the instructions, to cause the communication apparatus to perform the method according to any one of the foregoing aspects. The communication apparatus may be the first apparatus in the first aspect, or the terminal in the second aspect, or the data management function in the third aspect, or the second apparatus in the fourth aspect, or a node or device including the first apparatus, the second apparatus, the terminal, or the data management function, or a module in the first apparatus, the second apparatus, the terminal, or the data management function, such as a chip, a chip system, or a circuit, or a logical node, a logical module, or software that can implement some or all functions.

[0036] With reference to the sixth aspect, in a possible implementation, the communication apparatus is a chip or a chip system. Optionally, when the communication apparatus is the chip system, the communication apparatus may include a chip, or may include a chip and another discrete device.

[0037] According to a seventh aspect, a computer-readable storage medium is provided. The computer-readable storage medium stores instructions. When the instructions are run on a computer, the computer is caused to perform the method according to any one of the foregoing aspects.

[0038] According to an eighth aspect, a computer program product including instructions is provided. When the computer program product is run on a computer, the computer is caused to perform the method according to any one of the foregoing aspects.

[0039] According to a ninth aspect, a communication system is provided. The communication system includes the first apparatus configured to perform any possible implementation of the first aspect, and includes the terminal configured to perform any possible implementation of the second aspect.

[0040] With reference to the ninth aspect, in a possible implementation, the communication

system further includes the data management function configured to perform any possible implementation of the third aspect.

[0041] With reference to the ninth aspect, in a possible implementation, the communication system further includes the second apparatus configured to perform any possible implementation of the fourth aspect.

[0042] For technical effects brought by any one of the possible implementations of the second aspect to the ninth aspect, refer to technical effects brought by the different possible implementations of the first aspect. Details are not described herein again.

[0043] It may be understood that the solutions in the foregoing aspects may be combined if the solutions are not contradictory.

BRIEF DESCRIPTION OF DRAWINGS

[0044] FIG. 1 is a diagram of an architecture of a communication system according to an embodiment of this application;

[0045] FIG. 2 is a diagram of another communication system according to an embodiment of this application;

[0046] FIG. 3 is a diagram of a structure of a communication apparatus according to an embodiment of this application;

[0047] FIG. 4 is a schematic flowchart of a communication method according to an embodiment of this application;

[0048] FIG. 5 is a schematic flowchart of another communication method according to an embodiment of this application;

[0049] FIG. 6 is a schematic flowchart of another communication method according to an embodiment of this application;

[0050] FIG. 7 is a schematic flowchart of another communication method according to an embodiment of this application;

[0051] FIG. 8 is a schematic flowchart of another communication method according to an embodiment of this application;

[0052] FIG. 9 is a schematic flowchart of another communication method according to an embodiment of this application; and

[0053] FIG. 10 is a diagram of a structure of another communication apparatus according to an embodiment of this application.

DESCRIPTION OF EMBODIMENTS

[0054] The terms "first" and "second" mentioned below are merely intended for a purpose of description, and shall not be understood as an indication or implication of relative importance or implicit indication of the number of indicated technical features. Therefore, a feature limited by "first" or "second" may explicitly or implicitly include one or more features. In the descriptions of embodiments, unless otherwise specified, "a plurality of" means two or more.

[0055] It should be noted that in this application, the terms such as "example" or "for example" are used to represent giving an example, an illustration, or a description. Any embodiment or design scheme described as an "example" or "for example" in this application should not be explained as being more preferred or having more advantages than another embodiment or design scheme. To be precise, the words such as "example" or "for example" are intended to present a relevant concept in a specific manner.

[0056] The following clearly and completely describes the technical solutions in embodiments of this application with reference to the accompanying drawings in embodiments of this application. It is clear that the described embodiments are merely some but not all of embodiments of this application. All other embodiments obtained by a person of ordinary skill in the art based on embodiments of this application without creative efforts shall fall within the protection scope of this application.

[0057] An implementation environment and an application scenario of embodiments of this application are briefly described first.

[0058] A communication method provided in embodiments of this application may be applied to an architecture of a communication system shown in FIG. 1. FIG. 1 shows interaction relationships between network functions (network functions, NFs) and entities and corresponding interfaces by using a network service architecture of a 5th generation (5th generation, 5G) mobile communication system as an example. The network functions and the entities included in a service-based architecture (service-based architecture, SBA) of a 3rd generation partnership project (3rd generation partnership project, 3GPP) of the 5G system mainly include: user equipment (User Equipment, UE), at least one access network (access network, AN) or radio access network (radio access network, RAN) node, a user plane function (user plane function, UPF), a data network (data network, DN), an access and mobility management function (access and mobility management function, AMF), a session management function (session management function, SMF), a policy control function (policy control function, PCF), an application function (application function, AF), a unified data management (unified data management, UDM), a network exposure function (network exposure function, NEF),

a unified data repository (Unified Data Repository, UDR), a network repository function (NF repository function, NRF), and the like.

[0059] The UE, the (R)AN node, the UPF, and the DN are usually referred to as user plane network functions and entities (or user plane network elements), and the other parts are usually referred to as control plane network functions and entities (or control plane network elements). A processing function of the control plane network element in a network is defined by 3GPP. The control plane network element has a function behavior defined by 3GPP and an interface defined by 3GPP. The NF can be used as a network element running on dedicated hardware, a software instance running on dedicated hardware, or a virtual function that is instantiated on a proper platform, for example, implemented on a cloud infrastructure device.

[0060] Main functions in the network elements are described in detail below.

[0061] The user plane network functions in the communication system include:

[0062] (R)AN node: The (R)AN may be an AN, or may be a RAN, or may be referred to as an access network device, a RAN entity, an access node, or the like, and constitutes a part of the communication system, to help the terminal implement access to the communication network. For example, the (R)AN may be a base station in various forms, for example, a macro base station, a micro base station, a radio controller, a relay station, an access point, a vehicle-mounted device, a wearable device, or a network device in a future evolved public land mobile network (public land mobile network, PLMN). The (R)AN is mainly responsible for radio resource management, service quality management, data compression and encryption, and the like on an air interface side.

[0063] In addition, the (R)AN node may alternatively be an access node in an open radio access network (open RAN, O-RAN, or ORAN), a cloud radio access network (cloud radio access network, CRAN), or a wireless fidelity (wireless fidelity, Wi-Fi) system, or may be an access node in a communication system integrating two or more of the foregoing systems.

[0064] In a possible scenario, the RAN node may be a base station (base station), an evolved NodeB (evolved NodeB, eNodeB), an access point (access point, AP), a transmission reception point (transmission reception point, TRP), a next generation NodeB (next generation NodeB, gNB), a next generation base station in a 6th generation (6th generation, 6G) mobile communication system, a base station in a future mobile communication system, an access node in a Wi-Fi system, or the like. The RAN node may be a macro base station, a micro base station or an indoor base station, a relay node or a donor node, or a radio controller in a CRAN scenario. Optionally, the RAN node may alternatively be a server, a wearable device, a vehicle, a vehicle-mounted device, or the like. For

example, an access network device in a vehicle-to-everything (vehicle-to-everything, V2X) technology may be a road side unit (road side unit, RSU). All or some functions of the RAN node in this application may alternatively be implemented by using a software function run on hardware, or may be implemented by using a virtualization function instantiated on a platform (for example, a cloud platform). Alternatively, the RAN node in this application may be a logical node, a logical module, or software that can implement all or a part of functions of the RAN node.

[0065] In another possible scenario, a plurality of RAN nodes coordinate to assist the terminal in implementing radio access, and different RAN nodes respectively implement some functions of a base station. For example, the RAN node may be a central unit (central unit, CU), a distributed unit (distributed unit, DU), a CU-control plane (control plane, CP), a CU-user plane (user plane, UP), a radio unit (radio unit, RU), or the like. The CU and the DU may be separately arranged, or may be included in a same network element, for example, a baseband unit (baseband unit, BBU). The RU may be included in a radio frequency device or a radio frequency unit, for example, included in a remote radio unit (remote radio unit, RRU), an active antenna unit (active antenna unit, AAU), or a remote radio head (remote radio head, RRH).

[0066] In different systems, the CU (or the CU-CP and the CU-UP), the DU, or the RU may also have different names, but a person skilled in the art may understand meanings thereof. For example, in an ORAN system, the CU may also be referred to as an O-CU (open CU), the DU may also be referred to as an O-DU, the CU-CP may also be referred to as an O-CU-CP, the CU-UP may also be referred to as an O-CU-UP, and the RU may also be referred to as an O-RU. For ease of description, the CU, the CU-CP, the CU-UP, the DU, and the RU are used as examples for description in this application. Any one of the CU (or the CU-CP or the CU-UP), the DU, and the RU in this application may be implemented by using a software module, a hardware module, or a combination of a software module and a hardware module.

[0067] UE: The UE may also be referred to as a terminal, a terminal device, a mobile station, a mobile terminal, or the like. The terminal may be widely used in various scenarios, for example, device-to-device (device-to-device, D2D), vehicle-to-everything (vehicle-to-everything, V2X) communication, machine-type communication (machine-type communication, MTC), internet of things (internet of things, IoT), virtual reality, augmented reality, industrial control, autonomous driving, remote medical, smart grid, smart home, smart office, smart wearable, smart transportation, and smart city. The terminal may be a mobile phone, a tablet computer, a computer with a wireless transceiver function, a wearable device, a vehicle, an uncrewed aerial vehicle, a helicopter, an airplane,

a ship, a robot, a robotic arm, a smart home device, or the like. A device form of the terminal is not limited in embodiments of this application.

[0068] UPF: The UPF is mainly responsible for forwarding and receiving user data. The UPF may receive downlink data from the DN, and then transmit the downlink data to the UE via the (R)AN. The UPF may further receive uplink data from the UE via the (R)AN, and then forward the uplink data to the DN.

