

METHOD FOR PROCESSING CHANGE IN RADIO CAPABILITY OF TERMINAL APPARATUS AND APPARATUS

[0001]

TECHNICAL FIELD

5 [0002] This application relates to the field of communications technologies, and more specifically, to a method for processing a change in a radio capability of a terminal apparatus and an apparatus.

BACKGROUND

[0003] To better support a cellular internet of things (CIoT) device, a user plane transmission
10 enhancement technology is introduced. When UE and a network support a user plane optimization data transmission scheme, the network suspends an established connection by using a connection suspend () procedure. In the connection suspend procedure, a context of the UE and a context of a bearer are stored, and the UE enters an idle state. In this case, when the UE needs to send data, the UE may quickly resume a connection by using a connection resume procedure, to enter a
15 connected state, without initiating a service request procedure.

[0004] In a radio resource suspend (RRC suspend) state, when the UE is in the idle state, a radio capability of the UE may change, but a context retained on an access network apparatus is a context before the radio capability of the UE changes. When the UE resumes the connection, the access network apparatus resumes a radio resource based on the context retained before the radio
20 capability of the UE changes. Consequently, a failure may be caused to the resumption of the radio

resource. Alternatively, if the access network apparatus successfully resumes a radio resource based on the context retained before the radio capability of the UE changes, the access network apparatus needs to delete the context stored by the access network apparatus before the radio capability of the UE changes. However, currently in a current suspend/resume mechanism, a core
5 network apparatus does not instruct the access network apparatus to delete the context of the UE. Therefore, a problem of abnormal communication and efficiency reduction that are caused by the change in the radio capability of the UE in a suspend state needs to be resolved.

SUMMARY

[0005] This application provides a method for processing a change in a radio capability of a
10 terminal apparatus and an apparatus, to update a radio capability of the UE, and release a resource occupied by a context that is stored in an access network apparatus and that is before the radio capability of the UE changes, thereby avoiding abnormal communication and improving communication efficiency.

[0006] According to a first aspect, a method for processing a change in a radio capability of a
15 terminal apparatus is provided. The method includes:

receiving, by an access network apparatus, indication information, where the access network apparatus stores radio capability information of a terminal apparatus, and the indication information is used to indicate that a radio capability of the terminal apparatus changes, or is used to request a current radio capability of the terminal apparatus from the access network apparatus;
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obtaining, by the access network apparatus, current radio capability information of the terminal apparatus according to the indication information.

[0007] In this embodiment of this application, when a radio capability of the UE in a suspend state changes, the access network apparatus requests the current radio capability of the terminal
25 apparatus according to the indication information, so that the terminal apparatus can successfully resume a radio resource connection, thereby improving communication efficiency.

[0008] It should be noted that, the radio capability of the terminal apparatus already stored in the access network apparatus may be a first radio capability of the terminal apparatus, to be specific, radio capability information in a context of the UE that is stored when the terminal apparatus enters
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receiving, by the access network apparatus, a fourth message sent by a core network
5 apparatus, where the fourth message includes the indication information.

[0019] For example, the access network apparatus receives the fourth message sent by the core
network apparatus. The fourth message is used to instruct the access network apparatus to delete
or update the first radio capability information in the access network apparatus. The fourth message
includes the indication information. The core network apparatus is a mobility management entity
10 or an access and mobility management function entity.

[0020] Optionally, the fourth message may be a new message used by the core network
apparatus to indicate that the access network apparatus needs to delete or update a stored old
context of the UE.

[0021] Optionally, the fourth message may be an existing message used by the core network
15 apparatus to indicate that the access network apparatus needs to delete or update a stored old
context of the UE.

[0022] For example, the core network apparatus instructs, by adding an information element
to a connection establishment indication message, the access network apparatus to delete or
update the old context of the UE.

[0023] Optionally, the fourth message may be a downlink non-access stratum (downlink NAS
20 transport) message or a terminal apparatus transfer (UE information transfer) message sent by the
core network apparatus to the access network apparatus, to indicate that the access network
apparatus needs to update or delete a stored old context of the UE.

[0024] It should be understood that, in this embodiment of this application, the access network
25 apparatus receives the indication information sent by the terminal apparatus. The indication
information may be used to indicate that a first radio capability of the terminal apparatus changes,
or the indication information may be used to instruct the access network apparatus to update first
radio capability information of the terminal apparatus, or the indication information may be used
to instruct the access network apparatus to delete first radio capability information of the terminal
30 apparatus. A first radio capability may indicate a radio access technology supported by the terminal
apparatus, for example, information such as an energy level and a frequency band.

[0025] With reference to the first aspect, in some implementations of the first aspect, when the
indication information is used to request the current radio capability of the terminal apparatus from
the access network apparatus, the method further includes: receiving, by the access network

radio capability of a terminal apparatus according to another embodiment of this application;

[0149] FIG. 16 is a schematic block diagram of an apparatus for processing a change in a radio capability of a terminal apparatus according to an embodiment of this application;

[0150] FIG. 17 is a schematic block diagram of an apparatus for processing a change in a radio capability of a terminal apparatus according to an embodiment of this application;

[0151] FIG. 18 is a schematic block diagram of an apparatus for processing a change in a radio capability of a terminal apparatus according to an embodiment of this application; and

[0152] FIG. 19 is a schematic block diagram of an apparatus for processing a change in a radio capability of a terminal apparatus according to an embodiment of this application.

