Method for Paging, and Access Network Device, Terminal Device and Core Network Device

Technical Field

Embodiments of the present application relate to the field of communication, and more specifically, to a method for paging, an access network device, a terminal device, and a core network device.

Background

Paging is a signaling process performed when a network searches for a terminal. A called party in the network has to respond to the paging to communicate normally. In a fifth generation (5G) system, when downlink data of the terminal arrives, paging can be initiated by a Radio Access Network (RAN) to the terminal. Therefore, there is an urgent need for a method to enable the RAN to initiate paging to the terminal in a suitable paging area.

Summary

In view of the above, embodiments of the present application provide a method for paging, an access network device, a terminal device and a core network device, which are beneficial to the access network device to configure a reasonable paging area.

In a first aspect, a method for paging is provided, including: obtaining, by a first access network device, a tracking area list of a terminal device; and determining, by the first access network device according to the tracking area list, a target paging area for the first access network device to initiate paging to the terminal device.

The access network device determines a suitable paging area for RAN paging by referring to a TA list of the terminal device, so that it is beneficial to reducing signaling overhead.

In a possible implementation, the method further includes: initiating, by the first access network device, paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent.

Optionally, RAN paging may be triggered by a change of a system message of a cell.

In a possible implementation, the initiating, by the first access network device, paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent, includes: initiating, by the first access network device, paging to the terminal device within the target paging area, when the terminal device is in a Radio Resource Control (RRC) inactive state and there exists downlink data which needs to be sent.

Optionally, paging of the terminal device in an RRC idle state may be initiated by a RAN.

In a possible implementation, the obtaining, by the first access network device, the tracking area list of the terminal device, includes: receiving, by the first access network device, the tracking area list sent by the terminal device and/or the core network device.

In a possible implementation, before the receiving, by the first access network device, the tracking area list sent by the terminal device and/or the core network device, the method further includes: sending, by the first access network device, a request for obtaining the tracking area list to the terminal device and/or the core network device.

In a possible implementation, the first access network device receives the tracking area list sent by the terminal device, including: the first access network device receives the tracking area list obtained by the terminal device, once the terminal device performs tracking area update or an attachment process.

In a possible implementation, the first access network device receives the tracking area list sent by the terminal device, including: receiving, by the first access network device, the tracking area list obtained by the terminal device through RRC signaling.

Optionally, the terminal device may also send the TA list of the terminal device to the access network device through MAC signaling, or DCI signaling, etc.

In a possible implementation, the obtaining, by the first access network device, the tracking area list of the terminal device, includes: receiving, by the first access network device, the tracking area list sent by a second access network device, when the access network device which provides a network service for the terminal device switches from the second access

network device to the first access network device.

In a possible implementation, the tracking area list is carried in context information of the terminal device.

In a possible implementation, the method further includes: sending, by the first access network device, information of the target paging area to the terminal device so that the terminal device triggers the first access network device to reconfigure a paging area for the terminal device when the terminal device determines to move out of the target paging area.

In a second aspect, a method for paging is provided, including: obtaining, by a terminal device, a tracking area list of the terminal device; and sending, by the terminal device, the tracking area list to a first access network device so that the first access network device determines a target paging area for the first access network device to initiate paging to the terminal device.

In a possible implementation, the obtaining, by a terminal device, a tracking area list of the terminal device, includes: obtaining, by the terminal device, the tracking area list during tracking area update or an attaching process.

In a possible implementation, before sending, by the terminal device, the tracking area list of the terminal device to the first access network device, the method further includes: receiving, by the terminal device, a request for obtaining the tracking area list sent by the first access network device.

In a possible implementation, the sending, by the terminal device, the tracking area list to the first access network device, includes: sending, by the terminal device, the tracking area list to the first access network device, once the terminal device obtains the tracking area list.

In a possible implementation, the sending, by the terminal device, the tracking area list to the first access network device, includes: sending, by the terminal device, the tracking area list to the first access network device through Radio Resource Control (RRC) signaling.

In a possible implementation, the method further includes: receiving, by the terminal device, a paging message sent by the first access network device, when the terminal device is in an RRC inactive state, wherein the paging message is used for indicating that there exists

downlink data of the terminal device which needs to be sent.

In a possible implementation, the method further includes: receiving, by the terminal device, information of the target paging area sent by the first access network device; and triggering, by the terminal device according to the information of the target paging area, the first access network device to reassign a paging area to the terminal device.

In a third aspect, a method for paging is provided, including: obtaining, by a core network device, a tracking area list of a terminal device; and sending, by the core network device, the tracking area list to a first access network device, so that the first access network device determines a target paging area for the first access network device to initiate paging to the terminal device.

In a possible implementation, before sending, by the core network device, the tracking area list to the first access network device, the method further includes: receiving, by the core network device, information for obtaining the tracking area list sent by the first access network device.

In a fourth aspect, an access network device is provided, which is configured to perform the method in the above first aspect or any possible implementation of the first aspect. Specifically, the access network device includes units configured to perform the method in the above first aspect or any possible implementation of the first aspect.

In a fifth aspect, a terminal device is provided, which is configured to perform the method in the above second aspect or any possible implementation of the second aspect. Specifically, the terminal device includes units for performing the method in the above second aspect or any possible implementation of the second aspect.

In a sixth aspect, a core network device is provided, which is configured to perform the method in the above third aspect or any possible implementation of the third aspect. Specifically, the core network device includes units configured to perform the method in the above third aspect or any possible implementation of the third aspect.

In a seventh aspect, an access network device is provided, including a memory, a processor, an input interface, and an output interface. The memory, the processor, the input interface and the output interface are connected through a bus system. The memory is

configured to store instructions, and the processor is configured to execute the instructions stored in the memory to perform the method in the first aspect or any possible implementation of the above first aspect.