[0069] DN: For example, the DN may be an operator service network, an internet access network, a third-party service network, or the like. The DN may exchange information with the UE by using a protocol data unit (Protocol Data Unit, PDU) session. PDU sessions may be classified into a plurality of types, for example, internet protocol version 4 (internet protocol version 4, IPv4) and IPv6.

[0070] In addition, the control plane network functions in the communication system include:

[0071] AMF: The AMF is mainly responsible for processing a control plane message, and user mobility management, including mobility state management, temporary user identity allocation, and user authentication and authorization, for example, access control, mobility management, registration and deregistration, and network element selection.

[0072] SMF: The SMF is mainly used for session management, session establishment, and UE IP address allocation and management, and is responsible for session establishment, modification and release, quality of service (quality of service, QoS) control, and the like.

[0073] UDM: The UDM is mainly used for authentication credential processing, and is responsible for subscription data management, user identification handling, access authorization, registration/mobility management, subscription management, short message service management, and the like. For example, when subscription data of a user is modified, the UDM is responsible for notifying a corresponding network element.

[0074] PCF: The PCF is mainly used for policy management, is responsible for managing policy-related data in the network, and may provide policy rules to a control plane function (for example, the AMF and the SMF) in the network, and the like.

[0075] NEF: The NEF is mainly used to provide corresponding security assurance to ensure security of an external application to a communication network, and provide functions such as QoS customization capability exposure of the external application, mobility status event subscription, and AF request distribution.

[0076] NRF: The NRF is mainly used to provide an internal/external addressing function and the like.

[0077] AF: The AF is mainly used to send, to a network side, information regarding application influence on traffic routing, perform policy control by interacting with a policy framework via a network exposure function network element, and the like.

[0078] For functions of other network elements included in FIG. 1, refer to related descriptions in a conventional technology. Details are not described herein.

[0079] It should be noted that the network architecture shown in FIG. 1 is merely used as an example, and is not intended to limit the technical solutions of this application. A person skilled in the art should understand that, in a specific implementation process, another network element or apparatus may be further included, and a quantity of access network devices, terminals, and/or core network devices may also be determined based on a specific requirement.

[0080] Optionally, each network element shown in FIG. 1 may be a device, or a functional module in the device, or a logical function unit. It may be understood that the foregoing function may be a network element in a hardware device, for example, a communication chip in a mobile phone, a software function running on dedicated hardware, or a virtualized function instantiated on a platform (for example, a cloud platform).

[0081] In addition, the communication method provided in embodiments of this application may be applied to a communication system shown in FIG. 2. As shown in FIG. 2, the communication system may include a terminal, a control plane function, for example, a first apparatus, a user plane function, for example, a second apparatus, and an application server (Application Server, AS). The terminal may establish a connection with the application server, and data transmission may be performed via the user plane function. For example, simple communication transmission services may be provided by using UDP, or secure, reliable, and low-delay communication transmission services may be provided by using QUIC. In a media over QUIC (Media over QUIC, MoQ) transmission scenario, transmission of media data such as audio or video can be performed by using QUIC, to reduce latency and improve communication efficiency.

[0082] In an implementation provided in this application, the user plane function serves as a relay (relay) forwarding node, can identify media data, and support caching of some identified media data parameters, so that the user plane function may forward cached media data to the terminal based on a media access requirement of the terminal, and does not need to request, from the application server every time, the media data requested by the terminal.

[0083] For example, a terminal 1 requests to obtain media data 1 from a first application, a user plane function, for example, a UPF 1, may obtain the media data 1 from the first application and

forward the media data 1 to the terminal 1, and the UPF may locally cache the media data 1 to the UPF at the same time. When the terminal 2 requests to obtain the media data 1, the UPF 1 may forward the media data 1 to the terminal 2 based on the media data cached in the UPF 1, so that the UPF 1 does not need to obtain the media data from the first application (for example, the application server) again.

[0084] In a specific implementation scenario, a network may include a plurality of user plane functions, some user plane functions support an MoQ transmission function, and some user plane functions do not support MoQ transmission capability. Therefore, in the implementation provided in this application, a control plane function (for example, a first apparatus) may select, for a terminal based on an MoQ transmission access requirement of the terminal, a user plane function that has MoQ transmission capability and stores a media data parameter requested by the terminal, so that a QUIC connection between the terminal and the user plane function (for example, a second apparatus) can be established, and multimedia data can be transmitted to the terminal over the QUIC connection.

[0085] For example, a user plane function in a communication system may be a UPF in 5G, a network element having the user plane function in 6G or a future communication system, or the like. The control plane function may be a network element like an AMF, an SMF, a UDM, or a PCF in 5G, a network element having a control plane function in 6G or the future communication system, or the like. This is not limited in this application.

[0086] It may be understood that devices or network elements in the communication system in FIG. 1 or FIG. 2 may directly communicate with each other, or may communicate with each other through forwarding by another node or device. This is not specifically limited in embodiments of this application.

[0087] It may be understood that, FIG. 2 is merely a diagram, and does not constitute a limitation on an application scenario of the technical solutions provided in this application. A person skilled in the art should understand that, in a specific implementation process, the communication system may include fewer devices or network elements than those shown in FIG. 2, or the communication system may further include another device or another network element, and a quantity of devices or network elements in the communication system may also be determined based on a specific requirement.

[0088] It should be noted that the communication system shown in FIG. 1 or FIG. 2 is merely used as an example, and is not intended to limit the technical solutions of this application. A person skilled in the art should understand that, in a specific implementation process, the communication system may further include another device or network element, and a quantity of network elements

may also be determined based on a specific requirement.

[0089] Optionally, each network element in FIG. 1 or FIG. 2 in embodiments of this application may be a functional module in a device. It may be understood that the foregoing function may be a network element in a hardware device, for example, a communication chip in a mobile phone; a software function running on dedicated hardware; or a virtualized function instantiated on a platform (for example, a cloud platform).

[0090] For example, each network element in FIG. 1 or FIG. 2 may be implemented by using a communication apparatus 300 in FIG. 3. FIG. 3 is a diagram of a hardware structure of a communication apparatus that may be used in an embodiment of this application. The communication apparatus 300 includes at least one processor 301, a communication line 302, a memory 303, and at least one communication interface 304.

[0091] The processor 301 may be a general-purpose central processing unit (central processing unit, CPU), a microprocessor, an application-specific integrated circuit (application-specific integrated circuit, ASIC), or one or more integrated circuits configured to control program execution of the solutions of this application.

[0092] The communication line 302 may include a path for transferring information between the foregoing components, for example, a bus.

[0093] The communication interface 304 is configured to communicate with another device or a communication network by using any apparatus like a transceiver, for example, an Ethernet interface, a RAN interface, or a wireless local area network (wireless local area network, WLAN) interface.

[0094] The memory 303 may be a read-only memory (read-only memory, ROM) or another type of static storage device that can store static information and instructions or a random access memory (random access memory, RAM) or another type of dynamic storage device that can store information and instructions; or may be an electrically erasable programmable read-only memory (electrically erasable programmable read-only memory, EEPROM), a compact disc read-only memory (compact disc read-only memory, CD-ROM) or another compact disc storage medium, an optical disc storage medium (including a compact disc, a laser disc, an optical disc, a digital versatile disc, a Blu-ray disc, or the like) and a magnetic disk storage medium or another magnetic storage device, or any other medium that can be configured to carry or store expected program code in a form of instructions or a data structure and that is accessible by a computer, but is not limited thereto. The memory may exist independently, and is connected to the processor through the communication line 302. The memory may alternatively be integrated with the processor. The memory provided in embodiments of this

application may be usually non-volatile. The memory 303 is configured to store computer-executable instructions for executing the solutions in this application, and the processor 301 controls the execution. The processor 301 is configured to execute the computer-executable instructions stored in the memory 303, to implement the method provided in embodiments of this application.

[0095] Optionally, the computer-executable instructions in this embodiment of this application may also be referred to as application program code. This is not specifically limited in this embodiment of this application.

[0096] During specific implementation, in an embodiment, the processor 301 may include one or more CPUs such as a CPU 0 and a CPU 1 in FIG. 3.

[0097] During specific implementation, in an embodiment, the communication apparatus 300 may include a plurality of processors, for example, the processor 301 and a processor 307 in FIG. 3. Each of the processors may be a single-core (single-CPU) processor, or may be a multi-core (multi-CPU) processor. The processor herein may be one or more devices, circuits, and/or processing cores configured to process data (for example, computer program instructions).

[0098] During specific implementation, in an embodiment, the communication apparatus 300 may further include an output device 305 and an input device 306. The output device 305 communicates with the processor 301, and may display information in a plurality of manners. For example, the output device 305 may be a liquid crystal display (liquid crystal display, LCD), a light emitting diode (light emitting diode, LED) display device, a cathode ray tube (cathode ray tube, CRT) display device, a projector, or the like. The input device 306 communicates with the processor 301, and may receive user input in a plurality of manners. For example, the input device 306 may be a mouse, a keyboard, a touchscreen device, a sensor device, or the like.

[0099] The foregoing communication apparatus 300 may be a general-purpose device or a dedicated device. During specific implementation, the communication apparatus 300 may be a portable computer, a network server, a palmtop computer (personal digital assistant, PDA), a mobile phone, a tablet computer, a wireless terminal, an embedded device, or a device having a structure similar to that in FIG. 3. A type of the communication apparatus 300 is not limited in this embodiment of this application.

[00100] The following describes in detail the communication method provided in embodiments of this application.

[00101] It should be noted that names of messages between network elements, names of parameters in the messages, or the like in the following embodiments of this application are merely

examples, and there may be other names in a specific implementation. This is not specifically limited in embodiments of this application.

