

CONNECTION ESTABLISHMENT METHOD, APPARATUS, AND SYSTEM

[0001] This application claims priority to Chinese Patent Application No. 202110585190.8, filed with the China National Intellectual Property Administration on May 27, 2021 and entitled "CONNECTION ESTABLISHMENT METHOD, APPARATUS, AND SYSTEM", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to radio communication technologies, and in particular, to a connection establishment method, an apparatus, and a system.

BACKGROUND

[0003] A traffic detection function (traffic detection function, TDF) is for application detection. The TDF includes a traffic detection control plane function (TDF control plane function, TDF-C) and a traffic detection user plane function (TDF user plane function, TDF-U). In a long term evolution (long term evolution, LTE) system, an application detected by the TDF and service data flow description of the application may be reported to a policy and charging rules function (policy and charging rules function, PCRF). The application detection may alternatively be performed by a policy and charging enforcement function (policy and charging enforcement function, PCEF) on which an application detection and control (application detection and control, ADC) function is deployed.

[0004] However, currently, a core network network element merely copies session information to a TDF-C device, and does not perceive whether a device such as the TDF-C device successfully establishes a corresponding session based on the received information. In addition, a special router needs to be deployed between a gateway node and the TDF-U, to route data between the gateway node and the Internet to a corresponding TDF-U. This increases network deployment costs.

SUMMARY

[0005] This application provides a connection establishment method, an apparatus, and a

system, so that a core network can determine whether a corresponding TDF session or a user plane path is successfully established, thereby reducing route deployment costs.

[0006] According to a first aspect, an embodiment of this application provides a connection establishment method. The method includes:

5 **[0007]** A session management function sends to a traffic detection user plane function an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, where the IP address corresponds to a first session of the terminal; the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function,
10 and the downlink tunnel is for transmission of downlink data of the first session.

[0008] The session management function receives a second tunnel endpoint identifier of the traffic detection user plane function from the traffic detection user plane function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of
15 uplink data of the first session.

[0009] The session management function sends the second tunnel endpoint identifier to the user plane function.

[0010] According to the method in the first aspect, the session management function may determine, based on whether a tunnel endpoint identifier of the traffic detection user plane function is obtained, whether the traffic detection user plane function successfully establishes the first
20 session. In addition, the IP address of the terminal of the first session and the IP network segment route mask are advertised by the traffic detection user plane function to the network, so that the traffic detection user plane function can receive data of the first session from the network, and forward the data to the user plane function through a tunnel between the traffic detection user plane
25 function and the user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the traffic detection user plane function is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

30 **[0011]** In an optional design, the user plane function is an anchor user plane function.

[0012] In an optional design, the method further includes:

[0013] The session management function subscribes to information about a traffic detection user plane function.

[0014] The session management function selects the traffic detection user plane function based
35 on the information.

[0015] In an optional design, the IP network segment route mask is for advertising the traffic detection user plane function to the network, and the IP address belongs to an address range indicated by the IP network segment route mask.

[0016] In an optional design, the method further includes:

the session management function receives the IP address and the IP network segment route mask from the user plane function; or

the session management function determines the IP address and the IP network segment route mask, and

the session management function sends the IP address and the IP network segment route mask to the user plane function.

[0017] In an optional design, the method further includes:

[0018] The session management function sends a third tunnel endpoint identifier of the user plane function to an access network node or an intermediate user plane function, where the third tunnel endpoint identifier is for establishing an uplink tunnel between the access network node or the intermediate user plane node and the user plane node, and the uplink tunnel is for transmission of the uplink data of the first session.

[0019] According to a second aspect, an embodiment of this application provides a connection establishment method. The method includes:

[0020] A traffic detection user plane function receives from a session management function an internet protocol IP address of the terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, where the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session.

[0021] The traffic detection user plane function advertises the IP address and IP network segment route mask to a network.

[0022] The traffic detection user plane function sends a second tunnel endpoint identifier of the traffic detection user plane function to the session management function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

[0023] According to the method in the second aspect, the traffic detection user plane function may feed back a tunnel endpoint identifier of the traffic detection user plane function to the session management function, so that the session management function determines that the traffic detection user plane function successfully establishes the first session. In addition, the IP address

of the terminal of the first session and the IP network segment route mask are advertised by the traffic detection user plane function to the network, so that the traffic detection user plane function can receive data of the first session from the network, and forward the data to the user plane function through a tunnel between the traffic detection user plane function and the user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the traffic detection user plane function is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

[0024] In an optional design, the user plane function is an anchor user plane function.

[0025] According to a third aspect, an embodiment of this application provides a connection establishment method. The method includes:

[0026] The session management function sends to a traffic detection control plane function an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, where the IP address corresponds to a first session of the terminal; the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and a traffic detection user plane function, the downlink tunnel is for transmission of downlink data of the first session, and the traffic detection control plane function is for managing the traffic detection user plane function.

[0027] The session management function receives a second tunnel endpoint identifier of the traffic detection user plane function from the traffic detection control plane function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

[0028] The session management function sends the second tunnel endpoint identifier to the user plane function.

[0029] According to the method in the third aspect, the session management function may determine, based on whether a tunnel endpoint identifier of the traffic detection user plane function is obtained, whether the traffic detection user plane function successfully establishes the first session. In addition, the IP address of the terminal of the first session and the IP network segment route mask are advertised by the traffic detection user plane function to the network, so that the traffic detection user plane function can receive data of the first session from the network, and forward the data to the user plane function through a tunnel between the traffic detection user plane function and the user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part

of a data network. Therefore, when the traffic detection user plane function is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

[0030] In an optional design, the user plane function is an anchor user plane function.

5 **[0031]** In an optional design, the method further includes:

[0032] The session management function subscribes to information about the traffic detection control plane function.

[0033] The session management function selects the traffic detection control plane function based on the information.

10 **[0034]** In an optional design, the method further includes:

[0035] The session management function sends session establishment information to the traffic detection control plane function, where the session establishment information includes one or more types of the following information: a device identifier of the terminal, an access point name APN, a data network name DNN, and single network slice selection assistance information

15 S-NSSAI.

[0036] In an optional design, the method further includes:

[0037] The session management function receives a subscription request of the traffic detection control plane function, where the subscription request is for subscribing to session information.

20 **[0038]** That the session management function sends session establishment information to the traffic detection control plane function includes:

[0039] The session management function sends the session establishment information to the traffic detection control plane function in response to the subscription request.

25 **[0040]** In an optional design, the IP network segment route mask is for advertising the traffic detection user plane function to the network, and the IP address belongs to an address range indicated by the IP network segment route mask.

[0041] In an optional design, the method further includes:

the session management function receives the IP address and the IP network segment route mask from the user plane function; or

30 the session management function determines the IP address and the IP network segment route mask, and

the session management function sends the IP address and the IP network segment route mask to the user plane function.

[0042] In an optional design, the method further includes:

35 **[0043]** The session management function sends a third tunnel endpoint identifier of the user

plane function to an access network node or an intermediate user plane function, where the third tunnel endpoint identifier is for establishing an uplink tunnel between the access network node or the intermediate user plane node and the user plane node, and the uplink tunnel is for transmission of the uplink data of the first session.

5 **[0044]** According to a fourth aspect, an embodiment of this application provides a connection establishment method. The method includes:

10 **[0045]** A traffic detection control plane function receives from a session management function an internet protocol IP address of the terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, where the IP address
corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session.

15 **[0046]** The traffic detection control plane function sends the IP address, the IP network segment route mask, and the first tunnel endpoint identifier to the traffic detection user plane function.