In an eighth aspect, a terminal device is provided, including a memory, a processor, an input interface, and an output interface. The memory, the processor, the input interface and the output interface are connected through a bus system. The memory is configured to store instructions, and the processor is configured to execute the instructions stored in the memory to perform the method in the second aspect or any possible implementation of the above second aspect.

In a ninth aspect, a core network device is provided, including a memory, a processor, an input interface, and an output interface. The memory, the processor, the input interface and the output interface are connected through a bus system. The memory is configured to store instructions, and the processor is configured to execute the instructions stored in the memory to execute the method in the above third aspect or any possible implementation of the third aspect.

In a tenth aspect, a computer storage medium is provided, which is configured to store computer software instructions for executing the method in the above first aspect or any possible implementation of the first aspect, or the method in the above second aspect or any possible implementation of the second aspect, or the method in the above third aspect or any possible implementation of the third aspect, wherein the computer software instructions contain programs designed for executing each of the above aspects.

In an eleven aspect, a computer program product containing instructions is provided, wherein when the instructions are run on a computer, the computer is caused to perform the method in the above first aspect or any optional implementation of the first aspect, or the method in the above second aspect or any optional implementation of the second aspect, or the method in the above third aspect or any optional implementation of the third aspect.

These aspects and other aspects of the present application will be more simply understood in following description of the embodiments.

Brief Description of Drawings

FIG. 1 shows a schematic diagram of an application scenario according to an embodiment of the present application.

FIG. 2 shows a schematic block diagram of a method for paging according to an embodiment of the present application.

FIG. 3 shows a schematic block diagram of architecture of EPS bearer services.

FIG. 4 shows another schematic block diagram of a method for paging according to an embodiment of the present application.

FIG. 5 shows yet another schematic block diagram of a method for paging according to an embodiment of the present application.

FIG. 6 shows a schematic block diagram of an access network device according to an embodiment of the present application.

FIG. 7 shows a schematic block diagram of a terminal device according to an embodiment of the present application.

FIG. 8 shows a schematic block diagram of a core network device according to an embodiment of the present application.

FIG. 9 shows another schematic block diagram of an access network device according to an embodiment of the present application.

FIG. 10 shows another schematic block diagram of a terminal device according to an embodiment of the present application.

FIG. 11 shows another schematic block diagram of a core network device of an embodiment of the present application.

Detailed Description

Technical schemes in embodiments of the present application will be clearly and completely described below with reference to the drawings in the embodiments of the present application.

It should be understood that technical solutions of embodiments of the present application

may be applied to various communication systems, such as, a Global System of Mobile communication (GSM) system, a Code Division Multiple Access (CDMA) system, a Wideband Code Division Multiple Access (WCDMA) system, General Packet Radio Service (GPRS), an LTE system, an LTE Frequency Division Duplex (FDD) system, LTE Time Division Duplex (TDD), a Universal Mobile Telecommunication System (UMTS), a Worldwide Interoperability for Microwave Access (WiMAX) communication system, New Radio (NR) or a future 5G system, etc.

In particular, technical solutions of embodiments of the present invention may be applied to various communication systems based on non-orthogonal multiple access technologies, such as a Sparse Code Multiple Access (SCMA) system, and a Low Density Signature (LDS) system, etc. Of course, the SCMA system and the LDS system may also be referred to as other names in the field of communication. Further, technical solutions of embodiments of the present invention may be applied to multi-carrier transmission systems employing non-orthogonal multiple access technologies, such as an Orthogonal Frequency Division Multiplexing (OFDM) system based on the non-orthogonal multiple access technology, a Filter Bank Multi-Carrier (FBMC) system, a Generalized Frequency Division Multiplexing (GFDM) system, or a Filtered OFDM (F-OFDM) system, etc.

A terminal device in embodiments of the present application may refer to a User Equipment (UE), an access terminal, a subscriber unit, a subscriber station, a mobile station, a mobile platform, a remote station, a remote terminal, a mobile device, a user terminal, a terminal, a wireless communication device, a user agent or a user apparatus. An access terminal 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 with a wireless communication function, a computing device or another processing device connected to a wireless modem, an on-board device, a wearable device, a terminal device in a future 5G network, or a terminal device in a future evolved Public Land Mobile Network (PLMN), etc., which is not restricted in embodiments of the present invention.

An access network device in embodiments of the present application may be a device for communicating with a terminal device. The network device may be a Base Transceiver Station

(BTS) in GSM or CDMA, or a NodeB (NB) in a WCDMA system, or an Evolutional NodeB (eNB or eNodeB) in an LTE system, or a wireless controller in a scenario of a Cloud Radio Access Network (CRAN), or the network device may be a relay station, an access point, an on-board device, a wearable device, or a network device in the future 5G network or a network device in the future evolved PLMN network, etc., which is not restricted in embodiments of the present application.

The core network device in embodiment of the present application may be a Mobility Management Entity (MME), a Serving Gateway (S-GW), or a Packet Data Network Gateway (P-GW), etc., which is not restricted in embodiments of the present application.

FIG. 1 is a schematic diagram of an application scenario according to an embodiment of the present application. As shown in FIG. 1, a system architecture of LTE is divided into two parts, which includes MME/S-GW and eNodeB. The eNodeB and a UE are connected through a Uu interface to provide a protocol termination point to a control plane and a user plane of the UE. The eNodeBs are connected through an X2 interface, and there always exists an X2 interface between two different eNodeBs which need to communicate. An LTE access network and a core network are connected through an S1 interface, wherein the S1 interface supports a multiple-multiple contact mode.

Generally, a main purpose of paging is to establish a signaling connection from a UE to an Evolved Packet Core (EPC) so as to perform subsequent signaling or data transmission. In the 5G system, when downlink data of a terminal device arrives, the terminal device may be paged through a Core Network (CN) or a RAN.

FIG. 2 shows a schematic block diagram of a method 100 for paging according to an embodiment of the present application. As shown in FIG. 2, the method 100 includes part or all of the following contents.