[00102] It may be understood that some or all of steps in embodiments of this application are merely examples. Other steps or variations of various steps may be further performed in embodiments of this application. In addition, the steps may be performed in a sequence different from a sequence presented in embodiments of this application, and not all the steps in embodiments of this application may be necessarily performed.

[00103] This application provides a communication method. For a terminal having an MoQ transmission requirement, a control plane function in a network, for example, a first apparatus, may select, for the terminal based on a media access requirement of the terminal, a user plane function having MoQ transmission capability, so that a QUIC connection between the terminal and the user plane function (for example, a second apparatus) can be established, and multimedia data can be transmitted to the terminal via the user plane function, thereby improving MoQ transmission efficiency, avoiding occupation of network resources caused by forwarding of a large amount of data, and improving utilization of the network resources.

[00104] As shown in FIG. 4, the communication method may be applied to a first apparatus, and includes the following steps.

[00105] 401: The first apparatus receives a first message, where the first message includes that a terminal has a media over QUIC data transmission requirement.

[00106] The first apparatus may receive an access requirement of the terminal by using the first message. For example, the first message indicates the access requirement of the terminal, including that the terminal has the media over QUIC data transmission requirement. That is, the terminal requests MoQ transmission.

[00107] In an implementation, the first message may include first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link. In other words, the first message may explicitly indicate, by carrying the first indication information, that the terminal requests to establish the QUIC link for transmission of media data. That is, the terminal requests the MoQ transmission.

[00108] 402: The first apparatus determines a second apparatus based on the first message.

[00109] In this case, the first apparatus, for example, a control plane function in a network, may obtain the access requirement of the terminal based on the first message, and perform, for the terminal, matching on a user plane function having MoQ transmission capability. For example, the first

apparatus selects and determines the second apparatus, and establishes the QUIC link with the terminal via the second apparatus, for transmission of the media data. For example, the second apparatus may be a UPF.

[00110] The second apparatus supports a first function, where the first function is a media over QUIC data transmission function, that is, MoQ transmission capability. For example, the second apparatus can be configured to: establish a first QUIC link with the terminal, and transmit the media data over the first QUIC link.

[00111] For example, the first apparatus may locally store node information of a plurality of user plane functions. For example, the node information may specifically include a node identity and MoQ capability information supported by a node (for example, a media data parameter and other information stored in the node). The capability information may include whether the user plane function supports MoQ transmission capability, that is, whether the user plane function supports the first function. The first apparatus may retrieve the node information of the user plane functions, to select, from a node having the first function, a user plane function that satisfies the MoQ transmission requirement of the terminal indicated in the first message in step 401, and determine the selected user plane function as a target user plane function, namely, the second apparatus.

[00112] Alternatively, the first apparatus may obtain node information of a user plane function in the network from another node. For example, an NRF may maintain node information of a plurality of user plane functions (for example, a plurality of UPFs) in the network, and the first apparatus may obtain the node information of the user plane functions from the NRF, and select, for the terminal, a user plane function that satisfies MoQ transmission capability requested by the terminal.

[00113] In the foregoing two implementations, the user plane function may report the node information of the user plane function to a core network on a regular basis or in real time. For example, the user plane function configures the node information of the user plane function in the core network through registration, update, setup of an N4 connection, or the like. For a specific process, refer to the following implementation process described in FIG. 5. Details are not described herein.

[00114] For example, the first message may include an identifier of a media application for which the terminal requests MoQ transmission. For example, the terminal requests media data of a first media application, and the first message may carry an identifier corresponding to the first media application. Correspondingly, the first apparatus may query for, based on the identifier of the media application carried in the first message, a UPF that supports MoQ transmission capability, select a UPF that serves the first media application, and determine the selected UPF as a target UPF, namely,

the second apparatus.

[00115] In an implementation, the second apparatus stores media data corresponding to a media data parameter, or the second apparatus serves a media application corresponding to a media data parameter. Further, the second apparatus may report, to an SMF or the NRF on a regular basis, a media data parameter stored in the second apparatus.

[00116] In an implementation, the first message may include a media data parameter requested by the terminal. For example, the media data parameter may correspond to a part of content or a segment of a specified media category (for example, a TV series or a movie), content of a specified short video, a specified music/video clip, or the like. For example, the media data parameter may be specifically an identifier of media content.

[00117] For example, the first apparatus may determine, based on the first message and from the node supporting the first function, the second apparatus that satisfies a media data parameter supported by the terminal.

[00118] For example, a UPF 1 serves the first media application. When the UPF 1 establishes a user plane connection with another user terminal, and serves as a relay node to forward media data, requested by the terminal, of the first media application, the UPF 1 may identify and store all or a part of the transmitted media data, and may establish a mapping relationship between the media data and a media data parameter. Therefore, when the terminal requests the media data of the first media application, the SMF may select, based on the media data parameter requested by the terminal, the UPF 1 to establish a QUIC link with the terminal, and the UPF 1 transmits the media data corresponding to the media data parameter to the terminal without a need of transmitting the media data via an application server of the first media application, thereby improving utilization of network resources, reducing a transmission delay, and improving user experience.

[00119] It should be noted that, the user plane function in the network, for example, the UPF, may enable or disable a relay forwarding function, or enable or disable the first function, for example, the MoQ function. When enabling the relay forwarding function and the first function, the UPF may serve as the second apparatus determined by the first apparatus in the foregoing embodiment, and is configured to: establish the QUIC link between the terminal and the UPF, and transmit the media data.

[00120] In an implementation, at least one user plane function, for example, the second apparatus, may report/configure node information of the second apparatus to the core network. For example, the second apparatus may send second indication information to a network repository function in the core network, to indicate that the apparatus supports the first function. Optionally, the second indication

information may further include the media data parameter corresponding to the media data stored in the second apparatus.

[00121] For example, as shown in FIG. 5, a UPF may configure the node information of the UPF in a core network in Manner 1 or Manner 2.

[00122] Manner 1

[00123] 501: The UPF sends a registration request message or an update request message to an NRF.

[00124] In an implementation, the UPF may request registration with the NRF, and register the node information of the UPF with the NRF, so that a network element in the core network can obtain the node information of the UPF via the NRF, select a UPF, and the like. For example, the UPF may perform registration by sending the registration request message, for example, Nnrf_NFManagement_NFRegister operation, to the NRF; or the UPF may send the update request message to the NRF, to implement an operation of updating the node information.

[00125] The registration request message or the update request message may include second indication information, where the second indication information indicates that a second apparatus, namely, the UPF, supports a first function. Optionally, the second indication information may further include a media data parameter corresponding to media data stored in the second apparatus, namely, the UPF.

[00126] Optionally, the registration request message or the update request message may include information such as a data network name (Data Network Name, DNN), a single-network slice selection assistance information (Single-Network Slice Selection Assistance Information, S-NSSAI) list, an IPv4 address range available to a terminal, and a media data parameter corresponding to media data supported by the UPF, for example, namespace (namespace) of the media data.

[00127] Correspondingly, the NRF receives the second indication information from the UPF, and records/stores a mapping relationship between an identifier of the UPF and the second indication information (the carried node information).

[00128] 502: An SMF requests to query the NRF for information about an interested node.

[00129] 503: The NRF sends a query response to the SMF.

[00130] Optionally, the SMF may request, on a regular basis or periodically, to query the NRF for the information about the interested node.

[00131] Alternatively, when there is a service requirement, the SMF may request to query the NRF for the information about the interested node. For example, when the SMF receives a session

establishment request of the terminal, and needs to select an appropriate user plane function for the terminal, the SMF may query the NRF for information about a node that satisfies a service requirement of the terminal, and select and determine the UPF from the node.

[00132] Alternatively, in an implementation, the SMF may subscribe to the information about the interested node from the NRF. When obtaining node information that satisfies an SMF subscription condition, the NRF may send a subscription response to the SMF. The foregoing several implementations are not limited in this application.

[00133] For example, the SMF may send a subscription request to the NRF, for example, query the NRF for the information about the interested node and the target UPF by using an Nnrf_NFManagement_NFStatusSubscribe service. Correspondingly, the NRF may send, to the SMF by using an Nnrf_NFManagement_NFStatusNotify service, node information of one or more UPFs that satisfies the SMF subscription condition. For example, the subscription request may indicate a request to subscribe to the node information of the UPF, or, further, the subscription request may indicate a request to subscribe to node information of the UPF having the first function, or may indicate a request to subscribe to node information of a UPF serving a first media application, a request to subscribe to node information of a UPF storing specific media data, or the like. Then, the NRF performs, based on the subscription request, matching on a UPF that satisfies a condition, and feeds back the subscription response to the SMF.

[00134] For example, the SMF receives a service access request from a first terminal, where the service access request carries an identifier of the first media application, and may further carry an identifier of requested media data. Then, the SMF may send a query request message to the NRF, to query for information about a UPF that stores the media data of the first media application, where the query request message may carry the identifier of the first media application, and may further carry the identifier of the media data requested by the terminal. If the NRF determines, through query, that a UPF 1 satisfies a condition, the NRF may return a query response message to the SMF, where the query response message carries an identifier of the UPF 1.

[00135] Manner 2

[00136] 504: An SMF sets up an N4 connection with a UPF.

[00137] Specifically, the SMF may set up the N4 node-level connection with the UPF by using an N4 node connection setup (for example, an N4 Association Setup) procedure. The SMF and the UPF may be connected via an N4 node, and exchange functions supported by the SMF and the UPF. Subsequently, when the terminal requests to establish a PDU session, the SMF may establish a PDU

session–level connection with the UPF.