DESCRIPTION OF EMBODIMENTS

[0153] The following describes the technical solutions of this application with reference to the accompanying drawings.

[0154] The technical solutions of the embodiments of this application may be applied to various communications systems, such as a global system for mobile communications (GSM) system, a code division multiple access (CDMA) system, a wideband code division multiple access (WCDMA) system, a general packet radio service (GPRS), a long term evolution (LTE) system, an LTE frequency division duplex (FDD) system, an LTE time division duplex (TDD), a universal mobile telecommunication system (UMTS), a worldwide interoperability for microwave access (WiMAX) communications system, a future 5th generation (5G) system, a new radio (NR), or a possible future communications system.

[0155] A terminal apparatus in the embodiments of this application may be user equipment, an access terminal, a subscriber unit, a subscriber station, a mobile station, a mobile station, a remote station, a remote terminal, a mobile device, a user terminal, a terminal, a wireless communications device, a user agent, or a user apparatus. Alternatively, the terminal apparatus may be a cellular phone, a cordless phone, a session initiation protocol (

SIP) phone, a wireless local loop (WLL) station, a personal digital assistant (PDA), a handheld device having a wireless communication function, a computing device, another processing device connected to a wireless modem, an in-vehicle device, a wearable device, a terminal apparatus in a future 5G network, or a terminal apparatus in a future evolved public land mobile network (PLMN). This is not limited in the embodiments of this application.

[0156] A core network (CN) device in the embodiments of this application may be a control plane anchor of the terminal apparatus, and provides functions such as registration area update for the terminal. For example, the core network apparatus may include an access and mobility management function (AMF) entity. The core network apparatus may be a network device configured to provide functions such as core network access (core access) and mobility management for the terminal. A specific function of the core network apparatus may be similar to a function of a mobility management entity (MME) in an LTE system.

[0157] An access network apparatus in the embodiments of this application may be a device configured to communicate with the terminal apparatus, and the access network apparatus may be a radio access network (RAN) device. The RAN device may include various types of base stations. For example, the base station in the embodiments of this application may include macro base stations, micro base stations, relay stations, access points, and the like in various forms. In systems that use different radio access technologies, devices with a base station function may have different names. For example, in an LTE network, a device with a base station function is referred to as an evolved NodeB (eNB or eNodeB). In a 3rd generation (3G) network, a device with a base station function is referred to as a NodeB. In a 5th generation (5G) network, a device with a base station function is referred to as a g-NodeB (gNB) or the like. This is not limited in the embodiments of this application.

[0158] In a possible manner, the access network device may include a centralized unit (CU) and a distributed unit (DU). One CU may be connected to one DU, or a plurality of DUs may share one CU, to reduce costs and facilitate network expansion. The CU and the DU may be divided based on a protocol stack. In a possible manner, a radio resource control (RRC) layer, a service data mapping protocol stack

(SDAP) layer, and a packet data convergence protocol (PDCP) layer are deployed on the CU, and a remaining radio link control (RLC) layer, media access control (MAC) layer, and physical layer are deployed on the DU.

5 **[0159]** In addition, in the embodiments of this application, the access network device provides a service for a cell, and the terminal apparatus communicates with a network device by using a transmission resource (for example, a frequency domain resource or a spectrum resource) used by the cell. The cell may be a cell corresponding to the network device (for example, a base station). The cell may belong to a macro base station, or may belong to a base station corresponding to a
10 small cell. The small cell herein may include a metro cell, a micro cell, a pico cell, a femto cell, and the like. These small cells are characterized by small coverage and low transmit power, and are applicable to providing a high-rate data transmission service.

[0160] A context refers to establishment of a context session in a communications system, mainly refers to establishment of a connection between function entities, and is used for
15 information transmission, or refers to information stored in an entity.

[0161] For example, a context in LTE is mainly an EPS bearer context, and is established in a process of establishing a connection link between UE and a P-GW. Signaling interaction may be performed after a signaling bearer is established, and a data packet may be sent/received after a data bearer is established.

20 **[0162]** A radio capability includes a radio access technology (RAT) supported by UE, for example, an energy level or a frequency band.

[0163] The technical solutions in the embodiments of this application may be specifically applied to a 5G system in a non-roaming scenario. The following describes the 5G system in the non-roaming scenario with reference to FIG. 1.

25 **[0164]** FIG. 1 is a schematic diagram of an architecture of the 5G system in the non-roaming scenario.

[0165] The system architecture shown in FIG. 1 includes user equipment (UE), a radio access network (RAN), an access and mobility management network element (AMF), a session management network element (SMF), a user plane network element (

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UPF), a policy control network element (PCF), a unified data management network element (UDM), an authentication server function (AUSF) entity, and a data network (DN) module.