S110, a first access network device obtains a tracking area list of a terminal device.

S120, the first access network device determines, according to the tracking area list, a target paging area for the first access network device to initiate paging to the terminal device.

The so-called Tracking Area (TA) is a concept set up for location management of terminals in a communication system. Multiple TAs form a TA list and are simultaneously

allocated to a terminal. When the terminal moves in the TAs of the TA list, TA update need not to be performed to reduce frequent interactions with a network. When a UE enters a new TA which is not in the TA List registered by the UE, TA update needs to be performed. The core network reassigns a TA list to the terminal. The newly assigned TA list may also contain some TAs in the original TA list. When the terminal is in an idle state, the core network can know the tracking area in which the terminal is located, and meanwhile, when the terminal in the idle state needs to be paged, the core network must perform paging in all cells of the tracking area registered by the terminal, that is, all cells in the TA list of the terminal.

For RAN paging, the access network device should first determine a paging area for the terminal device. When the terminal device moves within the paging area, the terminal device may directly perform cell reselection within the paging area without notifying the network side. When the terminal device moves out of the paging area, the terminal device needs to trigger the access network device to reconfigure a new paging area for the terminal device. Specifically, the access network device may refer to the TA list of the terminal device, that is, the access network device may select a suitable paging area for the terminal device within a control area scope of the core network.

Therefore, in the method for paging according to the embodiment of the present application, the access network device may determine a suitable paging area for RAN paging by referring to the TA list of the terminal device, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, the method further includes: the first access network device initiates paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent.

Those skilled in the art will understand that paging may be triggered by data, or a change of a system message of a cell, etc. However, the paging usually mentioned by us mainly refers to paging triggered by the data. Specifically, when the access network device knows that there exists downlink data which is to be transmitted, the access network device may directly initiate paging to a corresponding terminal device within a determined target paging area. For example, when downlink data arrives at the access network device, the access network device may send a

paging message to the corresponding terminal device, wherein an identification of the terminal device may be carried in the paging message. For another example, when downlink data arrives at the core network device, the core network device temporarily does not send the downlink data to the access network device first, but may send indication information to the access network device to indicate that there exists downlink data of the terminal device which needs to be transmitted, and the access network device may send a paging message to the terminal device after receiving the indication information. The embodiment of the application does not limit conditions for triggering the access network device to initiate paging.

Optionally, in the embodiment of the present application, the first access network device initiates paging to the terminal device within the target paging area, when there exists the downlink data of the terminal device which needs to be sent, includes: the first access network device initiates paging to the terminal device within the target paging area, when the terminal device is in a Radio Resource Control (RRC) inactive state and there exists the downlink data which needs to be sent.

In order to facilitate the understanding of embodiments of the present application, first of all, some elements in architecture of Evolved Packet System (EPS) bearer services will be briefly described with reference to FIG. 3. As shown in FIG. 3, the network architecture mainly includes Evolved-Universal Mobile Telecommunication System Terrestrial Radio Access Network (E-UTRAN) and the Evolved Packet Core (EPC). In the EPS bearer service architecture system, an end-to-end service may be divided into two parts: an EPS bearer and an external bearer. Herein, an Evolved Radio Access Bearer (E-RAB) is used for transmitting a packet of an EPS bearer between a UE and the evolved EPC, wherein there is a one-to-one correspondence between the E-RAB and the EPS bearer. A radio bearer is used for transmitting a packet of an E-RAB bearer between the UE and an eNodeB, wherein there is a one-to-one correspondence between the radio bearer and E-RAB/EPS bearer. An S1 bearer is used for transmitting a packet of an E-RAB bearer between the eNodeB and an S-GW. An S5/S8 bearer is used for transmitting a packet of an EPS bearer between the S-GW and a P-GW.

In the LTE system, RRC states of the UE mainly include an RRC idle state and an RRC connected state. In the RRC idle state, there exists S5/S8 bearer, but there is no radio bearer or

S1 bearer, the core network side keeps a UE context, the eNodeB and the UE do not keep the context of each other, and the terminal keeps a unique identification (usually Temporary Mobile Subscriber Identity (TMSI)) within a Time Advance (TA). The UE in the RRC idle state cannot have behaviors such as data interchange with the network, a Discontinuous Reception (DRX) process configured by a Non-access stratum (NAS), system information broadcasting and paging, neighbor cell measurement, mobility of cell reselection, or reporting without any measurement report, or the like. In the RRC connected state, there exists an S5/S8 bearer, an S1 bearer and a radio bearer, the core network, the eNodeB and the UE all keep the corresponding context, and the eNodeB assigns an access stratum (AS) identification (usually Cell Radio Network Temporary Identifier (C-RNTI)). The UE in the RRC connected state may interchange data with the network and there may exist behaviors such as DRX configured by the AS, mobility of handover, or reporting channel measurement to the network side, or the like.

In the 5G system, a third state, i.e., an RRC inactive state, is introduced. In the RRC inactive State, there exists an S5/S8 bearer, an S1 bearer and partial radio bearer, the core network, the eNodeB and the UE all keep the corresponding context, and the eNodeB assigns an access stratum (AS) identification (usually a Resume identification (ID)). The UE in the RRC inactive state has the mobility of the cell reselection, no measurement report, may perform sending and receiving of small data, and there may exist the DRX configured by the AS.

In general, paging of the terminal device in the RRC idle state may be initiated by the CN, and the paging area is also configured by the CN; while paging of the terminal device in the RRC inactive state may be initiated by the RAN, and the paging area may be configured by the RAN. However, embodiments of the present application are not limited to this. For example, paging of the terminal device in the RRC idle state may also be initiated by the RAN.

Optionally, in the embodiment of the present application, the first access network device obtains the tracking area list of the terminal device, includes: the first access network device receives the tracking area list sent by the terminal device and/or the core network device.