20 **[0047]** The traffic detection control plane function sends a second tunnel endpoint identifier of the traffic detection user plane function to the session management function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

25 **[0048]** According to the method in the fourth aspect, the traffic detection control plane function may feed back a tunnel endpoint identifier of the traffic detection user plane function to the session management function, so that the session management function determines that the traffic detection control plane function and the traffic detection user plane function successfully
establishes the first session. In addition, the IP address of the terminal of the first session and the IP network segment route mask are sent to the traffic detection user plane function, and are advertised by the traffic detection user plane function to the network, so that the traffic detection user plane function can receive data of the first session from the network, and forwards the data to the user plane function through a tunnel between the traffic detection user plane function and the
30 user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the traffic detection user plane function is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

35 **[0049]** In an optional design, the method further includes:

the traffic detection control plane function receives the second tunnel endpoint identifier from the traffic detection user plane function; or

the traffic detection control plane function generates the second tunnel endpoint identifier for the first session; and

5 the traffic detection control plane function sends the second tunnel endpoint identifier to the traffic detection user plane function.

[0050] In an optional design, the user plane function is an anchor user plane function.

[0051] In an optional design, the method further includes:

[0052] The traffic detection control plane function subscribes to information about the traffic
10 detection user plane function.

[0053] The traffic detection control plane function selects the traffic detection user plane function based on the information.

[0054] In an optional design, the method further includes:

[0055] The traffic detection control plane function receives session establishment information
15 from the session management function, where the session establishment information includes one or more types of the following information: a device identifier of the terminal, an access point name APN, a data network name DNN, and single network slice selection assistance information S-NSSAI.

[0056] In an optional design, the method further includes:

20 **[0057]** The traffic detection control plane function sends a subscription request to the session management function, where the subscription request is for subscribing to session information.

[0058] In an optional design, the IP network segment route mask is for advertising the traffic detection user plane function to the network, and the IP address belongs to an address range indicated by the IP network segment route mask.

25 **[0059]** According to a fifth aspect, an embodiment of this application provides a connection establishment method. The method includes:

[0060] A traffic detection user plane function receives an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function from a traffic detection control plane function, where
30 the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session.

[0061] The traffic detection user plane function advertises the IP address and IP network segment route mask to a network.

35 **[0062]** The traffic detection user plane function sends a second tunnel endpoint identifier of

the traffic detection user plane function to the traffic detection control plane function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

5 **[0063]** According to the method in the fifth aspect, the traffic detection user plane function may feed back a tunnel endpoint identifier of the traffic detection user plane function, so that the session management function determines that the traffic detection user plane function successfully establishes the first session. In addition, the IP address of the terminal of the first session and the IP network segment route mask are advertised by the traffic detection user plane function to the
10 network, so that the traffic detection user plane function can receive data of the first session from the network, and forward the data to the user plane function through a tunnel between the traffic detection user plane function and the user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the traffic detection user plane function
15 is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

[0064] In an optional design, that the traffic detection user plane function receives an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function from a traffic detection
20 control plane function includes:

[0065] The traffic detection user plane function receives the IP address, the IP network segment route mask, and the first tunnel endpoint identifier from a session management function from the traffic detection control plane function.

[0066] That the traffic detection user plane function sends a second tunnel endpoint identifier of the traffic detection user plane function to the traffic detection control plane function includes:
25 **[0067]** The traffic detection user plane function sends the second tunnel endpoint identifier to the session management function via the traffic detection control plane function.

[0068] In an optional design, the user plane function is an anchor user plane function.

[0069] According to a sixth aspect, an embodiment of this application provides a connection
30 establishment method. The method includes:

[0070] A user plane function obtains an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, where the IP address corresponds to a first session of the terminal, and the first tunnel endpoint identifier is for transmission of downlink data of the first session.

35 **[0071]** The user plane function receives a second tunnel endpoint identifier of a traffic

detection user plane function from a session management function, where the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

5 **[0072]** According to the method in the sixth aspect, after the user plane function obtains the IP address of the terminal of the first session and the IP network segment route mask, the IP address and the IP network segment route mask are advertised by the traffic detection user plane function to the network, so that the traffic detection user plane function can receive data of the first session from the network, and forwards the data to the user plane function through a tunnel between the
10 traffic detection user plane function and the user plane function. For the first session, the traffic detection user plane function is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the traffic detection user plane function is deployed, a route is not required to be replanned to route the data of the first session by the traffic detection user plane function, that is, a data network is not required to be reconstructed.

15 **[0073]** In an optional design, the IP network segment route mask is for advertising the traffic detection user plane function to the network, and the IP address belongs to an address range indicated by the IP network segment route mask.

[0074] In an optional design, that the user plane function obtains an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address includes:
20 the user plane function determines the IP address and the IP network segment route mask, and

 the user plane function sends an IP address and an IP network segment route mask to the session management function; or

 the user plane function receives the IP address and the IP network segment route mask
25 from the session management function.

[0075] In an optional design, that the user plane function obtains a first tunnel endpoint identifier of a user plane function includes:

 the user plane function generates the first tunnel endpoint identifier for the first session;
and

30 the user plane function sends the first tunnel endpoint identifier to the session management function; or

 the user plane function receives the first tunnel endpoint identifier from the session management function.

[0076] In an optional design, the method further includes:

35 **[0077]** The user plane function obtains a third tunnel endpoint identifier of a second user plane

function, where the third tunnel endpoint identifier is for establishing an uplink tunnel between an access network node or an intermediate user plane node and the user plane node, and the uplink tunnel is for transmission of uplink data of the first session.

[0078] In an optional design, the user plane function is an anchor user plane function.

5 **[0079]** According to a seventh aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the first aspect.

10 **[0080]** According to an eighth aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the second aspect.

15 **[0081]** According to a ninth aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the third aspect.

20 **[0082]** According to a tenth aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the fourth aspect.

[0083] According to an eleventh aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the fifth aspect.

25 **[0084]** According to a twelfth aspect, an embodiment of this application provides a communication apparatus, including a processor and a memory. The processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to the sixth aspect.

30 **[0085]** According to a thirteenth aspect, an embodiment of this application provides a communication apparatus, configured to implement functions of the communication apparatus according to the seventh aspect or functions of the communication apparatus according to the ninth aspect. The communication apparatus according to the thirteenth aspect includes a corresponding module, unit, or means (means) for implementing the foregoing functions, and the module, the unit, or the means may be implemented by hardware, software, or hardware that executes
35 corresponding software. The hardware or software includes one or more modules or units

corresponding to the foregoing functions.

[0086] According to a fourteenth aspect, an embodiment of this application provides a communication apparatus, configured to implement functions of the communication apparatus according to the eighth aspect, the eleventh aspect, or the twelfth communication apparatus. The communication apparatus according to the fourteenth aspect includes a corresponding module, unit, or means (means) for implementing the foregoing functions, and the module, the unit, or the means may be implemented by hardware, software, or hardware that executes corresponding software. The hardware or software includes one or more modules or units corresponding to the foregoing functions.

[0087] According to a fifteenth aspect, an embodiment of this application provides a communication apparatus, configured to implement the communication apparatus according to the tenth aspect. The communication apparatus according to the fifteenth aspect includes a corresponding module, unit, or means (means) for implementing the foregoing functions, and the module, the unit, or the means may be implemented by hardware, software, or hardware that executes corresponding software. The hardware or software includes one or more modules or units corresponding to the foregoing functions.

[0088] According to a sixteenth aspect, an embodiment of this application provides a communication system, including the communication apparatus according to the eighth aspect or the thirteenth aspect, and the ninth aspect or the fourteenth aspect.

[0089] In an optional design, the communication system further includes the communication apparatus according to the fifteenth aspect.

[0090] According to a seventeenth aspect, an embodiment of this application provides a computer-readable storage medium. The computer-readable storage medium stores a computer program, and when the computer program runs on a computer, the computer is enabled to perform the method according to any one of the aspects from the first aspect to the seventh aspect.