[00138] For example, the N4 node connection setup procedure may specifically include: The SMF sends an N4 connection setup request (for example, N4 Association Setup Request) message to the UPF, and the UPF determines to set up the N4 connection with the SMF, and sends an N4 connection setup response (for example, N4 Association Setup Response) message to the SMF, to complete setup of the N4 node connection between the SMF and the UPF.

[00139] 505: The SMF and the UPF exchange node information over the N4 connection.

[00140] In an implementation, the UPF may send information that the UPF supports the first function, namely, the MoQ function, the media data parameter corresponding to the media data cached by the UPF, and other similar information to the SMF.

[00141] Similarly, the SMF may send an N4 connection update request (for example, N4 Association Update Request) message to the UPF, to request node information of the UPF, and the UPF sends an N4 connection update response (for example, N4 Association Update Response) message to the SMF, where the N4 connection update response message carries the node information of the UPF, and the node information may include supporting the first function by the UPF and the media data parameter.

[00142] It should be noted that configuration manners: Manner 1 and Manner 2 are not mutually exclusive. The two configuration manners may coexist, or one of the manners may be selected to configure the node information of the user plane function in the network. This is not limited in this application.

[00143] In an implementation, the first apparatus may be the SMF. The terminal may send a session establishment request message to an AMF network element in the core network. Then, the AMF selects the SMF and forwards the access requirement of the terminal to the SMF. The SMF selects an appropriate user plane function for the terminal to establish a user plane MoQ connection.

[00144] In this implementation scenario, the first message received by the first apparatus may be specifically a first message received by the first apparatus from the terminal, and the first message may be used to request session establishment.

[00145] In this implementation scenario, that the first apparatus determines the second apparatus based on the first message may specifically include: The first apparatus sends a second message to a data management function, where the second message is used to request to obtain subscription data of the terminal. If the terminal supports the first function, and optionally, the subscription data of the terminal further includes the media data parameter supported by the terminal, the first apparatus may

determine, from the node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal.

[00146] Specifically, the data management function pre-configures or stores the media data parameter supported by the terminal. For example, the data management function may be specifically a UDM.

[00147] For a specific interaction procedure, refer to the following Embodiment 1.

Embodiment 1

[00148] As shown in FIG. 6, the method may include the following steps.

[00149] 600: A UDM stores a media data parameter and information that a terminal supports an MoQ function.

[00150] For example, the UDM may pre-store information about whether a plurality of terminals support the MoQ function. If the terminal supports the MoQ function, the UDM may store one or more media data parameters supported by the terminal, for example, information about namespace (namespace) corresponding to media data. The UDM may locally store the foregoing information as subscription data of the terminal.

[00151] 601: The terminal sends a session establishment request to an AMF.

[00152] Optionally, the session establishment request may carry first indication information from the terminal, to indicate that the terminal requests to establish a media over QUIC data transmission link. That is, the terminal has an MoQ access requirement.

[00153] For example, the terminal sends a PDU session establishment request (for example, PDU Session Establishment Request) message to the AMF. Optionally, the request message may carry the first indication information, for example, an indicator of MoQ connection (Indicator of MoQ connection), to indicate that the terminal has an MoQ connection access requirement and a user plane QUIC connection needs to be established.

[00154] 602: The AMF selects an SMF, and forwards the session establishment request from the terminal to the SMF.

[00155] Specifically, the AMF selects an appropriate SMF for the terminal, and forwards the access requirement of the terminal to the SMF.

[00156] For example, the AMF may send a PDU session creation context (for example, PDU Session_CreateSMContext) request message to the SMF.

[00157] Optionally, the session establishment request sent by the AMF to the SMF may carry the first indication information, for example, the indicator of MoQ connection (Indicator of MoQ

connection), to indicate that the terminal has the MoQ access requirement and the user plane QUIC connection needs to be established.

[00158] 603: The SMF sends a data request message to the UDM.

[00159] The data request message sent by the SMF to the UDM is used to request to obtain the subscription data of the terminal.

[00160] For example, the SMF may subscribe to the subscription data of the terminal from the UDM, where the subscription data of the terminal may include whether the terminal supports the MoQ function, and if the terminal supports the MoQ function, the subscription data may further include the media data parameter corresponding to the media data supported by the terminal.

[00161] 604: The UDM sends the subscription data of the terminal to the SMF.

[00162] The UDM may obtain, through query based on the pre-stored information about the plurality of terminals in step 600 and an identifier of the terminal, the subscription data that corresponds to the terminal and that is requested by the SMF, and send the subscription data corresponding to the terminal to the SMF.

[00163] 605: The SMF selects a user plane function, and determines a second apparatus.

[00164] Specifically, the SMF may obtain, based on a UPF configuration enhancement manner in Manner 1 or Manner 2 in the foregoing procedure, a UPF having the MoQ function and a media data parameter corresponding to the UPF, and select the UPF that satisfies the access requirement of the terminal, that is, the second apparatus.

[00165] 606: The SMF establishes a PDU session connection with the UPF.

[00166] Specifically, the SMF establishes the PDU session connection with the UPF that supports the MoQ function and has a media data parameter requested by the terminal.

[00167] 607: The terminal completes session establishment.

[00168] For example, the terminal completes PDU session establishment.

[00169] Specifically, the SMF may send a response message to the AMF, for example, by using an Namf_Communication_N1N2MessageTransfer message, carrying an IP address of the UPF supporting the MoQ function, a port number of the UPF supporting the MoQ function, MoQ context information, and the like. Then, the AMF may forward the response message to the terminal via a RAN, so that the terminal may initiate the PDU session connection to the corresponding UPF based on the information carried in the response message, to support MoQ service transmission.

[00170] 608: The terminal establishes a QUIC connection with the UPF, for transmission of the media data.

[00171] After the PDU session establishment is completed, the terminal establishes the QUIC connection with the UPF supporting the MoQ function, and MoQ transmission may be established on the QUIC connection based on a service requirement of the terminal. For example, the terminal may send a data subscription request to the UPF, to request to subscribe to specific media data; and the UPF may send a subscription response to the terminal, to send the requested media data to the terminal.

[00172] In the foregoing implementation, the data management function, for example, the UDM, pre-stores whether the terminal has a MoQ transmission requirement, and pre-stores, as the subscription data of the terminal, the media data parameter supporting MoQ and other information. Therefore, in a process in which the terminal establishes a session, when determining, by querying the UDM and based on the access requirement of the terminal, that the terminal supports MoQ transmission, the core network may perform, for the terminal based on registration information of the user plane function in the network, matching of the UPF supporting the MoQ function. Further, the UPF that supports the media data requested by the terminal may be matched for the terminal, so that communication efficiency can be improved, and a data transmission delay can be reduced.

[00173] In addition, in an implementation, this application further supports an implementation of configuring a user plane function for the terminal based on a domain name system (Domain Name System, DNS) addressing procedure, to establish a QUIC link from the terminal to the user plane function for media data transmission. An edge application server discovery function (Edge Application Server Discovery Function, EASDF) may obtain, based on a DNS query request, information about a relay UPF supporting the MoQ function, and feed back the information to the terminal.

[00174] In this implementation scenario, that the first apparatus receives the first message in step 401 in the foregoing embodiment may specifically include: The first apparatus receives the first message from the EASDF, where the first message includes domain name information corresponding to a DNS server, the first message indicates that the terminal supports the first function, and the first message includes the media data parameter requested by the terminal.

[00175] In this implementation scenario, that the first apparatus determines the second apparatus based on the first message in step 402 in the foregoing embodiment may specifically include: The first apparatus determines, based on the domain name information carried in the first message from the EASDF, the second apparatus from the node supporting the first function, where the second apparatus satisfies the media data parameter requested by the terminal.

[00176] Specifically, in this implementation scenario, the terminal may include the MoQ transmission requirement (for example, the media data parameter) to request to query the EASDF for the DNS. The EASDF may trigger the SMF to select a UPF, and forward the MoQ transmission requirement of the terminal to the SMF. In this case, the SMF may select, for the terminal based on the UPF configuration process in the foregoing Manner 1 or Manner 2, a relay UPF that supports the MoQ request of the terminal. The SMF may insert the selected UPF as a local-PDU session anchor (local-PDU Session Anchor, L-PSA) or an uplink classifier (Uplink classifier, ULCL) into a user session corresponding to the terminal. Specifically, in an implementation, the SMF may return information (such as a node identifier) about the selected UPF to the EASDF, and then the EASDF provides the information about the UPF for the terminal by using a DNS response. Alternatively, in another implementation, the EASDF may send the information about the UPF to the terminal by using the DNS, so that the terminal may subsequently establish a QUIC link with the UPF and transmit media data transmission.

[00177] For a specific interaction procedure, refer to descriptions in the following Embodiment 2.

Embodiment 2

[00178] As shown in FIG. 7, the method may include the following steps.

[00179] 700: A terminal completes session establishment.

[00180] The terminal has completed a session establishment process. For example, the terminal completes PDU session establishment, and establishes a PDU session with a PDU session anchor (PDU Session Anchor, PSA) UPF. The PSA UPF may also be referred to as a target UPF, and may be understood as an initial UPF for establishing a session for the terminal by a network.

[00181] In the session establishment process of the terminal, an SMF may check whether the terminal is authorized to discover an edge application server (Edge Application Server, EAS) by using an EASDF. If it is determined that the terminal is authorized, the SMF selects the corresponding EASDF for the terminal.

[00182] 701: The terminal sends a DNS query request to the EASDF.

[00183] Specifically, an application program on the terminal may trigger to initiate a DNS query request (for example, DNS Query Request) to the EASDF, where the DNS query request may carry information related to an MoQ transmission request, for example, first indication information, and optionally, may further include a media data parameter.

[00184] 702: The EASDF sends the DNS query request to a DNS server.