As mentioned above, the terminal device itself may store the TA list of its own, and the core network device may also know the TA list of the terminal device, so the terminal device and/or the core network device may send the TA list of the terminal device to the access

network device. That is, the access network device may obtain the TA list of the terminal device from the terminal device and/or the core network device.

Optionally, the terminal device may send the TA List of the terminal device to the access network device through at least one of the following signaling: RRC signaling, Media Access Control (MAC) signaling and Download Control Information (DCI), etc.

Optionally, in the embodiment of the present application, before the first access network device receives the tracking area list sent by the terminal device and/or the core network device, the method further includes: the first access network device sends a request for obtaining the tracking area list to the terminal device and/or the core network device.

For example, the access network device may request the terminal device and/or the core network device to obtain the TA list of the terminal device, when the terminal device is in the RRC connected state. The access network device may also request the core network device to obtain the TA list of the terminal device, when the terminal device is in the RRC inactive state. For another example, the access network device may also request the terminal device and/or the core network device to obtain the TA list of the terminal device, only when paging the terminal device is needed. Embodiments of the present application do not restrict when the access network device specifically requests the terminal device and/or the core network device for the TA list of the terminal device.

Optionally, in the embodiment of the present application, the first access network device receives the tracking area list sent by the terminal device, includes: the first access network device receives the tracking area list obtained by the terminal device, once the terminal device performs tracking area update or an attachment process.

Generally, the terminal device obtains the TA list of the terminal device through the attachment process or the TA Update (TAU). The terminal device may actively send the TA list to the access network device, when obtaining the TA list of the terminal device. That is to say, the terminal device may be triggered by the attachment process or the TAU process to send the TA list to the access network device with no need of the access network device to ask the terminal device for the TA list.

Optionally, the terminal device may not actively send the TA list of the terminal device

when obtaining the TA list of the terminal device through the attachment process or the TAU process, but may only send the TA list obtained by the terminal device to the access network device after the access network device asks the terminal device for the TA list obtained by the terminal device.

Optionally, in the embodiment of the present application, the first access network device obtains the tracking area list of the terminal device, includes: the first access network device receives the tracking area list sent by a second access network device, when the access network device which provides a network service for the terminal device switches from the second access network device to the first access network device.

When the terminal device moves from a source cell to a target cell, the access network device of the source cell may send the TA list of the terminal device to an access network device of the target cell. The access network device of the target cell may also directly obtain the TA list of the terminal device from the terminal device or the core network device with no need of obtaining the TA list of the terminal device from the access network device of the source cell. Specifically, the access network device of the target cell may ask any of the terminal device, the access network device of the source cell and the core network device for the TA list of the terminal device.

Optionally, any of the terminal device, the access network device of the source cell and the core network device may send the TA list of the terminal device as a context of the terminal device to the access network device of the target cell.

Optionally, in the embodiment of the present application, the method further includes: the first access network device sends information of the target paging area to the terminal device so that the terminal device triggers the first access network device to reconfigure a paging area for the terminal device when the terminal device determines to move out of the target paging area.

As mentioned above, the terminal device may judge whether the terminal device is within a scope of the paging area according to information of the paging area configured by the access network device. If the terminal device is within the scope, the terminal device may directly perform cell handover without notifying the access network device. If the terminal device is not within the scope, the terminal device needs to notify the access network device so that the

access network device can reconfigure a new paging area for the terminal device.

FIG. 4 shows a schematic block diagram of a method 200 for paging according to an embodiment of the present application. As shown in FIG. 4, the method 200 includes part or all of the following contents.

S210, a terminal device obtains a tracking area list of the terminal device.

S220, the terminal device sends the tracking area list to a first access network device, so that the first access network device determines a target paging area for the first access network device to initiate paging to the terminal device.

Therefore, in the method for paging according to the embodiment of the present application, the terminal device enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, the terminal device obtains the tracking area list of the terminal device, includes: the terminal device obtains the tracking area list during tracking area update or an attaching process.

Optionally, in the embodiment of the present application, before the terminal device sends the tracking area list of the terminal device to the first access network device, the method further includes: the terminal device receives a request for obtaining the tracking area list sent by the first access network device.

Optionally, in the embodiment of the present application, the terminal device sends the tracking area list to the first access network device, includes: the terminal device sends the tracking area list to the first access network device, once the terminal device obtains the tracking area list.

Optionally, in the embodiment of the present application, the terminal device sends the tracking area list to the first access network device, includes: the terminal device sends the tracking area list to the first access network device through Radio Resource Control (RRC) signaling.

Optionally, in the embodiment of the present application, the method further includes: the

terminal device receives a paging message sent by the first access network device, when the terminal device is in an RRC inactive state, wherein the paging message is used for indicating that there exists downlink data of the terminal device which needs to be sent.

Optionally, in the embodiment of the present application, the method further includes: the terminal device receives information of the target paging area sent by the first access network device; and the terminal device triggers, according to the information of the target paging area, the first access network device to reassign a paging area to the terminal device.

It should be understood that the interaction between the terminal device and the access network device and the related characteristics, functions, or the like described for the terminal device correspond to the related characteristics and functions of the access network device. That is to say, what information the terminal device sends to the access network device is what information the access network device receives accordingly. For sake of conciseness, the specific description will not be repeated here.

It should be understood that in various embodiments of the present invention, values of sequence numbers in the aforementioned processes do not indicate an order of execution, and the order of execution of various processes should be determined by their functions and internal logics, and should not constitute any limitation on implementation processes of embodiments of the present application.

FIG. 5 shows a schematic block diagram of a method 300 for paging according to an embodiment of the present application. As shown in FIG. 5, the method 300 includes part or all of the following contents.

S310, a core network device obtains a tracking area list of a terminal device; and

S320, the core network device sends the tracking area list to a first access network device, so that the first access network device determines a target paging area for the first access network device to initiate paging to the terminal device.