[0091] According to an eighteenth aspect, an embodiment of this application provides a computer program product, where the computer program product includes computer program code. When the computer program code runs on a computer, the method according to any one of the aspects from the first aspect to the seventh aspect is performed.

BRIEF DESCRIPTION OF DRAWINGS

[0092] FIG. 1 is a schematic diagram of a communication system according to an embodiment of this application;

[0093] FIG. 2A is a schematic flowchart of connection establishment according to an

embodiment of this application;

[0094] FIG. 2B is a schematic flowchart of another type of connection establishment according to an embodiment of this application;

5 **[0095]** FIG. 3 is a schematic flowchart of obtaining TD-SMF information according to an embodiment of this application;

[0096] FIG. 4 is a schematic flowchart of obtaining TD-UPF information according to an embodiment of this application;

[0097] FIG. 5A and FIG. 5B are a schematic flowchart of still another type of connection establishment according to an embodiment of this application;

10 **[0098]** FIG. 6 is a schematic diagram of a structure of a communication apparatus according to an embodiment of this application; and

[0099] FIG. 7 is a schematic diagram of a structure of another communication apparatus according to an embodiment of this application.

DESCRIPTION OF EMBODIMENTS

15 **[00100]** The following describes technical solutions of this application with reference to accompanying drawings.

[00101] It should be understood that "first", "second", or "third" in embodiments of this application is merely for differentiation, and should not constitute any limitation on this application.

[00102] The method in this embodiment of this application is applicable to a long term evolution (long term evolution, LTE) system, a long term evolution-advanced technology (long term evolution-advanced, LTE-A) system, an enhanced long term evolution-advanced (enhanced long term evolution-advanced, eLTE) technology system, a 5th generation (5th generation, 5G) mobile communication system, and a new radio (new radio, NR) system, the method may also be extended to similar radio communication systems, for example, wireless fidelity (wireless fidelity, 20 Wi-Fi), worldwide interoperability for microwave access (worldwide interoperability for microwave access, WiMAX), and a cellular system related to the 3rd Generation Partnership Project (3rd Generation Partnership Project, 3GPP).

[00103] FIG. 1 shows a network architecture 100 used in an embodiment of this application, and various network elements that may be related to in the network architecture are separately 30 described.

[00104] Terminal device: The terminal devices may include various handheld devices, on-board equipment, wearable devices, computing devices, or other processing devices connected to a wireless modem that have a wireless communication function, and various forms of terminals,

mobile stations (mobile station, MS), terminals (terminal), user equipment (user equipment, UE), software terminals and the like.

[00105] (Radio) access network (radio access network, (R)AN) network element: The (radio) access network network element is configured to provide a network access function for authorized terminal devices in a specific region, and support use of transmission tunnels of different quality depending on levels of the terminal devices, service requirements, and the like.

[00106] The (R)AN network element can manage radio resources and provide an access service for terminal devices, to complete forwarding of control signals and terminal device data between the terminal devices and a core network. The (R)AN may also be understood as a base station in a conventional network.

[00107] It should be noted that the foregoing "network element" may also be referred to as an entity, a device, an apparatus, a module, or the like, and there is no particularly limitation in this application herein. In addition, in this application, for ease of understanding and description, a description of the "network element" is omitted in some descriptions. For example, the (R)AN network element is referred to as (R)AN for short. In this case, the "(R)AN network element" should be understood as an (R)AN network element or an (R)AN entity, and descriptions of a same case or similar cases below are omitted.

[00108] User plane network element: The user plane network element is for packet routing and forwarding, handling of quality of service (quality of service, QoS) of user plane data, and the like.

[00109] In a 5G communication system, the user plane network element may be a user plane function (user plane function, UPF) network element. In a future communication system, the user plane network element may still be a UPF network element, or may have another name. This is not limited in this application.

[00110] The UPF may include an anchor UPF and an intermediate UPF. The anchor UPF may be a protocol data unit (protocol data unit, PDU) session anchor (PDU session anchor, PSA) UPF (PSA-UPF) in FIG. 1. The intermediate UPF may be an intermediate UPF (intermediate UPF, I-UPF) in FIG. 1.

[00111] Data network: The data network is a network for data transmission.

[00112] In the 5G communication system, the data network may be a data network (data network, DN). In a future communication system, the data network may still be a DN, or may have another name. This is not limited in this application.

[00113] Access management network element: The access management network element is mainly for mobility management, access management, and the like, and may be for implementing functions in a mobility management entity (mobility management entity, MME) function other than session management, for example, lawful interception and access

authorization/authentication.

[00114] In the 5G communication system, the access management network element may be an access and mobility management function (access and mobility management function, AMF) network element. In the future communication system, the access management network element may still be an AMF network element, or may have another name. This is not limited in this application.

[00115] Session management network element: The session management network element is mainly for session management, internet protocol (internet protocol, IP) address assignment and management of the terminal devices, selection and control of user plane function, termination of interfaces towards policy control and charging functions, downlink data notification, and the like.

[00116] In the 5G communication system, the session management network element may be a session management function (session management function, SMF) network element. In the future communication system, the session management network element may still be an SMF network element, or may have another name. This is not limited in this application.

[00117] Policy control network element: The policy control network element is a unified policy framework for guiding network behavior, and provides policy rule information and the like for control plane function network elements (for example, an AMF network element and an SMF network element).

[00118] In a 4G communication system, the policy control network element may be a policy and charging rules function (policy and charging rules function, PCRF) network element. In the 5G communication system, the policy control network element may be a policy control function (policy control function, PCF) network element. In the future communication system, the policy control network element may still be a PCF network element, or may have another name. This is not limited in this application.

[00119] Data management network element: The data management network element is for handling terminal device identifiers, access authentication, registration, mobility management, and the like.

[00120] In the 5G communication system, the data management network element may be a unified data management (unified data management, UDM) network element. In the future communication system, the unified data management may still be a UDM network element, or may have another name. This is not limited in this application.

[00121] Data network: The data network is a network for data transmission.

[00122] In the 5G communication system, the data network may be a data network (data network, DN). In the future communication system, the data network network element may still be a DN, or may have another name. This is not limited in this application.

[00123] Traffic detection function: The traffic detection function is for application detection. The traffic detection function may be divided into a traffic detection control plane function and a traffic detection user plane function.

[00124] In the 5G communication system, the traffic detection control plane function may be a TD-SMF network element. The traffic detection user plane function may be a TD-UPF network element, and the network element may be understood as a special form of a user plane function entity. The TD-SMF network element manages the TD-UPF network element. The TD-SMF network element and the SMF element may be integrated together, or functions of the TD-SMF may be deployed in the SMF network element. In this case, the TDF may be understood as a TD-UPF. In the future communication system, the traffic detection function may still include a TD-SMF network element and a TD-UPF network element, or may have another name. This is not limited in this application.

[00125] It should be noted that the foregoing "network element" may also be referred to as an entity, a device, an apparatus, a module, or the like, and there is no particularly limitation in this application herein. In addition, in this application, for ease of understanding and description, the description of "network element" is omitted in some descriptions below. For example, the SMF network element is referred to as SMF for short. In this case, the "SMF" should be understood as an SMF network element or an SMF entity, and descriptions of a same case or similar cases below are omitted.

[00126] It may be understood that the foregoing network element or function may be a network element in a hardware device, or may be a software function running on dedicated hardware, or may be a virtual function instantiated on a platform (for example, a cloud platform).

[00127] It should be understood that FIG. 1 is merely an example of a network architecture described from the perspective of a service-oriented architecture, and a network architecture applicable to embodiments of this application is not limited thereto. Any network architecture that can implement functions of the foregoing network elements is applicable to embodiments of this application.