[00185] The EASDF may send the query request to the DNS server based on the request of the

terminal, to request to perform domain name resolution and query for information about an EAS capable of serving a service requested by the terminal.

[00186] 703: The DNS server sends a DNS query response to the EASDF.

[00187] Correspondingly, the DNS server performs query based on the received DNS query request, to obtain DNS information, for example, which may specifically include information such as a target fully qualified domain name (Fully Qualified Domain Name, FQDN) and an EAS address. The DNS server may send, to the EASDF, the DNS query response carrying the queried DNS information.

[00188] 704: The EASDF sends a first message to the SMF.

[00189] Specifically, the first message may be a DNS context notification (for example, Neasdf_DNSContext_Notify Request) message. The EASDF sends the notification message to the SMF, where the notification message carries the DNS information obtained in step 703. Optionally, the notification message may further carry the information that is related to the MoQ transmission request of the terminal and that is obtained in step 701 such as the media data parameter.

[00190] 705: The SMF selects a UPF that supports an MoQ function.

[00191] Correspondingly, the SMF may select a matched UPF for the terminal based on the received first message and an MoQ transmission requirement of the terminal.

[00192] Specifically, the SMF may obtain, based on the UPF configuration enhancement manner in Manner 1 or Manner 2 in the foregoing procedure, a UPF having the MoQ function and a media data parameter corresponding to the UPF, and select the UPF that satisfies the access requirement of the terminal, that is, a second apparatus.

[00193] 706: The SMF establishes an N4/PDU session connection with the UPF.

[00194] 707: The SMF establishes a path with the UPF, and performs ULCL-based steering.

[00195] It should be understood that, a 5G communication system may support insertion of a plurality of session anchor UPFs into a user plane path of one PDU session, to support a connection between the terminal and a local data network DN, so that the terminal device can access an application in the local DN nearby. Steering refers to directing service data ultimately to different networks or servers. During routing and local breakout of 5G data packets, a ULCL UPF or a branching point (Branching Point, BP) UPF can be used to selectively transfer application traffic of edge computing to an L-PSA UPF.

[00196] In this application, the relay UPF selected by the SMF may be used as an L-PSA or a ULCL and inserted into the user session corresponding to the terminal for steering. Specifically, the

SMF may determine, based on N6 traffic routing information of a data network access identifier (Data Network Access Identifier, DNAI) included in EAS deployment information, the N6 traffic routing information associated with the DNAI, and configure the L-PSA UPF based on a forwarding action derived from the N6 traffic routing information. The SMF may perform ULCL/BP and L-PSA selection and insertion.

[00197] 708: The SMF sends the information about the UPF to the EASDF.

[00198] Specifically, the SMF may send, to the EASDF, a DNS context update request (for example, Neasdf_DNSContext_Update Request) message that may carry the information about the UPF, to send, to the EASDF, the information about the UPF that supports MoQ transmission.

[00199] 709: The EASDF sends the information about the UPF to the terminal.

[00200] Specifically, the EASDF may send, to the terminal by sending a DNS query response (for example, DNS Query response) message to the terminal, the information about the UPF that supports the MoQ transmission.

[00201] 710: The terminal establishes a QUIC connection with the UPF, for transmission of the media data.

[00202] The terminal establishes the QUIC connection with the UPF supporting the MoQ function, and MoQ transmission may be established on the QUIC connection based on the service requirement of the terminal.

[00203] In the foregoing implementation, through enhancement of a DNS addressing procedure and participation of the EASDF in scheduling, the network can select, based on the MoQ requirement of the terminal, the UPF supporting the MoQ function to establish the user plane connection with the terminal, thereby improving communication efficiency and reducing a data transmission delay.

[00204] In addition, the foregoing embodiment provides an implementation process in which a network side selects the MoQ UPF for the terminal based on the MoQ transmission requirement of the terminal. It is considered that the selected MoQ UPF may not satisfy all MoQ transmission requirements of the terminal. For example, the MoQ UPF stores media data 1 requested by the terminal, but does not store media data 2 requested by the terminal. In other words, the MoQ UPF can satisfy only some MoQ transmission requirements of the terminal. In this case, the MoQ UPF may make a request to a corresponding application server for implementing a remaining MoQ transmission requirement, for example, obtaining the media data 2.

[00205] That is, in the foregoing Embodiment 1 or Embodiment 2, after step 608 or 701, in an implementation, the second apparatus (that is, the MoQ UPF) may send third indication information

to the SMF, to indicate that the second apparatus does not support some or all of the media data parameters requested by the terminal. That is, to satisfy the service requirement of the terminal, the network needs to establish a connection between the terminal and the application server AS, to obtain media data.

[00206] In an implementation, when the AS supports a QUIC connection and the MoQ function, or when the AS enables the QUIC connection and the MoQ function, the AS may send node information of the AS to the data management function, for example, the UDM or a unified data repository (Unified Data Repository, UDR), through a capability exposure interface. The node information sent by the AS may specifically include an identity of the AS, supporting, by the AS, the first function, namely, the MoQ transmission function, and a media data parameter corresponding to media data whose transmission is supported by the AS based on the first function. For example, the media data parameter may specifically include namespace (namespace), indication (indication) information, a protocol type (protocol type), or the like.

[00207] That is, through enhancement of AS capability exposure, an MoQ service function supported by the AS is stored in the UDM/UDR in a form of subscription data. Subsequently, when the UPF makes a request to the AS for QUIC connection establishment and an MoQ service, the SMF may establish the QUIC connection between the terminal and the AS by obtaining the information, stored in the UDR or the UDM, about the AS that supports the corresponding MoQ service.

[00208] In an implementation, the first apparatus (for example, the SMF) may send a fourth message to the data management function (for example, the UDM or the UDR), where the fourth message includes the media data parameter requested by the terminal, and the fourth message is used to request to obtain information about an application server corresponding to the media data parameter requested by the terminal. Correspondingly, the data management function may perform query based on the received fourth message, obtain the information about the application server that satisfies the MoQ requirement of the terminal, for example, the first application server, and send a response message to the first apparatus, where the response message may include information about the first application server. The first application server may be configured to: establish a third QUIC link with the second apparatus, and transmit media data over the third QUIC link.

[00209] For a specific interaction procedure, refer to descriptions in the following Embodiment 3.

Embodiment 3

[00210] As shown in FIG. 8, the method may include the following steps.

[00211] 801: An AS sends node information to an AF, where the node information includes a

corresponding media data parameter and support for an MoQ function.

[00212] Specifically, the AS may send, to the AF, an identity of the AS and the parameter of the media data whose transmission is supported by the AS based on the MoQ function.

[00213] 802: The AF sends the node information of the AS to an NEF.

[00214] Specifically, the AF may send the node information of the AS to the NEF through a capability exposure interface. For example, identity information of the AS, indication information indicating that the AS supports the MoQ, and the media data parameter supported by the AS based on the MoQ function may be carried in a parameter provision (Nnef_ParameterProvision) message sent to the NEF.

[00215] In an implementation, an operator may pre-configure, in the UDM, the node information of the AS that supports the MoQ. Alternatively, a process in which a data management function (for example, a UDM or a UDR) obtains the node information of the AS may adopt the following Manner 1 (steps 803a to 806a) or Manner 2 (803b and 804b). This is not limited in this application.

[00216] In an implementation, for a terminal roaming scenario or a scenario in which security authentication needs to be performed on the AF, steps in the following Manner 1 may be performed.

[00217] 803a: The NEF sends the node information of the AS to the UDM.

[00218] Specifically, after the NEF authenticates the AF successfully, the NEF may send a parameter provision (Nudm_ParameterProvision) message to the UDM, where the message carries information such as the identity information of the AS, the indication information indicating that the AS supports the MoQ, and the media data parameter supported by the AS based on the MoQ function. Correspondingly, the UDM may receive and store the foregoing information.

[00219] Optionally, the following steps 804a and 805a may be further performed.

[00220] 804a: The UDM sends the node information of the AS to the UDR.

[00221] Specifically, the UDM may send, to the UDR, a data management query (Nudr_DM_Query) request message or a data management update (Nudr_DM_Update) request message, which carries information such as the identity information of the AS, the indication information indicating that the AS supports the MoQ, and the media data parameter supported by the AS based on the MoQ function. Correspondingly, the UDR may receive and store the foregoing information.

[00222] 805a: The UDR sends a response message to the UDM.

[00223] Optionally, the UDR receives the foregoing message from the UDM, and obtains the node information of the AS. In this case, the UDR may send the response message to the UDM, to indicate

that the node information of the AS is successfully received. For example, the response message may be an acknowledgement (acknowledge, ACK) response.

[00224] 806a: The UDM sends the response message to the NEF.

[00225] Optionally, the UDM receives the foregoing message from the NEF, and obtains the node information of the AS. In this case, the UDM may send the response message to the NEF, to indicate that the node information of the AS is successfully received. For example, the response message may be an ACK response.

[00226] In an implementation, for a terminal non-roaming scenario or a scenario in which the UDM does not need to perform security authentication, steps in the following Manner 2 may be performed.

[00227] 803b: The NEF sends the node information of the AS to the UDR.

[00228] Specifically, the NEF may directly send, to the UDR, a data management update (Nudr_DM_Update) request message, which carries information such as the identity information of the AS, the indication information indicating that the AS supports the MoQ, and the media data parameter supported by the AS based on the MoQ function. Correspondingly, the UDR may receive and store the foregoing information.

[00229] 804b: The UDR sends a response message to the NEF.

[00230] Optionally, the UDR receives the foregoing message from the NEF, and obtains the node information of the AS. In this case, the UDR may send the response message to the NEF, to indicate that the node information of the AS is successfully received. For example, the response message may be an ACK response.

[00231] 807: The NEF sends the response message to the AF.