Therefore, in the method for paging according to the embodiment of the present application, the core network device enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, before the core network device sends the tracking area list to the first access network device, the method further includes: the core network device receives information for obtaining the tracking area list sent by the first access network device.

It should be understood that the interaction between the core network device and the access network device and the related characteristics, functions, or the like described for the core network device correspond to the related characteristics and functions of the access network device. In other words, what information the core network device sends to the access network device is what information the access network device receives accordingly. For sake of conciseness, the specific description will not be repeated here.

It should be understood that in various embodiments of the present invention, values of sequence numbers in the aforementioned processes do not indicate an order of execution, and the order of execution of various processes should be determined by their functions and internal logics, and should not constitute any limitation on implementation processes of embodiments of the present application.

The method for paging according to embodiments of the present invention has been described in detail above. An apparatus for paging according to embodiments of the present invention will be described below with reference to FIGs. 6 to 11. The technical features described in the method embodiments are applicable to the following apparatus embodiments.

FIG. 6 shows a schematic block diagram of an access network device 400 according to an embodiment of the present application. The access network device is a first access network device. As shown in FIG. 6, the access network device 400 includes: an obtaining unit 410, configured to obtain a tracking area list of a terminal device; and a determining unit 420, configured to determine, according to the tracking area list, a target paging area for the first access network device to initiate paging to the terminal device.

Therefore, the access network device according to the embodiment of the present application may refer to the TA list of the terminal device to determine a suitable paging area for RAN paging, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, the access network device

further includes: a paging unit, configured to initiate paging to the terminal device within the target paging area when there exists downlink data of the terminal device which needs to be sent.

Optionally, in the embodiment of the present application, the paging unit is specifically configured to initiate paging to the terminal device within the target paging area, when the terminal device is in a Radio Resource Control (RRC) inactive state and there exists the downlink data which needs to be sent.

Optionally, in the embodiment of the present application, the obtaining unit is specifically configured to receive the tracking area list sent by the terminal device and/or the core network device.

Optionally, in the embodiment of the present application, the access network device further includes: a first sending unit, configured to send a request for obtaining the tracking area list to the terminal device and/or the core network device.

Optionally, in the embodiment of the present application, the obtaining unit is specifically configured to receive the tracking area list obtained by the terminal device, once the terminal device performs tracking area update or an attachment process.

Optionally, in the embodiment of the present application, the obtaining unit is specifically configured to receive the tracking area list obtained by the terminal device through RRC signaling.

Optionally, in the embodiment of the present application, the obtaining unit is specifically configured to receive the tracking area list sent by a second access network device, when the access network device which provides a network service for the terminal device switches from the second access network device to the first access network device.

Optionally, in the embodiment of the present application, the tracking area list is carried in context information of the terminal device.

Optionally, in the embodiment of the present application, the access network device further includes: a second sending unit, configured to send information of the target paging area to the terminal device so that the terminal device triggers the first access network device to

reconfigure a paging area for the terminal device when the terminal device determines to move out of the target paging area.

It should be understood that the access network device 400 according to the embodiment of the present application may correspond to the first access network device in the method embodiments of the present application, and the above and other operations and/or functions of various units in the access network device 400 are respectively for realizing the corresponding processes of the first access network device in the method of FIG. 2, and will not be repeated here for the sake of brevity.

FIG. 7 shows a schematic block diagram of a terminal device 500 according to an embodiment of the present application. As shown in FIG. 7, the terminal device 500 includes: an obtaining unit 510, configured to obtain a tracking area list of the terminal device; and a sending unit 520, configured to send the tracking area list to a first access network device, so that the first access network device determines a target paging area for the first access network device to initiate paging to the terminal device.

Therefore, the terminal device according to the embodiment of the present application enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, the obtaining unit is specifically configured to obtain the tracking area list during tracking area update or an attaching process.

Optionally, in the embodiment of the present application, the terminal device further includes: a first receiving unit, configured to receive a request for obtaining the tracking area list sent by the first access network device.

Optionally, in the embodiment of the present application, the sending unit is specifically configured to send the tracking area list to the first access network device, once the terminal device obtains the tracking area list.

Optionally, in the embodiment of the present application, the sending unit is specifically configured to send the tracking area list to the first access network device through Radio Resource Control (RRC) signaling.

Optionally, in the embodiment of the present application, the terminal device further includes: a second receiving unit, configured to receive a paging message sent by the first access network device, when the terminal device is in an RRC inactive state, wherein the paging message is used for indicating that there exists downlink data of the terminal device which needs to be sent.

Optionally, in the embodiment of the present application, the terminal device further includes: a third receiving unit, configured to receive information of the target paging area sent by the first access network device; and a triggering unit, configured to trigger, according to the information of the target paging area, the first access network device to reconfigure a paging area to the terminal device.

It should be understood that the terminal device 500 according to the embodiment of the present application may correspond to the terminal device in the method embodiments of the present application, and the above and other operations and/or functions of various units in the terminal device 500 are respectively for realizing the corresponding processes of the terminal device in the method of FIG. 4, and will not be repeated here for the sake of brevity.

FIG. 8 shows a schematic block diagram of a core network device 600 according to an embodiment of the present application. As shown in FIG. 8, the core network device 600 includes: an obtaining unit 610, configured to obtain a tracking area list of a terminal device; and a sending unit 620, configured to send the tracking area list to a first access network device, so that the first access network device determines a target paging area in which the first access network device initiates paging to the terminal device.

Therefore, the core network device of the embodiment of the present application enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

Optionally, in the embodiment of the present application, the core network device further includes: a receiving unit, configured to receive information for obtaining the tracking area list sent by the first access network device.

It should be understood that the core network device 600 according to the embodiment of the present application may correspond to the core network device in the method embodiments

of the present application, and the above and other operations and/or functions of various units in the core network device 600 are respectively for realizing the corresponding processes of the core network device in the method of FIG. 5, and will not be repeated here for the sake of brevity.