[00128] For example, in some network architectures, network function entities such as an AMF, an SMF, a PCF, and a UDM are all referred to as network function (network function, NF) network elements. Alternatively, in some other network architectures, a set of network elements such as an AMF, an SMF, a PCF, and a UDM may be referred to as control plane function (control plane function, CPF) network elements.

[00129] The following uses network elements in a 5G system as an example to describe details of a solution in detail. It may be understood that, when the solution is used in an LTE system or a future communication system, each network element in the solution may be replaced with another

network element having a corresponding function. This is not limited in this application.

[00130] FIG. 2A is a schematic flowchart of a connection establishment method according to this application. The method shown in FIG. 2A is applicable to a scenario in which an SMF and a TD-SMF are separately deployed.

5 **[00131]** S201: The SMF sends, to the TD-SMF, an IP address of UE corresponding to session #1, an IP network segment route mask corresponding to the IP address of the UE, and an allocated tunnel endpoint identifier of a UPF to session #1. Correspondingly, the TD-SMF receives the foregoing information from the SMF.

10 **[00132]** The IP address of the UE corresponding to session #1 is referred to as the IP address of the UE for short in the following. The IP address corresponds to session #1. The IP address belongs to an address range indicated by the IP network segment route mask.

[00133] The SMF may determine, based on configuration information, whether session #1 needs a TDF. The configuration information may include a condition indicating that a TDF is required. The condition is, for example, an access point name (access point name, APN) or whether
15 session #1 is roaming. The SMF determines, depending on whether session #1 meets the condition, whether session #1 needs a TDF.

[00134] Whether session #1 needs a TDF may be understood as: whether the TD-SMF needs to be selected for session #1, whether the TD-UPF needs to be selected for session #1, or whether session information of session #1 needs to be sent to the TD-SMF.

20 **[00135]** The SMF may determine whether session #1 needs a TDF, and/or the APN of session #1, and/or whether session #1 is roaming, so as to generate or obtain the IP address of the UE and the IP network segment route mask corresponding to the IP address of the UE.

[00136] Before S201, the SMF may receive a session establishment request from the UE, to request to establish session #1; the SMF selects the UPF for session #1; the SMF allocates the
25 tunnel endpoint identifier of the UPF to session #1, or the SMF receives the tunnel endpoint identifier allocated by the UPF to session #1; and the SMF allocates the IP address of the UE corresponding to session #1, or the SMF receives the IP address of the UE allocated by the UPF to session #1. For details of this process, refer to section 4.3.2 in 3GPP TS 23.502, and details are not described herein again.

30 **[00137]** It may be understood that, when the SMF selects a plurality of UPFs for session #1, the allocated tunnel endpoint identifier of the UPF to session #1 in S201 is the tunnel endpoint identifier of the anchor UPF of session #1. The anchor UPF may be understood as a PSA-UPF, a last UPF on an uplink user plane path of session #1, or a UPF that allocates the IP address of the UE.

35 **[00138]** The tunnel endpoint identifier of the UPF is for establishing a downlink tunnel between

the UPF and a subsequent TD-UPF. The downlink tunnel is for transmission of downlink data of session #1, that is, the tunnel endpoint identifier is for transmission of the downlink data of session #1. In other words, the tunnel endpoint identifier is used by the TD-UPF for sending the downlink data of session #1 to the UPF based on the tunnel endpoint identifier. The UPF may learn that data that carries the tunnel endpoint identifier belongs to session #1. The tunnel endpoint identifier may be different from a tunnel endpoint identifier of the UPF, and the tunnel endpoint identifier of the UPF is for receiving data from an intermediate UPF or from a RAN. The downlink data may be understood as a packet sent from the DN to the UE.

[00139] S202: The TD-SMF selects the TD-UPF, and allocates a tunnel endpoint identifier of the TD-UPF to session #1.

[00140] Specifically, the TD-SMF selects the TD-UPF based on the IP address of the UE, and/or the IP network segment route mask. It may be understood that the TD-SMF selects a same TD-UPF for UE IP address segments in a same range of IP network segment route mask.

[00141] S203: The TD-SMF sends, to the TD-UPF, the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, the tunnel endpoint identifier of the UPF, and the tunnel endpoint identifier of the TD-UPF. Correspondingly, the TD-UPF receives the foregoing information from the TD-SMF.

[00142] The TD-UPF establishes a tunnel between the TD-UPF and the UPF based on the tunnel endpoint identifier of the UPF, where the tunnel may be understood as a downlink tunnel. Therefore, after receiving the downlink data of session #1, the TD-UPF may send the data to the UPF through the tunnel.

[00143] The tunnel endpoint identifier of the TD-UPF may be for transmission of uplink data of session #1, that is, the tunnel endpoint identifier is used to send the uplink data of session #1 to the TD-UPF by the UPF based on the tunnel endpoint identifier. The TD-UPF may learn that the data that carries the tunnel endpoint identifier belongs to session #1. The uplink data may be understood as a packet sent from the UE to the DN.

[00144] S204: The TD-UPF advertises the IP address of the UE and the IP network segment route mask to a network.

[00145] Based on S204, downlink data of the IP address of the UE can be routed to the TD-UPF. Then, the TD-UPF may send the data to the UPF based on the tunnel endpoint identifier of the UPF.

[00146] It may be understood that the IP address of the UE and the IP network segment route mask are determined by the SMF or the UPF, and are advertised by the TD-UPF to the network instead of being advertised by the UPF to the network.

[00147] Optionally, the TD-UPF may alternatively advertise the IP network segment route mask

to the network, instead of advertising the IP address of the UE, so that data of an IP address that belongs to the IP network segment route mask can be routed to the TD-UPF.

[00148] S205: The TD-SMF sends the tunnel endpoint identifier of the TD-UPF to the SMF. Correspondingly, the SMF receives the tunnel endpoint identifier of the TD-UPF from the TD-SMF.

[00149] Optionally, a sequence between S204 and S205 is not limited in this application. The S205 may be performed at any moment after the TD-SMF receives a confirmation message from the TD-UPF.

[00150] S206: The SMF sends the tunnel endpoint identifier of the TD-UPF to the UPF. Correspondingly, the UPF receives the tunnel endpoint identifier of the TD-UPF from the SMF.

[00151] The UPF establishes an uplink tunnel between the UPF and the TD-UPF based on the tunnel endpoint identifier of the TD-UPF. Therefore, after receiving the uplink data of session #1, the UPF may send the data to the TD-UPF through the tunnel.

[00152] In the foregoing process, the SMF may determine, based on whether the tunnel endpoint identifier of the TD-UPF is obtained, whether the TD-SMF and the TD-UPF successfully establish session #1. In addition, the IP address of the UE of session #1 and the IP network segment route mask are advertised by the TD-UPF to the network, so that the TD-UPF can receive data of session #1 from the network, and forward the data to the UPF through the tunnel between the TD-UPF and the UPF. For session #1, the TD-UPF is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the TD-UPF is deployed, a route is not required to be replanned to route the data of session #1 by the TD-UPF, that is, the data network is not required to be reconstructed.

[00153] As shown in FIG. 2B, in a possible implementation, the tunnel endpoint identifier of the TD-UPF may be allocated by the TD-UPF to session #1. In this case, S202 and S203 may be replaced with:

[00154] S202: The TD-SMF selects the TD-UPF.

[00155] S203a: The TD-SMF sends, to the TD-UPF, the IP address of the UE, the IP network segment route mask, and the tunnel endpoint identifier of the UPF. Correspondingly, the TD-UPF receives the foregoing information from the TD-SMF.

[00156] S203b: The TD-UPF allocates the tunnel endpoint identifier of the TD-UPF to session #1.

[00157] S203c: The TD-UPF sends the tunnel endpoint identifier of the TD-UPF to the TD-SMF.

[00158] In a possible implementation, before S201, the SMF may determine the TD-SMF in the following manners:

[00159] S201a: The TD-SMF registers with an NRF.