[0166] Main functions of devices in a core network in the system architecture shown in FIG.

5 1 are as follows:

[0167] An access and mobility management function (AMF) is mainly used for mobility management, access management, and the like, and may be used to implement functions other than session management in functions of a mobility management entity (MME), for example, functions such as lawful interception and access authorization/authentication.

10 **[0168]** A session management function (SMF) is mainly used for session management, internet protocol (IP) address allocation and management of a terminal apparatus, manageable user plane function selection, a termination point of a policy control and charging function interface, a downlink data notification, and the like.

[0169] A user plane function (UPF) has a main function of routing and forwarding a data
15 packet, and may be used as a mobility anchor or an uplink classifier to support routing of a service flow to a DN, or may be used as a BP to support a multi-homing PDU session, and the like.

[0170] The policy control network element (PCF) is a policy decision point, and has main functions of providing rules for service flow detection, application detection, gate control, QoS, and flow-based charging control.

20 **[0171]** A (radio) access network (R)AN is used to provide a network access function for an authorized user in a specific area, and can use transmission tunnels with different quality based on user levels, service requirements, and the like. The (R)AN network element can manage radio resources and provide an access service for a terminal apparatus, to forward a control signal and user data between the terminal apparatus and the core network. The (R)AN network element may
25 alternatively be understood as a base station in a conventional network.

[0172] An authentication server function (AUSF) is mainly used for user authentication and the like.

[0173] An application function (AF) is used for interaction with a 3GPP

core network to provide a service. The interaction includes interaction with a NEF, interaction with a policy architecture, and the like. Main functions of the network exposure function (NEF) include: securely opening, to inside, a third party, or the like, a service and a capability that are provided by a 3GPP network function; and converting or translating information exchanged with the AF and information exchanged with an internal network function, for example, an AF service identifier and internal 5G core network information such as a DNN and an S-NSSAI.

[0174] The network exposure function (NEF) is used to securely open, to outside, a service and a capability that are provided by a 3GPP network function.

[0175] A unified data management (UDM) is used for processing user identifier, access authentication, registration, mobility management, and the like.

[0176] It should be noted that names of the network elements (such as the SMF, the AF, and the UPF) included in FIG. 1 are also merely names, and the names do not constitute any limitation on the functions of the network elements. In a 5G network and another future network, the foregoing network elements may alternatively have other names. This is not specifically limited in the embodiments of this application. For example, in a 6G network, some or all of the foregoing network elements may still use terms in 5G, or may use other names, or the like. This is uniformly described herein. Details are not described in the following.

[0177] It should be understood that the foregoing network architecture applied to the embodiments of this application is merely an example of a network architecture for description, and a network architecture applicable to the embodiments of this application is not limited thereto. Any network architecture that can implement the functions of the foregoing network elements is applicable to the embodiments of this application.

[0178] It should be understood that, in addition to the 5G system in the non-roaming scenario shown in FIG. 1, the technical solutions in the embodiments of this application may be applied to another system architecture. For example, the technical solutions in the embodiments of this application may also be applied to a 5G system in a roaming scenario shown in FIG. 2.

[0179] The technical solutions in the embodiments of this application may be specifically applied to a 4G system in a non-roaming scenario. The following describes the 4G system in the non-roaming scenario with reference to FIG. 3.

[0180] FIG. 3 is a schematic diagram of an architecture of the 4G system in the non-roaming

scenario.

[0181] The system architecture shown in FIG. 3 includes user equipment (UE), a mobility management entity (MME), a packet data network gateway (P-GW), a serving gateway (S-GW), and the like.

[0182] Main functions of devices in a core network in the system architecture shown in FIG. 3 are as follows:

[0183] An evolved universal terrestrial radio access network (EUTRAN) is a network including a plurality of eNodeBs, and implements a radio physical layer function, resource scheduling and radio resource management, radio access control, and a mobility management function. The eNodeB is connected to the S-GW through a user plane interface S1-U, and is configured to transmit user data; and is connected to the MME through a control plane interface S1-MME, and implements a function such as radio access bearer control by using an S1-AP protocol.

[0184] The MME is mainly responsible for all control plane functions of user plane session management, including non-access stratum (NAS) signaling and security, tracking area management, P-GW and S-GW selection, and the like.

[0185] The S-GW is mainly responsible for data transmission, data forwarding, route switching, and the like of the user equipment, and serves as a local mobility anchor point when the user equipment is handed over between the eNodeBs (for each piece of user equipment, only one S-GW serves the user equipment at each moment).

[0186] The P-GW serves as an anchor point of a PDN connection, and is responsible for IP address allocation of the user equipment, and data packet filtering, rate control, charging information generation, and the like for the user equipment.

[0187] It should be understood that, in addition to the 4G system in the non-roaming scenario shown in FIG. 3, the technical solutions in the embodiments of this application may be applied to another system architecture. For example, the technical solutions in the embodiments of this application may also be applied to a 4G system in a roaming scenario shown in FIG. 4.

[0188] A user plane enhancement technology of an internet of things of 4G is used as an example for description below.