As shown in FIG. 9, embodiments of the present application also provide an access network device 700, wherein the access network device 700 may be the access network device 400 in FIG. 6, which may be configured to perform the contents of the first access network device corresponding to the method 100 of FIG. 2. The access network device 700 includes: an input interface 710, an output interface 720, a processor 730, and a memory 740, wherein the input interface 710, the output interface 720, the processor 730, and the memory 740 may be connected through a bus system. The memory 740 is configured to store programs, instructions, or codes. The processor 730 is configured to execute the programs, the instructions, or the codes in the memory 740 to control the input interface 710 to receive signals, to control the output interface 720 to send signals, and to complete the operations in the aforementioned method embodiments.

Therefore, the access network device of the embodiment of the present application may refer to the TA list of the terminal device to determine a suitable paging area for RAN paging, so that it is beneficial to reducing signaling overhead.

It should be understood that in the embodiment of the present application, the processor 730 may be a Central Processing Unit (CPU), or the processor 730 may be another general purpose processor, a Digital Signal Processor (DSP), an Application Specific Integrated Circuit (ASIC), a Field Programmable Gate Array (FPGA), or another programmable logic device, discrete gate or transistor logic device, or discrete hardware component, or the like. The general purpose processor may be a microprocessor or the processor may be any conventional processor or the like.

The memory 740 may include a read only memory and a random access memory, and provide instructions and data to the processor 730. A portion of memory 740 may include non-volatile random access memory. For example, the memory 740 may also store type information of a device.

In implementation processes, various acts of the methods described above may be accomplished by integrated logic circuits of hardware or instructions in the form of software in the processor 730. The acts of the method disclosed in connection with the embodiments of the present application may be directly embodied to be accomplished by an execution of the hardware processor or by the combination of hardware and software modules in the processor. The software modules may be located in a storage medium commonly used in the art, such as a random access memory, flash memory, read-only memory, programmable read-only memory or electrically erasable programmable memory, or register. The storage medium is located in the memory 740, and the processor 730 reads the information in the memory 740, and accomplishes the contents of the above method in combination with its hardware. In order to avoid repetition, it will not be described in detail here.

In a specific embodiment, the paging unit, the first sending unit and of the access network device 400 may be implemented by the output interface 720 in FIG. 9, and the obtaining unit and the determining unit of the access network device 400 may be implemented by the processor 730 in FIG. 9.

As shown in FIG. 10, embodiments of the present application also provide a terminal device 800, wherein, the terminal device 800 may be the terminal device 500 in FIG. 7, which may be configured to perform the contents of the terminal device corresponding to the method 200 of FIG. 4. The terminal device 800 includes an input interface 810, an output interface 820, a processor 830, and a memory 840. The input interface 810, the output interface 820, the processor 830, and the memory 840 may be connected through a bus system. The memory 840 is configured to store programs, instructions, or codes. The processor 830 is configured to execute the programs, the instructions, or the codes in the memory 840 to control the input interface 810 to receive signals, to control the output interface 820 to send signals, and to complete the operations in the aforementioned method embodiments.

Therefore, the terminal device of the embodiment of the present application enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

It should be understood that in the embodiment of the present application, the processor

830 may be a Central Processing Unit (CPU), or the processor 830 may be another general purpose processor, a Digital Signal Processor (DSP), an Application Specific Integrated Circuit (ASIC), a Field Programmable Gate Array (FPGA), or another programmable logic device, discrete gate or transistor logic device, or discrete hardware component, or the like. The general purpose processor may be a microprocessor or the processor may be any conventional processor or the like.

The memory 840 may include a read only memory and a random access memory, and provide instructions and data to the processor 830. A portion of memory 840 may include non-volatile random access memory. For example, the memory 840 may also store type information of a device.

In implementation processes, various acts of the methods described above may be accomplished by integrated logic circuits of hardware or instructions in the form of software in the processor 830. The acts of the method disclosed in connection with the embodiments of the present application may be directly embodied to be accomplished by an execution of the hardware processor or by the combination of hardware and software modules in the processor. The software modules may be located in a storage medium commonly used in the art, such as a random access memory, flash memory, read-only memory, programmable read-only memory or electrically erasable programmable memory, or register. The storage medium is located in the memory 840, and the processor 830 reads the information in the memory 840, and accomplishes the contents of the above method in combination with its hardware. In order to avoid repetition, it will not be described in detail here.

In a specific embodiment, the sending unit of the terminal device 500 may be implemented by the output interface 820 in FIG. 10, and the first receiving unit to the third receiving unit of the terminal device 500 may be implemented by the input interface 810 in FIG. 10. The obtaining unit and the triggering unit of the terminal device 500 may be implemented by the processor 830 in FIG. 10.

As shown in FIG. 11, embodiments of the present application also provide a core network device 900, wherein the core network device 900 may be the core network device 600 in FIG. 8, which may be configured to execute the contents of the core network device corresponding to

the method 300 in FIG. 5. The core network device 900 includes: an input interface 910, an output interface 920, a processor 930, and a memory 940, wherein the input interface 910, the output interface 920, the processor 930, and the memory 940 may be connected through a bus system. The memory 940 is configured to store programs, instructions, or codes. The processor 930 is configured to execute the programs, the instructions, or the codes in the memory 940 to control the input interface 910 to receive signals, to control the output interface 920 to send signals, and to complete the operations in the aforementioned method embodiments.

Therefore, the core network device of the embodiment of the present application enables the access network device to determine a suitable paging area for RAN paging by reporting the TA list, so that it is beneficial to reducing signaling overhead.