[00160] The TD-SMF may register an online/offline state and/or a selected policy of the local network element with the NRF. Therefore, the SMF may select an appropriate SMF based on the TD-SMF registration information on the NRF.

5 **[00161]** S201b: The SMF subscribes to TD-SMF information from the NRF.

[00162] S201c: The SMF selects an appropriate TD-SMF based on the subscribed TD-SMF information.

[00163] When the SMF determines that a TD-SMF needs to be selected for session #1, the SMF selects an appropriate TD-SMF based on the subscribed TD-SMF information.

10 **[00164]** Optionally, the SMF further selects an appropriate TD-SMF based on local configuration information.

[00165] In another possible implementation, before S201, the TD-SMF sends a subscription request to the SMF. The subscription request is for subscribing to information about a session that needs a TDF. When session #1 changes, such as creation, update, or deletion, the SMF sends
15 related information of session #1 to the TD-SMF in response to the subscription of the TD-SMF.

[00166] The S201a to S201c may be specifically implemented by using the method shown in FIG. 3.

[00167] In a possible implementation, the SMF interacts with the TD-SMF via a PCF. Optionally, the implementation is applicable to a scenario in which the SMF and the TD-SMF
20 cannot directly communicate with each other.

[00168] In this case, S201 may be replaced with: The SMF sends, to the PCF, the IP address of the UE corresponding to session #1, the IP network segment route mask corresponding to the IP address of the UE, and the allocated tunnel endpoint identifier of the UPF to session #1. Correspondingly, the PCF receives the foregoing information from the SMF, and sends the
25 information to the TD-SMF.

[00169] For a process in which the PCF determines the SMF, refer to a process from S201a to S201c in which the SMF determines the TD-SMF, and actions performed by the SMF from S201a to S201c are replaced with actions performed by the PCF.

[00170] In a possible implementation, the SMF and the TD-SMF may be integrated together, or
30 the SMF has functions of the TD-SMF. In this case, the foregoing interaction between the SMF and the TD-SMF may be omitted, and the foregoing actions performed by the TD-SMF may be performed by the SMF. It may be understood that, the SMF selects the TD-UPF in this case. For details, refer to the process in which the TD-SMF selects the TD-UPF in S202.

[00171] The following further describes the technical solutions in this application in an example
35 of which the method is applied to a 5G system.

[00172] FIG. 3 is a schematic flowchart of obtaining TD-SMF information by an SMF. As shown in FIG. 3, the process specifically includes the following steps:

[00173] S301: A TD-SMF registers an online/offline state and a selected policy of the TD-SMF through a service-oriented interface NRF named Nnrf_NFManagement_NFRegister service operation.

[00174] Among registration input parameters of the NRF, a parameter Names of supported NF services (if applicable) may include a TDF function, so that another NF may perceive, during subscription, that a role of the SMF is a TD-SMF. It may be understood that the TD-SMF may indicate that the SMF is a TD-SMF in another manner. For example, the TD-SMF may indicate, by adding indication information to the registration input parameter, that the SMF is a TD-SMF. This is not limited in this application.

[00175] S302: The SMF subscribes to the TD-SMF information through a service-oriented interface NRF named Nnrf_NFManagement_NFStatusSubscribe service operation.

[00176] S303: The NRF sends the online/offline state and the selected policy of the TD-SMF to the SMF through a service-oriented interface NRF named Nnrf_NFManagement_NFStatusNotify service operation.

[00177] The SMF may determine the role of the TD-SMF using the parameter Names of supported NF services (if applicable).

[00178] For example, the selected policy may include a service area of the TD-SMF, and the SMF selects an appropriate TD-SMF based on an address of UE.

[00179] FIG. 4 is a schematic flowchart of obtaining TD-UPF information by a TD-SMF. As shown in FIG. 4, the process specifically includes the following steps:

[00180] S401: A TD-UPF registers an online/offline state and a selected policy of the TD-UPF through a service-oriented interface NRF named Nnrf_NFManagement_NFRegister service operation.

[00181] Among registration input parameters of the NRF, a parameter Names of supported NF services (if applicable) may include a TDF function, so that another NF may perceive, during subscription, that a role of the UPF is a TD-UPF. It may be understood that the TD-UPF may indicate that the UPF is a TD-UPF in another manner. For example, the TD-UPF may indicate, by adding indication information to the registration input parameter, that the UPF is a TD-UPF. This is not limited in this application.

[00182] S402: The TD-SMF subscribes to the TD-UPF information through a service-oriented interface NRF named Nnrf_NFManagement_NFStatusSubscribe service operation.

[00183] S403: The NRF sends the online/offline state and the selected policy of the TD-UPF through a service-oriented interface NRF named Nnrf_NFManagement_NFStatusNotify service

operation.

[00184] The TD-SMF may determine the role of the TD-UPF using the parameter Names of supported NF services (if applicable).

5 **[00185]** It may be understood that, when an SMF and the TD-SMF are integrated together, or the SMF has functions of the TD-SMF, the SMF may obtain the TD-UPF information in a manner similar to that in FIG. 4, to select the TD-UPF. In other words, the TD-SMF in FIG. 4 may be replaced with the SMF.

[00186] FIG. 5A and FIG. 5B are a schematic flowchart of a connection establishment method. This may be used to implement the method shown in FIG. 2A or FIG. 2B. As shown in FIG. 5A
10 and FIG. 5B, the process includes the following steps:

[00187] S501: An SMF receives a session establishment request from UE.

[00188] The SMF receives the session establishment request from the UE via an access network node and an AMF.

[00189] The session establishment request includes an identifier of session #1, and the identifier
15 is subsequently referred to as session identifier #1 for short. The session establishment request is for requesting to establish session #1. The session establishment request further includes an identifier of the UE, a data network name DNN, an address of the UE, and the like.

[00190] S502: The SMF selects a TD-SMF.

[00191] Optionally, the SMF may select the TD-SMF based on the selected policy obtained in
20 S303.

[00192] The selection of the TD-SMF may be that one TD-SMF is selected from a plurality of TD-SMFs. Alternatively, the selection of the TD-SMF is to determine whether to select the unique TD-SMF.

[00193] S503: The SMF selects a UPF, and sends an N4 session establishment request to the
25 UPF, to request to establish session #1.

[00194] For specific details of which the SMF selects a UPF, refer to section 4.3.2 in 3GPP TS 23.502, and details are not described herein again.

[00195] A performing sequence of S502 and S503 is not limited in this application.

[00196] S504: The UPF sends an N4 session establishment response to the SMF.

30 **[00197]** The N4 session establishment response includes an allocated IP address of the UE to session #1, an IP network segment route mask corresponding to the IP address of the UE, and an allocated tunnel endpoint identifier of the UPF to session #1. The tunnel endpoint identifier is for establishing a tunnel with a TD-UPF. The tunnel endpoint identifier may be understood as a tunnel endpoint identifier of a downlink tunnel with the TD-UPF.

35 **[00198]** The N4 session establishment response further includes an allocated uplink tunnel

endpoint identifier of the UPF to session #1, and the uplink tunnel endpoint identifier is for establishing an uplink tunnel between a RAN and the UPF. The RAN sends uplink data of session #1 to the UPF based on the uplink tunnel endpoint identifier.

[00199] When the SMF selects a plurality of UPFs, the UPF may be understood as an anchor UPF, or may be understood as a last UPF on an uplink user plane path of session #1, or may be understood as a UPF that allocates the IP address of the UE. In this case, the uplink tunnel endpoint identifier is for establishing an uplink tunnel between an intermediate UPF and an anchor UPF. The intermediate UPF sends the uplink data of session #1 to the UPF based on the uplink tunnel endpoint identifier.