[00232] The NEF may send the response message to the AF, to indicate that sending the node information of the AS to the data management function has been completed.

[00233] 808: The SMF sends a query request to the UDM.

[00234] Specifically, when the SMF determines that a current UPF does not satisfy all MoQ data transmission requirements requested by a terminal, and a QUIC connection between the terminal and the AS that supports the MoQ transmission needs to be established, the SMF may request to query the UDM for the stored identity information of the AS that supports the MoQ function and a media data parameter.

[00235] Alternatively, in another implementation, the SMF may send a subscription request to the UDM in advance, to request to subscribe to node information of an AS that satisfies a condition, so

that when determining that an AS satisfies the subscription request of the SMF, the UDM may send a subscription response to the SMF, where the subscription response carries node information of the AS.

[00236] 809: The UDM sends a query response to the SMF.

[00237] Correspondingly, the UDM may locally search for, based on the query request of the SMF, the information about the AS that supports the MoQ function and the information about the AS that supports the media data parameter requested by the terminal.

[00238] 810: The SMF establishes an N4/PDU connection with the UPF, and sends the information about the AS to the UPF.

[00239] Specifically, the SMF may establish the N4/PDU connection with the UPF, and may provide, for the UPF, the identity information of the AS and the media data parameter supported by the AS that are obtained from the UDM.

[00240] 811: Establish a QUIC connection between the terminal and the AS, for transmission of the media data.

[00241] Specifically, the UPF may establish the QUIC connection with the AS based on a service requirement of the terminal, establish an MoQ connection, and implement the transmission of the media data.

[00242] In the foregoing implementation, through the enhancement of AS capability exposure, the MoQ service function supported by the AS is stored in the UDM/UDR. When the UPF makes a request to the AS for QUIC connection establishment and the MoQ service, the SMF may establish the QUIC connection between the terminal and the AS by obtaining the information, stored in the UDR or the UDM, about the AS that supports the corresponding MoQ service. This resolves a problem that the relay UPF cannot provide, for the terminal, all the MoQ transmission requirements requested by the terminal, transmission of the media data can be performed over the QUIC connection between the terminal and the AS, an implementation process is flexible, and communication efficiency can be improved.

[00243] In addition, for the foregoing case in which the MoQ UPF may not satisfy all the MoQ transmission requirements of the terminal, this application further provides another implementation, where an application server that satisfies the MoQ transmission requirement of the terminal may be obtained through query based on a service requirement of the terminal, and a QUIC connection between the terminal and the AS may be established via the UPF, for transmission of media data requested by the terminal.

[00244] In an implementation, the first apparatus (for example, the SMF) may send a third message to an application function entity through a capability exposure interface, where the third message includes the media data parameter requested by the terminal and information about the second apparatus (for example, the MoQ UPF), and the third message is used to request the application server to establish a second QUIC link with the UPF, for transmission of the media data over the second QUIC link.

[00245] In this implementation, a UPF that establishes a first QUIC connection with the terminal may send a media data parameter supported by the UPF to a related AS. In this case, the UPF serves as an MoQ relay node, the AS serves as an MoQ client, and the AS may trigger media data transmission to the UPF.

[00246] In a scenario of this embodiment, as the MoQ client, the AS supports the QUIC connection and the MoQ function, the AS may make a request to the UPF for QUIC connection establishment and the MoQ service, and the UPF may report DNAI information to the AF via the SMF, where the DNAI information carries a UPF ID and the supported media data parameter. The AS may establish a QUIC connection with a current MoQ UPF by obtaining current DNAI information and node information of the UPF.

[00247] For a specific interaction procedure, refer to descriptions in the following Embodiment 4.

Embodiment 4

[00248] As shown in FIG. 9, the method may include the following steps.

[00249] 901: An AF subscribes to a user plane management event notification from an SMF.

[00250] Specifically, the AF may initiate a subscription request to the SMF, where a first trigger (trigger) that triggers event reporting is newly added. The newly added first trigger is used to: when the SMF detects that a requirement of a user plane function changes, for example, when the SMF receives third indication information from a specified user plane function, indicating that the second apparatus, for example, the UPF, cannot satisfy all media data parameters requested by a terminal, trigger the SMF to send a notification message to the AF. For example, the first trigger may be MoQ relay function change. After the first trigger is triggered, the SMF may send, to the AF, an event notification message, which carries information such as information about the MoQ UPF (for example, an identifier or an IP address of the MoQ UPF), UDP port information, and a media data parameter.

[00251] 902: The UPF establishes an N4/PDU connection with the SMF.

[00252] When the SMF selects the UPF as an MoQ relay of the terminal, the UPF establishes a QUIC link with the terminal to provide an MoQ access requirement of the terminal. In addition, the

UPF establishes the N4/PDU connection with the SMF.

[00253] Optionally, in an implementation, the UPF sends third indication information to the SMF, to indicate that the UPF cannot satisfy some or all of MoQ transmission requirements requested by the terminal.

[00254] 903: The SMF sends the event notification message to the AF.

[00255] The SMF determines, based on the trigger received in step 901, that a user plane management event subscribed to by the AF occurs, and the SMF sends the event notification message to the AF based on the trigger. The event notification message may be the foregoing third message. The SMF sends the third message to the AF through a capability exposure interface, where the third message carries a media data parameter requested by the terminal and the information about the MoQ relay UPF, and the third message is used to request an application server to establish a QUIC link with the current MoQ UPF, for transmission of media data over the QUIC link.

[00256] Specifically, the SMF may send the event notification message to the AF through the capability exposure interface, or the SMF may send the event notification message to the AF through forwarding by a network exposure function NEF.

[00257] For example, in an implementation, implementation of step 903 may specifically include the following procedure: The SMF sends an event notification (for example, Nsmf_EventExposure_Notify) message to the NEF, where the message carries current DNAI information and the information about the MoQ UPF, for example, may include information such as the identifier or the IP address of the UPF, a UDP port, and the media data parameter. Then, the NEF sends a notification message (for example, Nnef_TrafficInfluence_Notify) to the AF by using a capability exposure service, where the notification message carries the DNAI information and the information about the MoQ UPF.

[00258] 904: The AF sends a notification message to the AS.

[00259] Correspondingly, if the AF receives the event notification message, and determines that the AS can satisfy the MoQ transmission requirement requested by the terminal, the AF sends the notification message to the AS, where the notification message carries the DNAI information and the information about the MoQ UPF, to request the AS to establish a QUIC connection with the MoQ UPF.

[00260] 905: The AS establishes the QUIC connection with the UPF.

[00261] Specifically, the AS may choose, based on the DNAI information and the information about the MoQ UPF, to establish the QUIC connection with the MoQ UPF, establish the MoQ

connection, and implement media data transmission.

[00262] In the foregoing implementation, by using a capability exposure function, the SMF may notify the AF of the information about the UPF currently serving as the MoQ relay and the DNAI information, so that the AF may notify the AS to establish the user plane connection between the AS and the UPF. This resolves a problem that the relay UPF cannot provide, for the terminal, all MoQ transmission requirements requested by the terminal, and satisfies the MoQ transmission requirement of the terminal, and an implementation process is flexible and communication efficiency can be improved.

[00263] It should be understood that embodiments mentioned above in this application may be combined when the solutions do not conflict. This is not limited.

[00264] The foregoing mainly describes the solutions provided in this application from the perspective of interaction between network elements. Correspondingly, this application further provides a communication apparatus. The communication apparatus may be the first apparatus in the foregoing method embodiment, or a node or a device including the first apparatus, or a component that can be used in the first apparatus. Alternatively, the communication apparatus may be the second apparatus in the foregoing method embodiment, or a node or a device including the second apparatus, or a component that can be used in the second apparatus. Further, the communication apparatus may be the terminal in the foregoing method embodiments, or a node or a device including the foregoing terminal, or a component that can be used in a third apparatus. In addition, the communication apparatus may be the data management function in the foregoing method embodiments, or a node or a device including the foregoing data management function, or a component that can be used in the data management function.

[00265] It may be understood that, the communication apparatus includes a corresponding hardware structure and/or software module for performing each function to implement the foregoing functions. A person skilled in the art should be easily aware that, in combination with units and algorithm operations of the examples described in embodiments disclosed in this specification, this application can be implemented by hardware or a combination of hardware and computer software. Whether a function is performed by hardware or hardware driven by computer 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 for each particular application, but it should not be considered that the implementation goes beyond the scope of this application.

[00266] It should be understood that the foregoing describes interaction between network elements

by using only the first apparatus, the terminal, the data management function, or the second apparatus as an example. Actually, processing performed by the terminal is not limited to being performed only by a single network element, and processing performed by the network device is not limited to being performed only by a single network element.

[00267] In this application, functional modules of the communication apparatus may be obtained through division based on the foregoing method examples. For example, each functional module may be obtained through division in correspondence to each function, or two or more functions may be integrated into one processing module. The integrated module may be implemented in a form of hardware, or may be implemented in a form of a software functional module. It may be understood that division into the modules in this application is an example, and is merely logical function division. During actual implementation, there may be another division manner.

[00268] For example, when each functional module is obtained through division in an integrated manner, FIG. 10 is a diagram of a structure of a communication apparatus 1000. The communication apparatus 1000 includes an interface module 1001 and a processing module 1002.

[00269] In some embodiments, the communication apparatus 1000 may further include a storage module (not shown in FIG. 10), configured to store program instructions and data.

[00270] For example, the communication apparatus 1000 may be configured to implement a function of the first apparatus. The communication apparatus 1000 is, for example, the first apparatus or the SMF in the foregoing embodiments.

[00271] The interface module 1001 is configured to receive a first message, where the first message includes that a terminal has a media over quick user datagram protocol internet connections QUIC data transmission requirement.