[0189] In 4G, to better support a cellular internet of things (CIoT)

device, a user plane transmission enhancement technology is introduced. When UE and a network support a user plane optimization data transmission scheme, the network suspends an established connection by using a connection suspend procedure. In the connection suspend procedure, a context of the UE and a context of a bearer are stored, and the UE enters an idle state. In this case, when the UE needs to send data, the UE may quickly resume a connection by using a connection resume procedure, to enter a connected state, without initiating a service request procedure.

[0190] FIG. 5 is a schematic diagram of a connection suspend procedure initiated by an eNB in a 4G system.

[0191] S101: The eNodeB sends an S1-AP UE context suspend request message to an MME, to trigger a connection suspend procedure. The eNodeB indicates to the MME that an RRC connection of UE is to be suspended, and therefore the MME enters an ECM-idle state. The eNB, the UE, and the MME retain data related to an S1-AP association, a context of UE, and a context of a bearer that are required for resuming a connection.

[0192] The eNodeB may add an information element "information on recommended cells and eNBs for Paging" to the S1-AP UE context suspend request message. After receiving the information, the MME should store the information for use when paging the UE.

[0193] If an information element "information for enhanced coverage" is available, the eNB adds the information element "information for enhanced coverage" to the S1-AP UE context suspend request message.

[0194] S102. The MME sends a release access bearer request message to an SGW, to request to release all S1-U bearers of the UE.

[0195] S103: The SGW releases all information (an address and a downlink TEID) related to the eNodeB of the UE, and returns a release access bearer response message to the MME, to instruct to release all the S1-U bearers. Another element in a context of the UE in the SGW is not affected. If the SGW further receives a downlink data packet of the UE, the SGW buffers the received downlink data packet of the UE and initiates a "network trigger service request" procedure.

[0196] It should be noted that, according to a policy of an operator, any received prompt "the abnormal release of radio link" may be used by the SGW to subsequently determine to trigger suspending PDN charging, provided that the PDN enables this function.

[0197] S104. The MME sends an S1-AP UE context suspend response message to the eNB, to successfully terminate the connection suspend procedure initiated by the eNB.

[0198] S105: The eNodeB sends an RRC message to the UE, to suspend an RRC connection from the eNodeB to the UE.

[0199] A context stored in each network element in the connection suspend procedure is shown in FIG. 6.

[0200] A data packet retained in the MME includes data required for resuming a connection.

[0201] For example, an S1AP association relationship (S1AP association) includes a UE context bearer and a context of the UE that are of a downlink TEID.

[0202] The data packet retained in the UE includes the data required for resuming a connection.

[0203] The data retained in the eNB may include data related to an S1AP connection, the context of the UE, the context of the bearer, and the related data required for resuming a connection.

[0204] Data released from the S-GW may include an eNB address, the downlink TEID, and another released context of the UE.

[0205] For a connection resume procedure, if the UE and a network support user plane optimization data transmission, and the UE has stored necessary information for performing the connection resume procedure, the UE uses this procedure to resume an ECM connection. Otherwise, the UE shall use a service request procedure to resume a connection.

[0206] When the connection is resumed, all bear connections are also resumed. FIG. 7 shows a connection resume procedure. Contexts of UE and all bears are stored in the UE, an eNodeB, an MME, and an S-GW, so that all bears except a bearer that fails to be resumed can be quickly resumed.

[0207] FIG. 7 is a schematic diagram of a connection resume procedure initiated by an eNB in a 4G system.

[0208] S201. UE triggers a random access procedure from the UE to the eNodeB.

[0209] S202. The UE triggers a radio resource connection resume (RRC connection Resume) procedure, including information required by the eNodeB to access a stored AS context of the UE. The E-UTRAN performs a security check. An EPS bearer status is synchronized between the UE and a network. To be specific, the UE locally removes an EPS bearer that is not established for the

UE or an EPS bearer that is not a control plane bearer. If a radio bearer for a default EPS bearer is not established, the UE locally deactivates all EPS bearers associated with the default EPS bearer.

[0210] S203: The eNodeB sends an S1-AP UE context resume request message to an MME, to notify RRC connection resume of the UE. If the eNodeB cannot allow all suspended bearers, the eNodeB shall perform identification in an information element "E-RAB Failed To Resume List". The MME enters an ECM-connected state. The MME identifies locally stored connection suspend procedure data that is corresponding to the UE and that is returned to the eNodeB. The data includes data related to an S1AP association, a context of the UE, and a context of a bearer that includes a DL TEID. (For example, the connection suspend procedure shown in FIG. 5).

[0211] If the eNodeB does not accept a default EPS bearer, all EPS bearers associated with the default bearer should be considered as unaccepted bearers. The MME may trigger a bearer release procedure to release bearers that are not accepted and not established.

[0212] In an example, if an S1-U connection is resumed and the UE accesses an NB-IoT RAT with an RRC resume cause "MO exception data", the MME shall maintain an MO exception data counter and send the MO exception data counter to an SGW, to notify the SGW of use of this establishment cause.