It should be understood that in the embodiment of the present application, the processor 930 may be a Central Processing Unit (CPU), or the processor 930 may be another general purpose processor, a Digital Signal Processor (DSP), an Application Specific Integrated Circuit (ASIC), a Field Programmable Gate Array (FPGA), or another programmable logic device, discrete gate or transistor logic device, or discrete hardware component, or the like. The general purpose processor may be a microprocessor or the processor may be any conventional processor or the like.

The memory 940 may include a read only memory and a random access memory, and provide instructions and data to the processor 930. A portion of memory 940 may include non-volatile random access memory. For example, the memory 940 may also store type information of a device.

In implementation processes, various acts of the methods described above may be accomplished by integrated logic circuits of hardware or instructions in the form of software in the processor 930. The acts of the method disclosed in connection with the embodiments of the present application may be directly embodied to be accomplished by an execution of the hardware processor or by the combination of hardware and software modules in the processor. The software modules may be located in a storage medium commonly used in the art, such as a random access memory, flash memory, read-only memory, programmable read-only memory or electrically erasable programmable memory, or register. The storage medium is located in the

memory 940, and the processor 930 reads the information in the memory 940, and accomplishes the contents of the above method in combination with its hardware. In order to avoid repetition, it will not be described in detail here.

In a specific embodiment, the sending unit in the core network device 600 may be implemented by the output interface 920 in FIG. 11, and the receiving unit in the core network device 600 may be implemented by the input interface 910 in FIG. 11. The obtaining unit in the core network device 600 may be implemented by the processor 930 in FIG. 11.

Those of ordinary skill in the art will recognize that the exemplary units and algorithm acts described in connection with the embodiments disclosed herein may be implemented in electronic hardware, or a combination of computer software and electronic hardware. Whether these functions are implemented in hardware or software depends on a specific application and design constraint of the technical solution. Skilled in the art may use different manners to realize the described functions for each particular application, but such realization should not be considered to be beyond the scope of the present application.

Those skilled in the art may clearly understand that for convenience and conciseness of description, the specific working process of the system, device and unit described above may refer to the corresponding process in the aforementioned embodiments of methods, and details are not described herein again.

In several embodiments provided by the present application, it should be understood that the disclosed system, apparatus and method may be implemented in other ways. For example, the apparatus embodiment described above is only illustrative, for example, the division of the unit is only a logical function division, and there may be other ways of division in actual implementation, for example, multiple units or components may be combined or integrated into another system, or some features may be ignored or not executed. On the other hand, the mutual coupling or direct coupling or communication connection shown or discussed may be indirect coupling or communication connection through some interfaces, devices or units, and may be in electrical, mechanical or other forms.

The unit described as a separate component may or may not be physically separated, and the component shown as a unit may or may not be a physical unit, i.e., may be located in one

place or may be distributed over multiple network units. Some or all of the units may be selected according to practical needs to achieve a purpose of the solution of the embodiments.

In addition, various functional units in various embodiments of the present application may be integrated in one processing unit, or various units may be physically present separately, or two or more units may be integrated in one unit.

The functions may be stored in a computer readable storage medium if implemented in a form of software functional units and sold or used as a separate product. Based on this understanding, the technical solution of the present application, in essence, or the part contributing to the prior art, or the part of the technical solution, may be embodied in the form of a software product stored in a storage medium, including several instructions for causing a computer device (which may be a personal computer, a server, or a network device, etc.) to perform all or part of the acts of the various embodiments of the present application. The aforementioned storage medium includes various media capable of storing program codes, such as a U disk, a mobile hard disk, a read-only memory (ROM), a random access memory (RAM), a magnetic disk, or an optical disk.

The aforementioned are merely exemplary embodiments of the present application, but the protection scope of the present application is not limited thereto. Any person skilled in the art may easily conceive variations or substitutions within the technical scope disclosed by the present application, which should be included within the protection scope of the present application. Therefore, the protection scope of the present application shall be the protection scope defined by the claims.

What is claimed is:

1. A method for paging, comprising:

obtaining, by a first access network device, a tracking area list of a terminal device; and

determining, by the first access network device according to the tracking area list, a target paging area for the first access network device to initiate paging to the terminal device.

2. The method according to claim 1, wherein the method further comprises:

initiating, by the first access network device, paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent.

3. The method according to claim 2, wherein the initiating, by the first access network device, paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent, comprises:

initiating, by the first access network device, paging to the terminal device within the target paging area, when the terminal device is in a Radio Resource Control (RRC) inactive state and there exists the downlink data which needs to be sent.

4. The method according to any one of claims 1 to 3, wherein the obtaining, by the first access network device, the tracking area list of the terminal device, comprises:

receiving, by the first access network device, the tracking area list sent by the terminal device and/or a core network device.

5. The method according to claim 4, wherein before receiving, by the first access network device, the tracking area list sent by the terminal device and/or the core network device, the method further comprises:

sending, by the first access network device, a request for obtaining the tracking area list to the terminal device and/or the core network device.

6. The method according to claim 4, wherein the receiving, by the first access network device, the tracking area list sent by the terminal device, comprises:

receiving, by the first access network device, the tracking area list obtained by the

terminal device, once the terminal device performs tracking area update or an attachment process.

7. The method according to any one of claims 4 to 6, wherein the receiving, by the first access network device, the tracking area list sent by the terminal device, comprises:

receiving, by the first access network device, the tracking area list obtained by the terminal device through RRC signaling.

8. The method according to any one of claims 1 to 3, wherein the obtaining, by the first access network device, the tracking area list of the terminal device, comprises:

receiving, by the first access network device, the tracking area list sent by a second access network device, when an access network device which provides a network service for the terminal device switches from the second access network device to the first access network device.

9. The method according to claim 8, wherein the tracking area list is carried in context information of the terminal device.

10. The method according to any one of claims 1 to 9, wherein the method further comprises:

sending, by the first access network device, information of the target paging area to the terminal device, to enable the terminal device to trigger the first access network device to reconfigure a paging area for the terminal device when the terminal device determines that the terminal device has moved out of the target paging area.