[00272] The processing module 1002 is configured to determine a second apparatus based on the first message, where the second apparatus supports a first function, the first function is a media over QUIC data transmission function, and the second apparatus is configured to: establish a first QUIC link with the terminal, and transmit media data over the first QUIC link.

[00273] In an implementation, the first message includes a media data parameter requested by the terminal, and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

[00274] In an implementation, the interface module 1001 is configured to receive the first message from the terminal, where the first message is used to request session establishment. The interface module 1001 is further configured to: send a second message to a data management function, where

the second message is used to request to obtain subscription data of the terminal; and receive a response message from the data management function, where the response message indicates that the terminal supports the first function, and the response message further includes a media data parameter supported by the terminal.

[00275] The processing module 1002 is configured to determine, from a node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal.

[00276] In an implementation, the first message includes first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link.

[00277] In an implementation, the interface module 1001 is further configured to receive the first message from an edge application server discovery function, where the first message includes domain name information corresponding to a domain name system DNS server, the first message indicates that the terminal supports the first function, and the first message includes the media data parameter requested by the terminal.

[00278] The processing module 1002 is configured to determine, based on the domain name information and from a node supporting the first function, the second apparatus that satisfies the media data parameter requested by the terminal.

[00279] In an implementation, the interface module 1001 is further configured to receive second indication information from the second apparatus or a network repository function, where the second indication information indicates that the second apparatus supports the first function, and the second indication information further includes the media data parameter corresponding to the media data stored in the second apparatus.

[00280] In an implementation, the interface module 1001 is further configured to receive third indication information from the second apparatus, where the third indication information indicates that the second apparatus does not support the media data parameter requested by the terminal.

[00281] In an implementation, the interface module 1001 is further configured to send a third message to an application function entity through a capability exposure interface, where the third message includes the media data parameter requested by the terminal and information about the second apparatus, and the third message is used to request an application server to establish a second QUIC link with the second apparatus, for transmission of media data over the second QUIC link.

[00282] In an implementation, the interface module 1001 is further configured to: send a fourth message to the data management function, where the fourth message includes the media data

parameter requested by the terminal, and the fourth message is used to request to obtain information about a corresponding application server supporting the media data parameter requested by the terminal; receive a response message from the data management function, where the response message includes information about a first application server, the first application server is configured to: establish a third QUIC link with the second apparatus, and transmit media data over the third QUIC link; and send the information about the first application server to the second apparatus.

[00283] In addition, the communication apparatus 1000 may be further configured to implement, for example, the terminal in the foregoing embodiments.

[00284] The interface module 1001 is configured to send a first message to a first apparatus, where the first message includes first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link. The interface module 1001 is further configured to: establish a first QUIC link with a second apparatus, and perform, over the first QUIC link, transmission of media data corresponding to a media data parameter.

[00285] In an implementation, the first message further includes the media data parameter requested by the terminal, and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

[00286] In addition, the communication apparatus 1000 may be further configured to implement, for example, the data management apparatus in the foregoing embodiments.

[00287] The interface module 1001 is configured to receive a second message from a first apparatus, where the second message is used to request to obtain subscription data of a terminal.

[00288] The processing module 1002 is configured to determine, based on the second message and stored subscription data corresponding to at least one terminal, the subscription data corresponding to the terminal, where the subscription data includes supporting a first function by the terminal, and the first function is a media over QUIC data transmission function.

[00289] The interface module 1001 is further configured to send a response message to the first apparatus, where the response message indicates that the terminal supports the first function, and the response message further includes a media data parameter supported by the terminal.

[00290] In an implementation, the apparatus 1000 stores the media data parameter supported by the terminal.

[00291] In an implementation, the interface module 1001 is further configured to obtain, through a capability exposure interface, information about an application server and a media data parameter

whose transmission is supported by the application server based on the first function.

[00292] In addition, the communication apparatus 1000 may be further configured to implement, for example, the second apparatus, for example, the UPF, in the foregoing embodiments.

[00293] The interface module 1001 is configured to send second indication information to a network repository function, where the second indication information indicates that a first function is supported, and the first function is a media over QUIC data transmission function; or

the interface module 1001 is configured to: establish a node-level connection with a first apparatus, and send the second indication information to the first apparatus.

[00294] In an implementation, the second indication information further includes a media data parameter corresponding to media data stored in the apparatus.

[00295] When the communication apparatus 1000 is configured to implement functions of the first apparatus, the terminal, the data management function, the second apparatus, or the like in the foregoing embodiments, for other functions that can be implemented by the communication apparatus 1000, refer to the related descriptions of embodiments shown in FIG. 4 to FIG. 9. Details are not described again.

[00296] In a simple embodiment, a person skilled in the art may figure out that the communication apparatus 1000 may be in a form shown in FIG. 3. For example, the processor 301 in FIG. 3 may invoke the computer-executable instructions stored in the memory 303, to cause the communication apparatus 1000 to perform the method in the foregoing method embodiments.

[00297] For example, a function/implementation process of the processing module 1002 in FIG. 10 may be implemented by the processor 301 in FIG. 3.

[00298] For example, a function/implementation process of the interface module 1001 in FIG. 10 may be implemented by the communication interface 304 in FIG. 3.

[00299] It may be understood that one or more of the foregoing modules or units may be implemented by using software, hardware, or a combination thereof. When any one of the foregoing modules or units is implemented by software, the software exists in a form of computer program instructions, and is stored in the memory. The processor may be configured to execute the program instructions and implement the foregoing method procedure. The processor may be built in an SoC (system-on-chip) or an ASIC, or may be an independent semiconductor chip. The processor may further include a necessary hardware accelerator, such as a field programmable gate array (field programmable gate array, FPGA), a PLD (programmable logic device), or a logic circuit that implements special logic operations, in addition to the core for executing software instructions to

perform operations or processing.

[00300] When the foregoing modules or units are implemented by using hardware, the hardware may be any one or any combination of a CPU, a microprocessor, a digital signal processing (digital signal processing, DSP) chip, a microcontroller unit (microcontroller unit, MCU), an artificial intelligence processor, an ASIC, a SoC, an FPGA, a PLD, a dedicated digital circuit, a hardware accelerator, or a non-integrated discrete device, and the hardware may run necessary software or may not depend on software to perform the foregoing method procedures.

[00301] Optionally, this application further provides a chip system, including at least one processor and an interface. The at least one processor is coupled to a memory through the interface, and when the at least one processor executes a computer program or instructions in the memory, the method in any one of the foregoing method embodiments is performed. In a possible implementation, the chip system further includes the memory. Optionally, the chip system may include a chip, or may include a chip and another discrete component. This is not specifically limited in this application.

[00302] Optionally, this application further provides a computer-readable storage medium. All or a part of procedures in the foregoing method embodiments may be implemented by a computer program instructing related hardware. The program may be stored in the foregoing computer-readable storage medium. When the program is executed, the procedures in the foregoing method embodiments may be included. The computer-readable storage medium may be an internal storage unit of the communication apparatus in any one of the foregoing embodiments, for example, a hard disk drive or a memory of the communication apparatus. Alternatively, the computer-readable storage medium may be an external storage device of the communication apparatus, for example, a plug-in hard disk, a smart media card (smart media card, SMC), a secure digital (secure digital, SD) card, or a flash card (flash card) that is configured on the communication apparatus. Further, the computer-readable storage medium may include both an internal storage unit and an external storage device of the communication apparatus. The computer-readable storage medium is configured to store the computer program and store other programs and data that are required by the communication apparatus. The computer-readable storage medium may be further configured to temporarily store data that has been output or is to be output.

[00303] Optionally, this application further provides a computer program product. All or a part of procedures in the foregoing method embodiments may be implemented by a computer program instructing related hardware. The program may be stored in the computer program product. When the program is executed, the procedures in the foregoing method embodiments may be included.

[00304] Optionally, this application further provides computer instructions. All or some of procedures in the foregoing method embodiments may be completed by computer instructions instructing related hardware (for example, a computer, a processor, a network device, or a terminal). The program may be stored in the computer-readable storage medium or the computer program product.

[00305] Optionally, this application further provides a communication system, including the first apparatus and the second apparatus in the foregoing embodiments.

[00306] Optionally, this application further provides a communication system, including the first apparatus and the terminal in the foregoing embodiments.

[00307] Optionally, this application further provides a communication system, including the first apparatus, the terminal, and the data management function in the foregoing embodiments.

[00308] Optionally, this application further provides a communication system, including the first apparatus, the terminal, the data management function, and the second apparatus in the foregoing embodiments.

[00309] The foregoing descriptions about implementations allow a person skilled in the art to understand that, for the purpose of convenient and brief description, division of the foregoing functional modules is taken as an example for illustration. In actual application, the foregoing functions can be allocated to different functional modules and implemented according to a requirement, that is, an inner structure of an apparatus is divided into different functional modules to implement all or some of the functions described above.

[00310] In several embodiments provided in this application, it should be understood that the disclosed apparatus and method may be implemented in other manners. For example, the described apparatus embodiment is merely an example. For example, the module or division into the units is merely logical function division and may be other division in actual implementation. For example, a plurality of units or components may be combined or integrated into another apparatus, or some features may be ignored or not performed. In addition, the displayed or discussed mutual couplings or direct couplings or communication connections may be implemented through some interfaces. The indirect couplings or communication connections between the apparatuses or units may be implemented in electronic, mechanical, or other forms.

[00311] The units described as separate parts may or may not be physically separate, and parts displayed as units may be one or more physical units, may be located in one place, or may be distributed in different places. Some or all of the units may be selected based on actual requirements

to achieve the objectives of the solutions of embodiments.

[00312] In addition, functional units in embodiments of this application may be integrated into one processing unit, each of the units may exist alone physically, or two or more units are integrated into one unit. The integrated unit may be implemented in a form of hardware, or may be implemented in a form of a software functional unit.