[0213] In an example, if an RRC establishment cause "MO exception data" has been used by an MO exception data counter, an SGW should notify a PGW. The SGW indicates, by using a related counter on a CDR of the SGW, use of the RRC establishment cause each time.

[0214] In an example, a PGW indicates, by using a related counter on a CDR of the PGW, each use of an RRC establishment cause "MO exception data".

[0215] S204. The MME returns an S1-AP UE context resume response message to the eNB, to acknowledge connection resume. If the MME cannot allow all suspended E-RABs, the MME shall perform indication in an information element "E-RAB Failed To Resume List".

[0216] S205: If the MME indicates, in step S204, that there is a list of an E-RAB that fails to be resumed, the eNodeB reconfigures a radio bearer.

[0217] S206: The eNodeB may forward, to an SGW, uplink data from the UE. The eNodeB may send the uplink data to an SGW address and a TEID (for example, the connection suspend procedure shown in FIG. 5) that are stored in the connection suspend procedure, and the SGW

forwards the uplink data to a PGW.

[0218] S207: The MME sends, for each PDN connection, a modify bearer request message (including an eNodeB address, an S1 TEID (downlink) of an accepted EPS bearer, a delay downlink packet notification request, and a RAT type) to the SGW.

[0219] If the SGW supports a modify access bearers request procedure, and the SGW does not need to send signaling to the PGW, the MME may send, for the UE, a modify access bearer request message (including an eNodeB address and a TEID that are of a downlink user plane of the accepted EPS bearer, and the delay downlink packet notification request) to the SGW, to optimize signaling. The SGW now can send downlink data to the UE.

[0220] The MME and the SGW clear downlink data buffer timers (if the times are previously set) in a context of UE of the MME and a context of UE of the SGW. Any downlink data buffered by the UE for using a power saving function should be transmitted, to avoid establishing an unnecessary user plane connection in a subsequent tracking area update (TAU) procedure.

[0221] S208. The SGW should return a modify bearer response message (an SGW address and an uplink TEID) to the MME, to respond to the modify bearer request message, or return a modify access bearer response message (an SGW address and an uplink TEID), to respond to the modify access bearer request message. If the SGW cannot serve the request of the MME in the modify access bearer request message without S5/S8 signaling (except for cancelling suspending charging in the PGW), the SGW shall feed back, to the MME, an indication that modification is not limited to an S1-U bearer, the MME shall use the modify bearer request message for each PDN connection to repeat a request of the MME.

[0222] The 4G system is used as an example to describe a user plane enhancement procedure (Suspend/Resume) above. It should be understood that this embodiment of this application is also applicable to a user plane enhancement procedure and a radio resource inactive (RRC Inactive) procedure in 5G. For the RRC inactive procedure, a main difference from the user plane enhancement procedure is that UE is in a connected state. For the user plane enhancement procedure in 5G, a main difference from a user plane enhancement procedure in 4G is that the procedure is applied to an architecture in 5G. This is not limited in the embodiments of this application.

[0223] According to a current protocol, a radio capability of UE cannot change when the UE

is in a connected state, and can change only when the UE is in an idle state. If the capability of the UE in the idle state changes, in a TAU procedure, the UE may notify an MME of the change in the radio capability of the UE by using non-access stratum (NAS) signaling. The MME notifies a RAN. The RAN obtains the radio capability of the UE from the UE, and sends the capability to the MME. When the UE is in an RRC suspend state, the UE first performs RRC resume, resumes a signaling radio bearer (SRB) and a data radio bearer (DRB), and then performs the TAU procedure.

[0224] When the UE is in an RRC suspend state, the UE is in an idle state, and the UE may change the radio capability. In a suspend/resume mechanism, the RAN stores a context of the radio capability of the UE. If the radio capability of the UE changes, the RAN still processes the RRC resume of the UE based on the radio capability of the UE stored in the RAN before the radio capability of UE changes. Therefore, an error may occur in the RRC resume.

[0225] For example, FIG. 8 is a schematic diagram of resuming a radio resource when a radio capability of UE changes.

[0226] S310. A radio capability of the UE changes when the UE is in an RRC suspend state.

[0227] S311. The UE sends a radio resource resume request to an eNB.

[0228] S312. The eNB establishes an SRB and a DRB based on retained resume data of a first radio capability of the UE, to perform an RRC resume procedure.

[0229] It should be understood that, when the first radio capability of the UE changes, the eNB does not know that the first radio capability of the UE changes. Therefore, the eNB still performs a radio resource resume procedure based on the previously retained context of the UE. Consequently, an error may occur in the radio resource resume procedure.

[0230] It should be noted that, when the first radio capability of the UE changes, if RRC resume succeeds, a RAN needs to be instructed to update and delete the context of the UE that is stored in the RAN before the radio capability of the UE changes. However, currently in a suspend/resume mechanism, there is no manner in which an MME instructs the RAN to delete the context of the UE. If an error occurs in the RRC resume, a conventional radio resource connection establishment (RRC connection establishment) procedure needs to be performed. Establishment of an RRC connection through trial and error causes an increase of a time of the RRC connection. In addition, if the RRC resume is processed based on the error, operation and maintenance load of a network may also be increased.