11. A method for paging, comprising:

obtaining, by a terminal device, a tracking area list of the terminal device; and

sending, by the terminal device, the tracking area list to a first access network device to enable the first access network device to determine a target paging area for the first access network device to initiate paging to the terminal device.

12. The method according to claim 11, wherein the obtaining, by the terminal device, the tracking area list of the terminal device, comprises:

obtaining, by the terminal device, the tracking area list during tracking area update or an

attaching process.

13. The method according to claim 11 or 12, wherein before sending, by the terminal device, the tracking area list of the terminal device to the first access network device, the method further comprises:

receiving, by the terminal device, a request for obtaining the tracking area list sent by the first access network device.

14. The method according to claim 11 or 12, wherein the sending, by the terminal device, the tracking area list to the first access network device, comprises:

sending, by the terminal device, the tracking area list to the first access network device, once the terminal device obtains the tracking area list.

15. The method according to any one of claims 11 to 14, wherein the sending, by the terminal device, the tracking area list to the first access network device, comprises:

sending, by the terminal device, the tracking area list to the first access network device through Radio Resource Control (RRC) signaling.

16. The method according to any one of claims 11 to 15, wherein the method further comprises:

receiving, by the terminal device, a paging message sent by the first access network device, when the terminal device is in an RRC inactive state, wherein the paging message is used for indicating that there exists downlink data of the terminal device which needs to be sent.

17. The method according to any one of claims 11 to 16, wherein the method further comprises:

receiving, by the terminal device, information of the target paging area sent by the first access network device; and

triggering, by the terminal device according to the information of the target paging area, the first access network device to reassign a paging area to the terminal device.

18. A method for paging, comprising:

obtaining, by a core network device, a tracking area list of a terminal device; and

sending, by the core network device, the tracking area list to a first access network device, to enable the first access network device to determine a target paging area for the first access network device to initiate paging to the terminal device.

19. The method according to claim 18, wherein before sending, by the core network device, the tracking area list to the first access network device, the method further comprises:

receiving, by the core network device, information for obtaining the tracking area list sent by the first access network device.

20. An access network device, the access network device being a first access network device and comprising:

an obtaining unit, configured to obtain a tracking area list of a terminal device; and

a determining unit, configured to determine, according to the tracking area list, a target paging area for the first access network device to initiate paging to the terminal device.

21. The access network device according to claim 20, wherein the access network device further comprises:

a paging unit, configured to initiate paging to the terminal device within the target paging area, when there exists downlink data of the terminal device which needs to be sent.

22. The access network device according to claim 21, wherein the paging unit is specifically configured to:

initiate paging to the terminal device within the target paging area, when the terminal device is in a Radio Resource Control (RRC) inactive state and there exists the downlink data which needs to be sent.

23. The access network device according to any one of claims 20 to 22, wherein the obtaining unit is specifically configured to:

receive the tracking area list sent by the terminal device and/or a core network device.

24. The access network device according to claim 23, wherein the access network device further comprises:

a first sending unit, configured to send a request for obtaining the tracking area list to the terminal device and/or the core network device.

25. The access network device according to claim 23, wherein the obtaining unit is specifically configured to:

receive the tracking area list obtained by the terminal device, once the terminal device performs tracking area update or an attachment process.

26. The access network device according to any one of claims 23 to 25, wherein the obtaining unit is specifically configured to:

receive the tracking area list obtained by the terminal device through RRC signaling.

27. The access network device according to any one of claims 20 to 22, wherein the obtaining unit is specifically configured to:

receive the tracking area list sent by a second access network device, when an access network device which provides a network service for the terminal device switches from the second access network device to the first access network device.

28. The access network device according to claim 27, wherein the tracking area list is carried in context information of the terminal device.

29. The access network device according to any one of claims 20 to 28, wherein the access network device further comprises:

a second sending unit, configured to send information of the target paging area to the terminal device to enable the terminal device to trigger the first access network device to reconfigure a paging area for the terminal device when the terminal device determines that the terminal device has moved out of the target paging area.

30. A terminal device, comprising:

an obtaining unit, configured to obtain a tracking area list of the terminal device; and

a sending unit, configured to send the tracking area list to a first access network device, to enable the first access network device to determine a target paging area for the first access network device to initiate paging to the terminal device.

31. The terminal device according to claim 30, wherein the obtaining unit is specifically configured to:

obtain the tracking area list during tracking area update or an attaching process.

32. The terminal device according to claim 30 or 31, wherein the terminal device further comprises:

a first receiving unit, configured to receive a request for obtaining the tracking area list sent by the first access network device.

33. The terminal device according to claim 30 or 31, wherein the sending unit is specifically configured to:

send the tracking area list to the first access network device, once the terminal device obtains the tracking area list.

34. The terminal device according to any one of claims 30 to 33, wherein the sending unit is specifically configured to:

send the tracking area list to the first access network device through Radio Resource Control (RRC) signaling.

35. The terminal device of any one of claims 30 to 34, wherein the terminal device further comprises:

a second receiving unit, configured to receive a paging message sent by the first access network device, when the terminal device is in an RRC inactive state, wherein the paging message is used for indicating that there exists downlink data of the terminal device which needs to be sent.

36. The terminal device of any one of claims 30 to 35, wherein the terminal device further comprises:

a third receiving unit, configured to receive information of the target paging area sent by the first access network device; and

a triggering unit, configured to trigger, according to the information of the target paging area, the first access network device to reassign a paging area to the terminal device.

37. A core network device, comprising:

an obtaining unit, configured to obtain a tracking area list of a terminal device; and

a sending unit, configured to send the tracking area list to a first access network device, to enable the first access network device to determine a target paging area for the first access network device to initiate paging to the terminal device.

38. The core network device according to claim 37, wherein the core network device further comprises:

a receiving unit, configured to receive information for obtaining the tracking area list sent by the first access network device.