[00200] Optionally, the IP address of the UE, the corresponding IP network segment route mask, the tunnel endpoint identifier of the UPF, or the uplink tunnel endpoint identifier may be determined or generated by the SMF. In this case, the SMF sends these information to the UPF (for example, these information is carried in the session establishment request sent by the SMF to the UPF), and the SMF does not need to obtain these information from the UPF.

[00201] S505: The SMF sends, to the TD-SMF, the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF through a Nsmf_PDUSession_Create service operation interface.

[00202] Optionally, the foregoing information may be carried in a Nsmf_PDUSession_TDCreate service operation in the foregoing interface.

[00203] Optionally, the SMF further sends session establishment information of session #1 to the TD-SMF through the interface. The session establishment information may include a terminal device identifier of the UE, an APN, a data network name (data network name, DNN), and one or more of single network slice selection assistance information (single network slice selection assistance information, S-NSSAI).

[00204] For this step, refer to S201.

[00205] Optionally, the SMF may send the foregoing information to the TD-SMF via a PCF. That is, S505 may be replaced with:

[00206] S505a: The SMF sends, to the PCF, the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF.

[00207] S505b: The PCF sends, to the TD-SMF, the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF through the Nsmf_PDUSession_Create service operation interface.

[00208] Optionally, the foregoing information may be carried in a Nsmf_PDUSession_TDCreate service operation in the foregoing interface.

[00209] S506: The TD-SMF selects the TD-UPF.

[00210] The TD-SMF selects the TD-UPF based on the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF.

5 **[00211]** Optionally, the TD-SMF may obtain, from the PCF, a policy and a rule related to the TDF of session #1.

[00212] For this step, refer to S202.

[00213] S507: The TD-SMF sends the N4 session establishment request to the TD-UPF.

10 **[00214]** The N4 session establishment request includes the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF.

[00215] For this step, refer to S203.

[00216] It may be understood that, when the SMF and the TD-SMF may be integrated together, or when the SMF has functions of the TD-SMF, S505 to S507 may be replaced with the following:

15 The SMF sends the N4 session establishment request to the TD-UPF. The session establishment request includes the IP address of the UE, the IP network segment route mask corresponding to the IP address of the UE, and the tunnel endpoint identifier of the UPF. In this scenario, the TD-UPF may be selected by the SMF. For example, the SMF may select the TD-UPF in the manner shown in FIG. 4.

20 **[00217]** S508: The TD-UPF sends the N4 session establishment response to the TD-SMF.

[00218] The N4 session establishment response includes the tunnel endpoint identifier of the TD-UPF.

25 **[00219]** Optionally, the tunnel endpoint identifier of the TD-UPF may alternatively be generated by the TD-SMF. In this case, the N4 session establishment request in S507 further includes the tunnel endpoint identifier of the TD-UPF, and the TD-UPF is not required to send the tunnel endpoint identifier of the TD-UPF to the SMF in S508.

30 **[00220]** It may be understood that, when the SMF and TD-SMF are integrated together, or when the SMF has functions of the TD-SMF, S508 may be replaced with the following: The TD-UPF sends the N4 session establishment response to the SMF. In addition, S510 does not need to be performed.

[00221] S509: The TD-UPF advertises the IP address of the UE and IP network segment route mask.

[00222] Optionally, a sequence between S508 and S509 is not limited in this application.

[00223] For this step, refer to S204.

35 **[00224]** S510: The TD-SMF sends the tunnel endpoint identifier of the TD-UPF to the SMF

through a Nsmf_PDUSession_Create Response interface.

[00225] For this step, refer to S205.

[00226] S511: The SMF sends a N4 session modification request to the UPF.

5 **[00227]** The N4 session modification request includes the tunnel endpoint identifier of the TD-UPF.

[00228] For this step, refer to S206.

[00229] S512: The SMF sends the session establishment response to the RAN.

[00230] The session response includes the uplink tunnel endpoint identifier of the UPF. In the foregoing process, the SMF may determine, based on whether the tunnel endpoint identifier of the TD-UPF is obtained, whether the TD-SMF and the TD-UPF successfully establish session #1. In addition, the IP address of the UE of session #1 and the IP network segment route mask are advertised by the TD-UPF to the network, so that the TD-UPF can receive data of session #1 from the network, and forward the data to the UPF through the tunnel between the TD-UPF and the UPF. For session #1, through the foregoing process, the TD-UPF is deployed as a hop in a user plane of a core network, and is not required to be deployed as a part of a data network. Therefore, when the TD-UPF is deployed, a route is not required to be replanned to route the data of session #1 by the TD-UPF, that is, the data network is not required to be reconstructed.

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[00231] The method provided in embodiments of this application is described above in detail with reference to FIG. 2A to FIG. 5B. Communication apparatuses provided in embodiments of this application is described below with reference to FIG. 6 and FIG. 7. The communication apparatus may be configured to implement functions such as the functions of the SMF in FIG. 2A to FIG. 5B, the functions of the UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the functions of the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the functions of the UDM in FIG. 3 and FIG. 4, or the functions of the TD-SMF in FIG. 2A to FIG. 5B. In embodiments of this application, the communication apparatus may be divided into functional units based on the foregoing method embodiments. For example, division into the functional units may be based on corresponding functions, or two or more units may be integrated into one processing module. The integrated unit may be implemented in a form of hardware, or may be implemented in a form of a software functional module. It should be noted that division into the units in embodiments of this application is an example, and is merely logical function division. In actual implementation, there may be another division manner.

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[00232] For a diagram of a structure of the communication apparatus, refer to FIG. 6.

[00233] FIG. 6 is a schematic diagram of a structure of a communication apparatus 600 according to this application. The communication apparatus 600 includes one or more processors 601, a communication line 602, and at least one communication interface (an example in which a

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communication interface 603 and one processor 601 are included is merely used for description in FIG. 6). Optionally, the communication apparatus 600 may further include a memory 604.

[00234] The processor 601 may be a common 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 in this application.

[00235] The communication line 602 is configured to connect different components.

[00236] The communication interface 603 may be a transceiver module, configured to communicate with another device, a communication apparatus, or a communication network, such as the Ethernet, a RAN, or a wireless local area network (wireless local area network, WLAN). For example, the transceiver module may be an apparatus, for example, a transceiver or a transceiving machine, or may be a network adapter or an optical fiber switching apparatus. Optionally, the communication interface 603 may be a transceiver circuit located in the processor 601, and is configured to implement signal input and signal output of the processor.

[00237] The memory 604 may be an apparatus with a storage function. For example, the memory may be a read-only memory (read-only memory, ROM) or another type of static storage device capable of storing static information and instructions, may be a random access memory (random access memory, RAM) or another type of dynamic storage device capable of storing 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 other compact disc storage, optical disc storage (including a compressed optical disc, a laser disc, an optical disc, a digital versatile disc, a Blu-ray disc, or the like), a magnetic disk storage medium or another magnetic storage device, or any other medium capable of carrying or storing expected program code in a form of instructions or a data structure and capable of being accessed by a computer. This is not limited thereto. The memory may be independent, and connected to the processor through the communication line 1002. Alternatively, the memory may be integrated into the processor.

[00238] The memory is configured to store a computer-executable instruction for performing the solutions of this application, and the processor controls execution of the computer-executable instruction. The processor is configured to execute the computer-executable instruction stored in the memory, to implement functions of the SMF in FIG. 2A to FIG. 5B, the functions of the UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the functions of the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the functions of the UDM in FIG. 3 and FIG. 4, or the functions of the TD-SMF in FIG. 2A to FIG. 5B in this application. The computer-executable instruction in this embodiment of this application may also be referred to as application program code, or a computer

program instruction, or a program instruction. This is not specifically limited in this embodiment of this application.

[00239] In a specific implementation, in an embodiment, the processor 601 may include one or more CPUs, for example, a CPU 0 and a CPU 1 in FIG. 6.