[0263] For example, FIG. 10 is a schematic diagram of a method for processing a change in a radio capability of a terminal apparatus according to an embodiment of this application.

[0264] It should be understood that, in FIG. 10, an access network apparatus may be an eNB in a 4G system, or may be a gNB in a 5G system; and a core network apparatus may be an MME entity in the 4G system, or may be an AMF entity in the 5G system. This is not limited in this application.

[0265] It should be noted that, the method for processing a change in a radio capability of a terminal apparatus shown in FIG. 10 is obtained by altering an RRC resume procedure, and an RRC resume message may include indication information indicating that a radio capability of UE changes.

[0266] S301. A terminal apparatus initiates a random access procedure to the access network apparatus.

[0267] S302a. The UE sends a radio resource connection resume request (RRC connection resume request) message to the access network apparatus, to resume a connection. The message may include UE radio capability changed indication (UE capability changed indication) information and connection resume identification (Resume ID) information.

[0268] The UE capability changed indication may be used to indicate that a radio capability of the UE changes.

[0269] S302b. The access network apparatus sends a radio resource connection resume message (RRC connection resume) to the terminal apparatus.

[0270] S302c. The UE resumes security of all of an SRB, a DRB, and an AS, and the UE enters an RRC-connected state.

[0271] S302d. The UE responds to the access network apparatus by using a radio resource connection resume complete message, and determines that an RRC connection has been successfully resumed.

[0272] Optionally, in this embodiment of this application, the radio resource connection resume complete message may also carry the indication information. The indication information may be used to indicate that a first radio capability of the terminal apparatus changes, or may be used to instruct the access network apparatus to delete or update a context of a first radio capability of the terminal apparatus.

[0273] S303. The access network apparatus requests the radio capability of the UE from the

capability of the UE is updated, and the stored context of the old radio capability of the UE should be deleted, or a current radio capability of the UE should be requested from the access network apparatus.

[0319] Optionally, the core network apparatus may send the indication information to the access network apparatus. The indication information is used to indicate that a radio capability of the terminal apparatus changes, and the access network apparatus updates the radio capability of the terminal apparatus according to the indication information.

[0320] It should be noted that, in this embodiment of this application, the core network apparatus may send the indication information to the access network apparatus, where the indication information is used to indicate that the radio capability of the terminal apparatus changes; and the access network apparatus may update, according to the indication information, the radio capability information stored in the access network apparatus. Alternatively, the core network apparatus may send the indication information to the access network apparatus, where the indication information is used to request a current radio capability of the terminal apparatus from the access network apparatus; and the core network apparatus may further send an update indication to the access network apparatus, where the update indication is used to instruct the access network apparatus to update radio capability information of the terminal apparatus, and the indication information and the update indication may be carried in a same message or carried in different messages.

[0321] Optionally, the core network apparatus uses a new message to indicate that the access network apparatus needs to delete or update stored old context of the UE, for example, delete a context of a first radio capability of the UE.

[0322] Optionally, the access network apparatus uses an existing message to indicate that the access network apparatus needs to delete a stored old context of the UE, for example, delete a context of a first radio capability of the UE.

[0323] For example, an information element is added to a connection establishment indication message, and used to instruct the access network apparatus to delete or update the old context of the UE.

[0324] Specifically, in the prior art, for the connection establishment indication message, if the message includes a UE radio capability IE, the access network apparatus stores the radio capability of the UE. If the message does not include a UE radio

UE has succeeded, that is, it indicates that the context of the UE is reused in an RRC resume process. In this case, the context of the first radio capability retained in the access network apparatus may be updated based on the updated radio capability such as the second radio capability. Alternatively, the conventional radio resource connection establishment (RRC connection establishment) procedure of the UE has succeeded.

[0342] S507. The access network apparatus reconfigures an RRC connection based on the updated radio capability of the UE.

[0343] S508. The core network apparatus reconfigures the capability stored in the access network apparatus in the suspend state.

[0344] In this embodiment of this application, the core network apparatus may instruct the access network apparatus to delete the old context of the UE, thereby resolving a problem that when the radio capability of the UE changes, currently, in a suspend/resume mechanism, the core network apparatus does not instruct the access network apparatus to delete the context of the UE.

[0345] It should be understood that, sequence numbers of the foregoing processes do not mean execution sequences. The execution sequences of the processes should be determined based on functions and internal logic of the processes, and should not be construed as any limitation on the implementation processes of the embodiments of this application.

[0346] FIG. 10 to FIG. 12 show the methods for processing a change in a radio capability of a terminal apparatus in an RRC resume procedure when UE is in a suspend state and a first radio capability of the UE changes. In this embodiment of this application, when the UE is in the suspend state, the UE may determine not to initiate an RRC resume procedure, but initiate a conventional radio resource connection establishment (RRC connection establishment) procedure.

