(12) UK Patent Application (19) GB (11) 2515969 (13) A

(43) Date of Reproduction by UK Office 07.01.2015

(21) Application No: **1419878.2**

(22) Date of Filing: **23.11.2012**

Date Lodged: **07.11.2014**

(30) Priority Data:
(31) **201210104077** (32) **10.04.2012** (33) **CN**

(86) International Application Data:
PCT/CN2012/075124 Zh 23.11.2012

(87) International Publication Data:
WO2013/152592 Zh 17.10.2013

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(51) INT CL:
H04W 24/02 (2009.01)

(56) Documents Cited:
CN 102340470 A **CN 102186181 A**
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(58) Field of Search:
INT CL **H04B, H04L, H04W**
Other: **CPRSABS, VEN, CNKI**

(54) Title of the Invention: **LTE network device**
Abstract Title: **LTE network device**

(57) A rubber frame structure and a backlight module. The rubber frame structure includes four sub-rubber frames (11), limiting holes (15) arranged on the side surfaces (141) of a back plate (14) and a fixing element (12). At least one limiting element (13) is arranged on the inner side of each of the sub-rubber frames (11), and corresponding sub-rubber frames (11) are fixed on the side surfaces (141) of the back plate (14) through cooperation of the limiting holes (15) and corresponding limiting elements (13). The rubber frame structure and the backlight module are low in production cost, and assembly and disassembly efficiencies of the rubber frame structure are high.

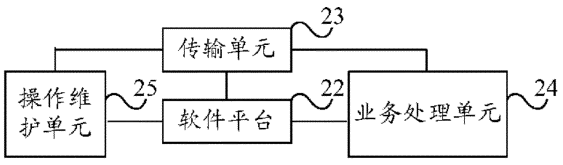

图 2a / **Fig.** 2a

22 SOFTWARE PLATFORM
23 TRANSMISSION UNIT
24 SERVICE PROCESSING UNIT
25 OPERATION MAINTENANCE UNIT

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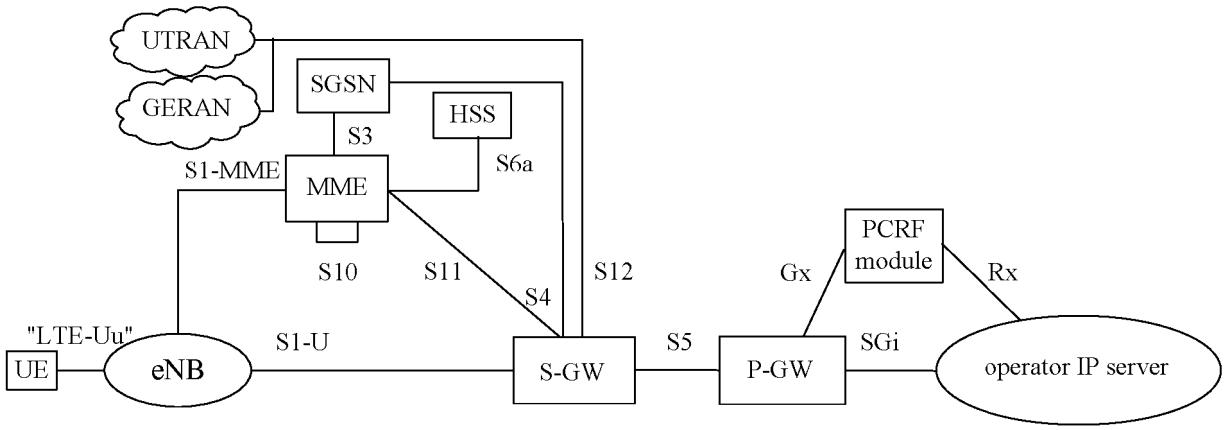