5 **[00240]** In a specific implementation, in an embodiment, the communication apparatus 600 may include a plurality of processors, for example, the processor 601 and a processor 605 in FIG. 6. Each of these processors may be a single core central processing unit (single-CPU), or may be a multi-core central processing unit (multi-CPU). The processor herein may be one or more devices, circuits, and/or processing cores configured to process data (for example, a computer program
10 instruction).

[00241] The communication apparatus 600 may be a common apparatus or a dedicated apparatus. For example, the communication apparatus 600 may be a network server, an embedded device, a desktop computer, a portable computer, a mobile phone, a tablet computer, a wireless terminal device, or a device having a similar structure in FIG. 6. A type of the communication
15 apparatus 600 is not limited in this embodiment of this application.

[00242] It may be understood that, in the foregoing embodiments, the methods and the steps implemented by the SMF in FIG. 2A to FIG. 5B, the UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the UDM in FIG. 3 and FIG. 4, or the TD-SMF in FIG. 2A to FIG. 5B may alternatively be implemented by a chip system
20 that implements the functions of the SMF in FIG. 2A to FIG. 5B, the UPF in FIG. 2A, FIG. 2B, FIG. 5A and FIG. 5B, the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, the UDM in FIG. 3 and FIG. 4, or the TD-SMF in FIG. 2A to FIG. 5B.

[00243] For a diagram of a structure of the foregoing communication apparatus, refer to FIG. 7. A communication apparatus 700 includes a processing unit 711 and a transceiver unit 112.

25 **[00244]** The communication apparatus may be configured to implement functions of the SMF in FIG. 2A to FIG. 5B. The transceiver unit 712 performs receiving and sending operations performed by the SMF in the methods in FIG. 2A to FIG. 5B, and the processing unit 711 performs operations other than the receiving and sending operations.

[00245] The communication apparatus may be configured to implement functions of the UPF
30 in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B. The transceiver unit 712 performs receiving and sending operations performed by the UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B, and the processing unit 711 performs operations other than the receiving and sending operations.

[00246] The communication apparatus may be configured to implement functions of the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B. The transceiver unit 712 performs receiving
35 and sending operations performed by the TD-UPF in FIG. 2A, FIG. 2B, and FIG. 5A and FIG. 5B,

and the processing unit 711 performs operations other than the receiving and sending operations.

[00247] The communication apparatus may be configured to implement functions of the UDM in FIG. 3 and FIG. 4. The transceiver unit 712 performs the receiving and sending operations performed by the UDM in FIG. 3 and FIG. 4, and the processing unit 711 performs operations other than the receiving and sending operations.

[00248] The communication apparatus may be configured to implement functions of the TD-SMF in FIG. 2A to FIG. 5B. The transceiver unit 712 performs receiving and sending operations performed by the TD-SMF in FIG. 2A to FIG. 5B, and the processing unit 711 performs operations other than the receiving and sending operations.

[00249] In this embodiment of this application, the communication apparatus may be divided into functional units based on the foregoing method embodiments. For example, division into the functional units may be based on corresponding functions, or two or more units may be integrated into one processing module. The integrated unit may be implemented in a form of hardware, or may be implemented in a form of a software functional module. It should be noted that division into the units in embodiments of this application is an example, and is merely logical function division. In actual implementation, there may be another division manner.

[00250] Function/implementation processes of the processing unit 711 and the transceiver unit 712 in FIG. 7 may be implemented by a processor in the communication apparatus shown in FIG. 6 invoking a computer-executable instruction stored in a memory. Alternatively, the function/implementation process of the processing unit 711 in FIG. 7 may be implemented by the processor in the communication apparatus shown in FIG. 6 by invoking the computer-executable instruction stored in the memory, and the function/implementation process of the transceiver unit 712 in FIG. 7 may be implemented through a communication interface in the communication apparatus shown in FIG. 6.

[00251] All or some of the foregoing embodiments may be implemented by using software, hardware, firmware, or any combination thereof. When a software program is for implementing the embodiments, all or some of the embodiments may be implemented in a form of a computer program product. The computer program product includes one or more computer instructions. When the computer program instruction is loaded and executed on a computer, all or some of the procedures or functions according to embodiments of this application are generated. The computer may be a general-purpose computer, a dedicated computer, a computer network, or other programmable apparatuses. The computer instruction may be stored in a computer-readable storage medium or may be transmitted from a computer-readable storage medium to another computer-readable storage medium. For example, the computer instruction may be transmitted from a website, computer, server, or data center to another website, computer, server, or data center

in a wired (for example, a coaxial cable, an optical fiber, or a digital subscriber line (digital subscriber line, DSL)) or wireless (for example, infrared, radio, or microwave) manner. The computer-readable storage medium may be any usable medium accessible by the computer, or a data storage device, for example, a server or a data center, integrating one or more usable media.

5 The usable medium may be a magnetic medium (for example, a floppy disk, a hard disk, or a magnetic tape), an optical medium (for example, a DVD), a semiconductor medium (for example, a solid-state drive (solid-state drive, SSD)), or the like. In embodiments of this application, the computer may include the apparatus described above.

[00252] Although this application is described with reference to embodiments, in a process of
10 implementing this application that claims protection, a person skilled in the art may understand and implement another variation of the disclosed embodiments by viewing the accompanying drawings, disclosed content, and appended claims. In the claims, the term "comprise" (comprising) does not exclude another component or another step, and "a" or "one" does not exclude a case of plurality. A single processor or another unit may implement several functions enumerated in the
15 claims. Some measures are recorded in dependent claims that are different from each other, but this does not indicate that these measures cannot be combined to produce a better effect.

[00253] Although this application has been described with reference to specific features and embodiments thereof, it is obvious that various modifications and combinations may be made to this application without departing from the spirit and scope of this application. Correspondingly,
20 the specification and the accompanying drawings are merely example descriptions of this application defined in the appended claims, and are considered as any of or all modifications, variations, combinations or equivalents that cover the scope of this application. It is clear that a person skilled in the art can make various modifications and variations to this application without departing from the spirit and scope of this application. This application is intended to cover these
25 modifications and variations of this application provided that they fall within the scope of protection defined by the following claims and their equivalent technologies.

CLAIMS

What is claimed is:

1. A connection establishment method, comprising:

5 sending, by a session management function to a traffic detection user plane function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, wherein the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session;

10 receiving, by the session management function, a second tunnel endpoint identifier of the traffic detection user plane function from the traffic detection user plane function, wherein the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session; and

15 sending, by the session management function, the second tunnel endpoint identifier to the user plane function.

2. The method according to claim 1, wherein the user plane function is an anchor user plane function.

3. The method according to claim 1, further comprising:

20 subscribing to, by the session management function, information about the traffic detection user plane function; and

selecting, by the session management function, the traffic detection user plane function based on the information.

4. The method according to any one of claims 1 to 3, wherein the IP network segment route mask is used by the traffic detection user plane function for advertising to a network that the IP address belongs to an address range indicated by the IP network segment route mask.

5. The method according to claim 1, further comprising:

receiving, by the session management function, the IP address and the IP network segment route mask from the user plane function; or

30 determining, by the session management function, the IP address and the IP network segment route mask; and

sending, by the session management function, the IP address and the IP network segment route mask to the user plane function.

6. The method according to any one of claims 1 to 5, further comprising:

sending, by the session management function, a third tunnel endpoint identifier of the user plane function to an access network node or an intermediate user plane function, wherein the third tunnel endpoint identifier is for establishing an uplink tunnel between the access network node or the intermediate user plane node and the user plane node, and the uplink tunnel is for transmission of the uplink data of the first session.