[00313] 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 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

1. A communication method, applied to a first apparatus, wherein the method comprises: receiving a first message, wherein the first message comprises that a terminal has a media over quick user datagram protocol internet connections QUIC data transmission requirement; and determining a second apparatus based on the first message, wherein the second apparatus supports a first function, the first function is a media over QUIC data transmission function, and the second apparatus is configured to: establish a first QUIC link with the terminal, and transmit media data over the first QUIC link.

2. The method according to claim 1, wherein the first message comprises a media data parameter requested by the terminal; and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

3. The method according to claim 1 or 2, wherein the receiving the first message comprises: receiving the first message from the terminal, wherein the first message is used to request session establishment; and the determining the second apparatus comprises: sending a second message to a data management function, wherein the second message is used to request to obtain subscription data of the terminal; receiving a response message from the data management function, wherein the response message indicates that the terminal supports the first function, and the response message further comprises a media data parameter supported by the terminal; and determining, based on the response message and from a node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal.

4. The method according to any one of claims 1 to 3, wherein the first message comprises first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link.

5. The method according to claim 1 or 2, wherein the receiving the first message comprises: receiving the first message from an edge application server discovery function, wherein the first message comprises domain name information corresponding to a domain name system DNS server, the first message indicates that the terminal supports the first function, and the first message comprises the media data parameter requested by the terminal; and the determining the second apparatus comprises: determining, based on the domain name information and from a node supporting the first function, the second apparatus that satisfies the media data parameter requested by the terminal.

6. The method according to any one of claims 1 to 5, wherein the method comprises: receiving second indication information from the second apparatus or a network repository function, wherein the second indication information indicates that the second apparatus supports the first function, and the second indication information further comprises the media data parameter corresponding to the media data stored in the second apparatus.

7. The method according to any one of claims 1 to 6, wherein the method further comprises: receiving third indication information from the second apparatus, wherein the third indication information indicates that the second apparatus does not support the media data parameter requested by the terminal.

8. The method according to claim 7, wherein the method comprises: sending a third message to an application function entity through a capability exposure interface, wherein the third message comprises the media data parameter requested by the terminal and information about the second apparatus, and the third message is used to request an application server to establish a second QUIC link with the second apparatus, for transmission of media data over the second QUIC link.

9. The method according to claim 7, wherein the method comprises: sending a fourth message to the data management function, wherein the fourth message comprises the media data parameter requested by the terminal, and the fourth message is used to request to obtain information about a corresponding application server supporting the media data parameter requested by the terminal; receiving a response message from the data management function, wherein the response message comprises information about a first application server, the first application server is configured to: establish a third QUIC link with the second apparatus, and transmit media data over the third QUIC link; and sending the information about the first application server to the second apparatus.

10. A communication method, applied to a terminal, wherein the method comprises: sending a first message to a first apparatus, wherein the first message comprises first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link; and establishing a first QUIC link with a second apparatus, and performing, over the first QUIC link, transmission of media data corresponding to a media data parameter.

11. The method according to claim 10, wherein the first message further comprises the media data parameter requested by the terminal; and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

12. A communication method, applied to a data management function, wherein the method comprises: receiving a second message from a first apparatus, wherein the second message is used to request to obtain subscription data of a terminal; determining, based on the second message and stored subscription data corresponding to at least one terminal, the subscription data corresponding to the terminal, wherein the subscription data comprises supporting a first function by the terminal, and the first function is a media over QUIC data transmission function; and sending a response message to the first apparatus, wherein the response message indicates that the terminal supports the first function, and the response message further comprises a media data parameter supported by the terminal.

13. The method according to claim 12, wherein the data management function stores the media data parameter supported by the terminal.

14. The method according to claim 12 or 13, wherein the method further comprises: obtaining, through a capability exposure interface, information about an application server and a media data parameter whose transmission is supported by the application server based on the first function.

15. A communication method, applied to a second apparatus, wherein the method comprises: sending second indication information to a network repository function, wherein the second indication information indicates that a first function is supported, and the first function is a media over QUIC data transmission function; or establishing a node-level connection with a first apparatus, and sending the second indication information to the first apparatus.

16. The method according to claim 15, wherein the second indication information further comprises a media data parameter corresponding to media data stored in the second apparatus.

17. A communication apparatus, wherein the apparatus comprises: an interface module, configured to receive a first message, wherein the first message comprises that a terminal has a media over quick user datagram protocol internet connections QUIC data transmission requirement; and a processing module, configured to determine a second apparatus based on the first message, wherein the second apparatus supports a first function, the first function is a media over QUIC data transmission function, and the second apparatus is configured to: establish a first QUIC link with the terminal, and transmit media data over the first QUIC link.

18. The apparatus according to claim 17, wherein the first message comprises a media data parameter requested by the terminal; and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

19. The apparatus according to claim 17 or 18, wherein the interface module is configured to receive the first message from the terminal, wherein the first message is used to request session establishment; the interface module is further configured to: send a second message to a data management function, wherein the second message is used to request to obtain subscription data of the terminal; and receive a response message from the data management function, wherein the response message indicates that the terminal supports the first function, and the response message further comprises a media data parameter supported by the terminal; and the processing module is configured to determine, from a node supporting the first function, the second apparatus that satisfies the media data parameter supported by the terminal.

20. The apparatus according to any one of claims 17 to 19, wherein the first message comprises first indication information, and the first indication information indicates that the terminal requests to establish a media over QUIC data transmission link.

21. The apparatus according to claim 17 or 18, wherein the interface module is further configured to receive the first message from an edge application server discovery function, wherein the first message comprises domain name information corresponding to a domain name system DNS server, the first message indicates that the terminal supports the first function, and the first message comprises the media data parameter requested by the terminal; and the processing module is configured to determine, based on the domain name information and from a node supporting the first function, the second apparatus that satisfies the media data parameter requested by the terminal.

22. The apparatus according to any one of claims 17 to 21, wherein the interface module is further configured to receive second indication information from the second apparatus or a network repository function, wherein the second indication information indicates that the second apparatus supports the first function, and the second indication information further comprises the media data parameter corresponding to the media data stored in the second apparatus.

23. The apparatus according to any one of claims 17 to 22, wherein the interface module is further configured to receive third indication information from the second apparatus, wherein the third indication information indicates that the second apparatus does not support the media data parameter requested by the terminal.

24. The apparatus according to claim 23, wherein the interface module is further configured to send a third message to an application function entity through a capability exposure interface, wherein the third message comprises the media data parameter requested by the terminal and information about the second apparatus, and the third message is used to request an application server to establish a second QUIC link with the second apparatus, for transmission of media data over the second QUIC link.

25. The apparatus according to claim 24, wherein the interface module is further configured to: send a fourth message to the data management function, wherein the fourth message comprises the media data parameter requested by the terminal, and the fourth message is used to request to obtain information about a corresponding application server supporting the media data parameter requested by the terminal; receive a response message from the data management function, wherein the response message comprises information about a first application server, the first application server is configured to: establish a third QUIC link with the second apparatus, and transmit media data over the third QUIC link; and send the information about the first application server to the second apparatus.

26. A communication apparatus, wherein the apparatus comprises: an interface module, configured to send a first message to a first apparatus, wherein the first message comprises first indication information, and the first indication information indicates that a terminal requests to establish a media over QUIC data transmission link, wherein the interface module is further configured to: establish a first QUIC link with a second apparatus, and perform, over the first QUIC link, transmission of media data corresponding to the media data parameter.

27. The apparatus according to claim 26, wherein the first message further comprises the media data parameter requested by the terminal; and the second apparatus stores the media data corresponding to the media data parameter, or the second apparatus serves a media application corresponding to the media data parameter.

28. A communication apparatus, wherein the apparatus comprises: an interface module, configured to receive a second message from a first apparatus, wherein the second message is used to request to obtain subscription data of a terminal; and a processing module, configured to determine, based on the second message and stored subscription data corresponding to at least one terminal, the subscription data corresponding to the terminal, wherein the subscription data comprises supporting a first function by the terminal, and the first function is a media over QUIC data transmission function, wherein the interface module is further configured to send a response message to the first apparatus, wherein the response message indicates that the terminal supports the first function, and the response message further comprises a media data parameter supported by the terminal.

29. The apparatus according to claim 28, wherein the apparatus stores the media data parameter supported by the terminal.

30. The apparatus according to claim 28 or 29, wherein the interface module is further configured to obtain, through a capability exposure interface, information about an application server and a media data parameter whose transmission is supported by the application server based on the first function.

31. A communication apparatus, wherein the apparatus comprises: an interface module, configured to send second indication information to a network repository function, wherein the second indication information indicates that a first function is supported, and the first function is a media over QUIC data transmission function; or the interface module is configured to: establish a node-level connection with a first apparatus, and send the second indication information to the first apparatus.

32. The apparatus according to claim 31, wherein the second indication information further comprises a media data parameter corresponding to media data stored in the apparatus.

33. A communication apparatus, comprising a processor, wherein the processor is coupled to a memory, the memory is configured to store a program or instructions, and when the program or the instructions are executed by the processor, the method according to any one of claims 1 to 16 is performed.

34. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program or instructions, and when the computer program or the instructions are executed, the method according to any one of claims 1 to 16 is performed.

35. A computer program product, wherein the computer program product comprises computer program code, and when the computer program code is run on a computer, the method according to any one of claims 1 to 16 is performed.

36. A communication system, wherein the communication system comprises the apparatus according to any one of claims 17 to 25 and the apparatus according to claim 26 or 27.

37. The communication system according to claim 36, wherein the communication system further comprises the apparatus according to any one of claims 28 to 30, and/or the apparatus according to claim 31 or 32.