[0347] The following provides descriptions by using examples according to FIG. 13 to FIG. 15. It should be understood that the following describes specific implementations of the embodiments of this application in more detail with reference to specific examples. It should be noted that the examples below are merely intended to help a person skilled in the art understand the embodiments of this application, instead of limiting the embodiments of this application to a specific value or a specific scenario shown in the examples. A person skilled in the art can apparently make various equivalent modifications or changes based on the examples provided below, and such modifications and changes also fall within the scope of the embodiments of this application.

context of the UE.

[0394] For example, the core network apparatus instructs, by adding an information element to a connection establishment indication) message, the access network apparatus to delete or update the old context of the UE.

5 **[0395]** For example, the fourth message may be a downlink non-access stratum (downlink NAS transport) message or a terminal apparatus transfer (UE information transfer) message sent by the core network apparatus to the access network apparatus, to indicate that the access network apparatus needs to delete a stored old context of the UE.

[0396] Optionally, the processing module 920 is further configured to:

10 receive, by using the transceiver module 910, the indication information sent by the core network apparatus, and update, according to the indication information, the radio capability information stored in the access network apparatus.

[0397] Optionally, the transceiver module 910 is further configured to:

receive an update indication, where the update indication is used to instruct the access
15 network apparatus to update the radio capability information of the terminal apparatus, and the indication information is sent by the core network apparatus.

[0398] Optionally, the processing module 920 is specifically configured to:

delete the radio capability information of the terminal apparatus that is stored before
the processing module obtains the radio capability information from the terminal apparatus.

20 **[0399]** Optionally, the processing module 920 is specifically configured to:

send a request message of the radio capability to the terminal apparatus according to
indication information by using the transceiver module 910; and

update the radio capability information of the terminal apparatus based on a second
radio capability, where the second radio capability is a current radio capability of the terminal
25 apparatus.

[0400] Optionally, the radio capability includes at least one of system information or a transceiving capability supported by the terminal apparatus.

[0401] In an embodiment, the transceiver module 910 is configured to receive radio resource
resume identification information, where the apparatus 900 stores radio capability information of
30 a terminal apparatus; and

the processing module 920 processes a context of the terminal apparatus in the access

[0457] Optionally, the radio resource control connection establishment message includes radio resource resume identification information.

[0458] Optionally, the radio resource control connection establishment message further includes indication information, where the indication information is used to indicate that the radio capability of the terminal apparatus changes, or is used to update radio capability information of the terminal apparatus.

[0459] In a design, an apparatus (for example, an integrated circuit, a wireless device, a circuit module, a network device, or a terminal device) may include a processor and a transceiver. When the apparatus is configured to implement the step or operation of the core network apparatus in FIG. 12, for example, the transceiver 35 may send indication information to an access network apparatus. The indication information is used to indicate that a radio capability of a terminal apparatus changes, or is used to request a current radio capability of the terminal apparatus from the access network apparatus.

[0460] Optionally, the processor 31 is further configured to: when the terminal apparatus is in a connected state, send the indication information to the access network apparatus by using the transceiver 35.

[0461] Optionally, when the indication information is used to request the current radio capability of the terminal apparatus from the access network apparatus, the transceiver 35 is further configured to send an update indication to the access network apparatus, where the update indication is used to instruct the access network apparatus to update radio capability information of the terminal apparatus, and the update indication and the indication information are carried in a same message.

[0462] Optionally, when the indication information is used to indicate that the radio capability of the terminal apparatus changes, the indication information is further used to instruct the access network apparatus to update the radio capability of the terminal apparatus according to the indication information.

[0463] The processor and the transceiver described in this application may be implemented on an integrated circuit (IC), an analog IC, a radio frequency integrated circuit RFIC, a hybrid signal IC, an application-specific integrated circuit (ASIC), a printed circuit board (printed circuit board, PCB), an electronic device, or the like. The processor and the transceiver may also be manufactured by using various IC technologies, for

example, a complementary metal oxide semiconductor (CMOS), an N-channel metal-oxide-semiconductor (NMOS), a P-channel metal-oxide-semiconductor (PMOS), a bipolar junction transistor (BJT), a bipolar CMOS (BiCMOS), silicon germanium (SiGe), and gallium arsenide (GaAs).

5 **[0464]** In the foregoing embodiment descriptions, the apparatus 1300 is described by using an access network apparatus or a terminal apparatus as an example, but the apparatus described in this application is not limited to the access network apparatus or the terminal apparatus, and a structure of the apparatus may not be limited by FIG. 19. The apparatus may be an independent device or may be a part of a relatively large device. For example, the device may be:

- 10 (1) An independent integrated circuit (IC), a chip, or a chip system or subsystem;
(2) A set having one or more ICs, where optionally, the IC set may also include a storage component configured to store data and/or an instruction;
(3) An ASIC, for example, a modem (MSM);
(4) A module that can be embedded in another device;
15 (5) A receiver, a terminal, a cellular phone, a wireless device, a hand-held phone, a mobile unit, a network device, or the like; and
(6) Others, etc.

[0465] In addition, the terms "system" and "network" in this specification may be often used interchangeably in this specification. The term "and/or" in this specification describes only an
20 association relationship for describing associated objects and represents that three relationships may exist. For example, A and/or B may represent the following three cases: only A exists, both A and B exist, and only B exists. In addition, the character "/" in this specification generally indicates an "or" relationship between the associated objects.