7. A connection establishment method, comprising:

receiving, by a traffic detection user plane function from a session management function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, wherein the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session;

advertising, by the traffic detection user plane function, the IP address and the IP network segment route mask to a network; and

sending, by the traffic detection user plane function, a second tunnel endpoint identifier of the traffic detection user plane function to the session management function, wherein the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

8. The method according to claim 1, wherein the user plane function is an anchor user plane function.

9. A connection establishment method, comprising:

sending, by a session management function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function to a traffic detection control plane function, wherein the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and a traffic detection user plane function, the downlink tunnel is for transmission of downlink data of the first session, and the traffic detection control plane function is for managing the traffic detection user plane function;

receiving, by the session management function, a second tunnel endpoint identifier of the traffic detection user plane function from the traffic detection control plane function, wherein the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session; and

sending, by the session management function, the second tunnel endpoint identifier to the

user plane function.

10. The method according to claim 9, wherein the user plane function is an anchor user plane function.

11. The method according to claim 9 or 10, further comprising:

5 subscribing to, by the session management function, information about the traffic detection control plane function; and

 selecting, by the session management function, the traffic detection control plane function based on the information.

12. The method according to any one of claims 9 to 11, further comprising:

10 sending, by the session management function, session establishment information to the traffic detection control plane function, wherein the session establishment information comprises one or more types of the following information: a device identifier of the terminal, an access point name APN, a data network name DNN, and single network slice selection assistance information S-NSSAI.

15 13. The method according to any one of claims 9 to 12, wherein the IP network segment route mask is used by the traffic detection user plane function for advertising to a network that the IP address belongs to an address range indicated by the IP network segment route mask.

14. The method according to any one of claims 9 to 13, further comprising:

20 receiving, by the session management function, the IP address and the IP network segment route mask from the user plane function; or

 determining, by the session management function, the IP address and the IP network segment route mask; and

 sending, by the session management function, the IP address and the IP network segment route mask to the user plane function.

25 15. The method according to any one of claims 9 to 14, further comprising:

 sending, by the session management function, a third tunnel endpoint identifier of the user plane function to an access network node or an intermediate user plane function, wherein the third tunnel endpoint identifier is for establishing an uplink tunnel between the access network node or the intermediate user plane node and the user plane node, and the uplink tunnel is for transmission
30 of the uplink data of the first session.

16. A connection establishment method, comprising:

 receiving, by a traffic detection control plane function from a session management function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, wherein the IP address
35 corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing

a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session;

sending, by the traffic detection control plane function, the IP address, the IP network segment route mask, and the first tunnel endpoint identifier to the traffic detection user plane function; and

5 sending, by the traffic detection control plane function, a second tunnel endpoint identifier of the traffic detection user plane function to the session management function, wherein the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

10 17. The method according to claim 16, further comprising:

receiving, by the traffic detection control plane function, the second tunnel endpoint identifier from the traffic detection user plane function; or

generating, by the traffic detection control plane function, the second tunnel endpoint identifier for the first session; and

15 sending, by the traffic detection control plane function, the second tunnel endpoint identifier to the traffic detection user plane function.

18. The method according to claim 16 or 17, wherein the user plane function is an anchor user plane function.

19. The method according to any one of claims 16 to 18, further comprising:

20 subscribing to, by the traffic detection control plane function, information about the traffic detection user plane function; and

selecting, by the traffic detection control plane function, the traffic detection user plane function based on the information.

20. The method according to any one of claims 16 to 19, further comprising:

25 receiving, by the traffic detection control plane function, session establishment information from the session management function, wherein the session establishment information comprises one or more types of the following information: a device identifier of the terminal, an access point name APN, a data network name DNN, and single network slice selection assistance information S-NSSAI.

30 21. The method according to any one of claims 16 to 20, wherein the IP network segment route mask is used by the traffic detection user plane function for advertising to a network that the IP address belongs to an address range indicated by the IP network segment route mask.

22. A connection establishment method, comprising:

35 receiving, by a traffic detection user plane function from a traffic detection control plane function, an internet protocol IP address of a terminal, an IP network segment route mask

corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function, wherein the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session;

advertising, by the traffic detection user plane function, the IP address and the IP network segment route mask to a network; and

sending, by the traffic detection user plane function, a second tunnel endpoint identifier of the traffic detection user plane function to the traffic detection control plane function, wherein the second tunnel endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

23. The method according to claim 22, wherein

the receiving, by a traffic detection user plane function from a traffic detection control plane function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of a user plane function comprises:

receiving, by the traffic detection user plane function from the traffic detection control plane function, the IP address, the IP network segment route mask, and the first tunnel endpoint identifier from a session management function; and

the sending, by the traffic detection user plane function, a second tunnel endpoint identifier of the traffic detection user plane function to the traffic detection control plane function comprises:

sending, by the traffic detection user plane function, the second tunnel endpoint identifier to the session management function via the traffic detection control plane function.

24. The method according to claim 22 or 23, wherein the user plane function is an anchor user plane function.

25. A connection establishment method, comprising:

obtaining, by a user plane function, an internet protocol IP address of a terminal, an IP network segment route mask corresponding to the IP address, and a first tunnel endpoint identifier of the user plane function, wherein the IP address corresponds to a first session of the terminal, the first tunnel endpoint identifier is for establishing a downlink tunnel between the user plane function and the traffic detection user plane function, and the downlink tunnel is for transmission of downlink data of the first session; and

receiving, by the user plane function, a second tunnel endpoint identifier of the traffic detection user plane function from a session management function, wherein the second tunnel

endpoint identifier is for establishing an uplink tunnel between the user plane function and the traffic detection user plane function, and the uplink tunnel is for transmission of uplink data of the first session.

26. The method according to claim 25, wherein the obtaining, by a user plane function, an internet protocol IP address of a terminal and an IP network segment route mask corresponding to the IP address comprises:

determining, by the user plane function, the IP address and the IP network segment route mask, and

sending, by the user plane function, the IP address and the IP network segment route mask to the session management function; or

receiving, by the user plane function, the IP address and the IP network segment route mask from the session management function.

27. The method according to claim 25 or 26, wherein the obtaining, by a user plane function, a first tunnel endpoint identifier of the user plane function comprises:

generating, by the user plane function, the first tunnel endpoint identifier for the first session; and

sending, by the user plane function, the first tunnel endpoint identifier to the session management function; or

receiving, by the user plane function, the first tunnel endpoint identifier from the session management function.

28. The method according to any one of claims 25 to 27, further comprising:

obtaining, by the user plane function, a third tunnel endpoint identifier of a second user plane function, wherein the third tunnel endpoint identifier is for establishing an uplink tunnel between an access network node or an intermediate user plane node and the user plane node, and the uplink tunnel is for transmission of the uplink data of the first session.

29. The method according to any one of claims 8 to 11, wherein the user plane function is an anchor user plane function.

30. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to any one of claims 1 to 6.

31. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to claim 7 or 8.

32. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the

communication apparatus performs the method according to any one of claims 9 to 15.

33. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to any one of claims 16 to 21.

5 34. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to any one of claims 22 to 24.

10 35. A communication apparatus, comprising a processor and a memory, wherein the processor is configured to execute a computer program or instructions stored in the memory, so that the communication apparatus performs the method according to any one of claims 25 to 28.

36. A communication system, comprising the communication apparatus according to claim 30, and the communication apparatus according to claim 31.

37. A communication system, comprising the communication apparatus according to claim 32, the communication apparatus according to claim 33, and the apparatus according to claim 34.

15 38. The communication system according to claim 36 or 37, further comprising:
the communication apparatus according to claim 35.

39. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program, wherein when the computer program runs on a computer, the computer is enabled to perform any one of claims 1 to 29.

20 40. A computer program product, wherein the computer program product comprises computer program code, wherein when the computer program code is run on a computer, the method according to any one of claims 1 to 29 is performed.