[0466] It should be understood that in the embodiments of this application, "B corresponding
25 to A" indicates that B is associated with A, and B may be determined based on A. However, it should further be understood that determining B based on A does not mean that B is determined based on only A. B may be alternatively determined based on A and/or other information.

[0467] Aspects or features in the embodiments of this application may be implemented as a method, an apparatus, or a product that uses standard programming and/or engineering
30 technologies. The term "product" used in this application covers a computer program that can be

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

[0468] A person of ordinary skill in the art may be aware that, in combination with units and algorithm steps in the examples described in the embodiments disclosed in this specification, the embodiments may be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraint conditions of the technical solutions. A person skilled in the art may use different methods to implement the described functions for each particular application, but it should not be considered that the implementation goes beyond the scope of this application.

[0469] It may be clearly understood by a person skilled in the art that, for the purpose of convenient and brief description, for a detailed working process of the foregoing system, apparatus, and unit, refer to a corresponding process in the foregoing method embodiments, and details are not described herein again.

[0470] In the several embodiments provided in this application, it should be understood that the disclosed system, apparatus, and method may be implemented in other manners. For example, the unit division is merely logical function division and may be other division in actual implementation. For example, a plurality of units or components may be combined or integrated into another system, or some features may be ignored or not performed. In addition, the displayed or discussed mutual couplings or direct couplings or communication connections may be implemented by using some interfaces. The indirect couplings or communication connections between the apparatuses or units may be implemented in electronic, mechanical, or other forms.

[0471] The units described as separate parts may or may not be physically separate, and parts

displayed as units may or may not be physical units, may be located in one position, or may be distributed on a plurality of network units. Some or all of the units may be selected based on actual requirements to achieve the objectives of the solutions in the embodiments.

[0472] In addition, functional units in the embodiments of this application may be integrated into one processing unit, or each of the units may exist alone physically, or two or more units are integrated into one unit.

[0473] When the functions are implemented in the form of a software functional unit and sold or used as an independent product, the functions may be stored in a computer-readable storage medium. Based on such an understanding, the technical solutions of this application essentially, or the part contributing to the prior art, or some of the technical solutions may be implemented in a form of a software product. The computer software product is stored in a storage medium, and includes several instructions for instructing a computer device (which may be a personal computer, a server, a network device, or the like) to perform all or some of the steps of the methods described in the embodiments of this application. The foregoing storage medium includes: any medium that can store program code, such as a USB flash drive, a removable hard disk, a read-only memory (ROM), a random access memory (RAM), a magnetic disk, or an optical disc.

[0474] The foregoing descriptions are merely specific implementations of this application, but are not intended to limit the protection scope of this application. Any variation or replacement readily figured out by a person skilled in the art within the technical scope disclosed in this application shall fall within the protection scope of this application. Therefore, the protection scope of this application shall be subject to the protection scope of the claims.

CLAIMS

What is claimed is:

1. A method of processing a change in a radio capability of a terminal apparatus, comprising:
5 initiating, by a terminal apparatus, a radio resource control connection establishment message based on that the terminal apparatus is in a suspend state and the radio capability of the terminal apparatus changes.
2. The method according to claim 1, wherein the initiating, by a terminal apparatus, a radio
10 resource control connection establishment message based on that the terminal apparatus is in a suspend state and a radio capability of the terminal apparatus changes comprises:
instructing, by a non-access stratum of the terminal apparatus, an access stratum to initiate the radio resource control connection establishment message.
- 15 3. The method according to claim 1 or 2, wherein the radio resource control connection establishment message comprises radio resource resume identification information.
4. The method according to claim 3, wherein the radio resource control connection establishment message further comprises indication information, wherein the indication
20 information is used to indicate that the radio capability of the terminal apparatus changes, or is used to request a current radio capability of the terminal apparatus from the access network apparatus.
5. A terminal apparatus, for processing in a radio capability of a terminal apparatus,
25 comprising:
a processing module, configured to initiate, by using a transceiver module, a radio resource control connection establishment message based on that the terminal apparatus is in a suspend state and the radio capability of the terminal apparatus changes.
- 30 6. The terminal apparatus according to claim 5, wherein the processing module is specifically

configured to:

instruct, by using a non-access stratum of the terminal apparatus, an access stratum to initiate the radio resource control connection establishment message.

5 7. The terminal apparatus according to claim 5 or 6, wherein the processing module is specifically configured to determine not to initiate a radio resource control connection resume procedure.

10 8. The terminal apparatus according to any one of claims 5 to 7, wherein the radio resource control connection establishment message comprises radio resource resume identification information.

15 9. The terminal apparatus according to claim 8, wherein the radio resource control connection establishment message further comprises indication information, wherein the indication information is used to indicate that the radio capability of the terminal apparatus changes, or is used to request a current radio capability of the terminal apparatus from the access network apparatus.

20 10. A terminal apparatus, comprising means for carrying out of the method according to any one of claims 1 to 4.