FIG. 1

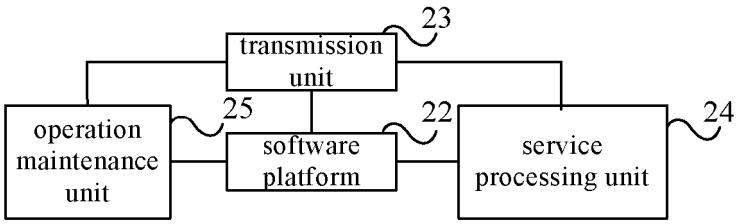

FIG. 2a

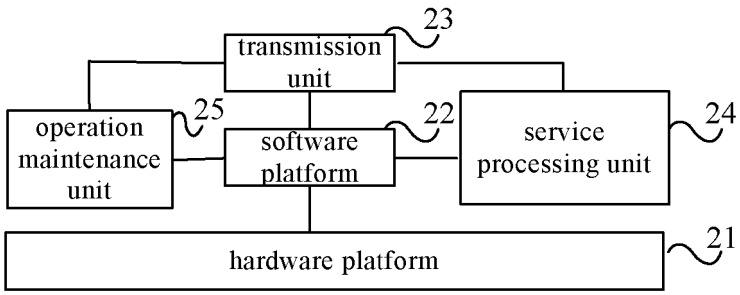

FIG. 2b

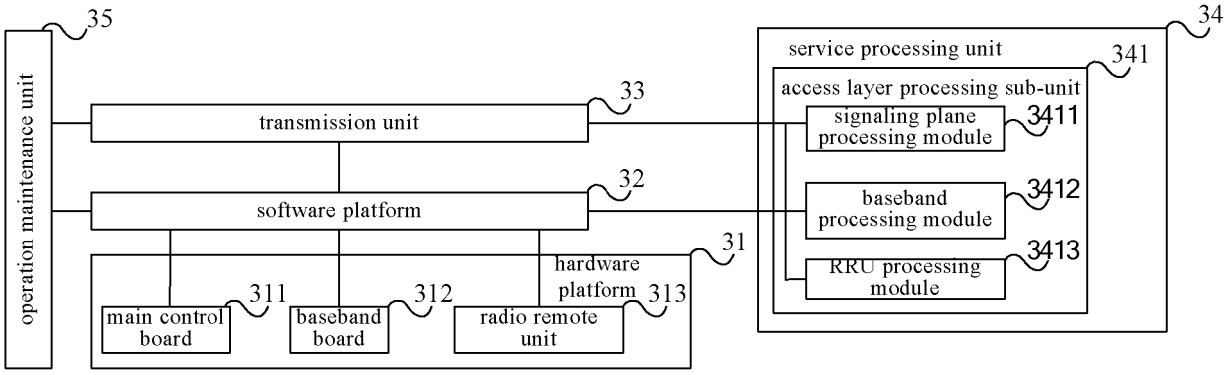

FIG. 3

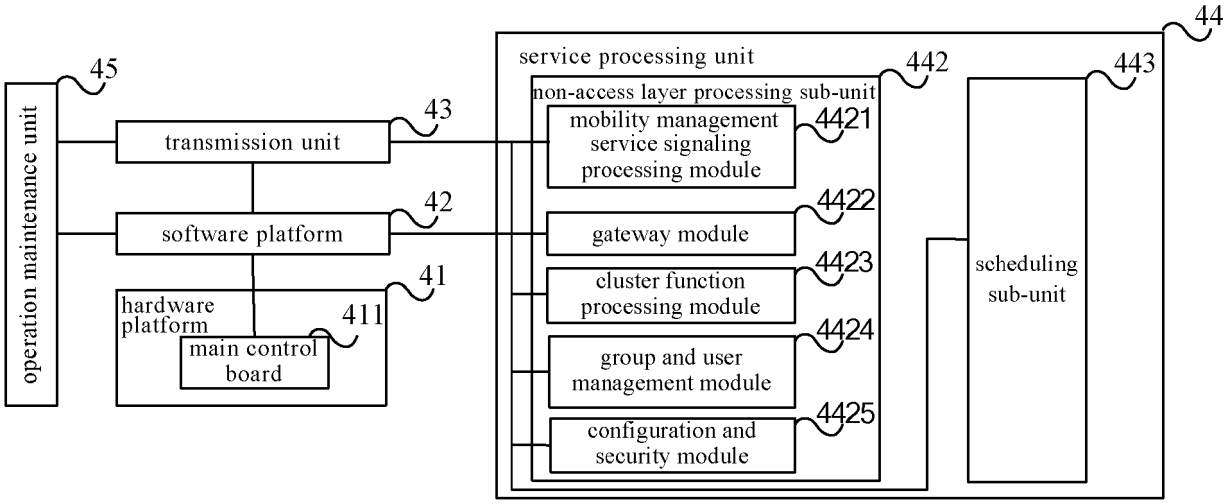

FIG. 4

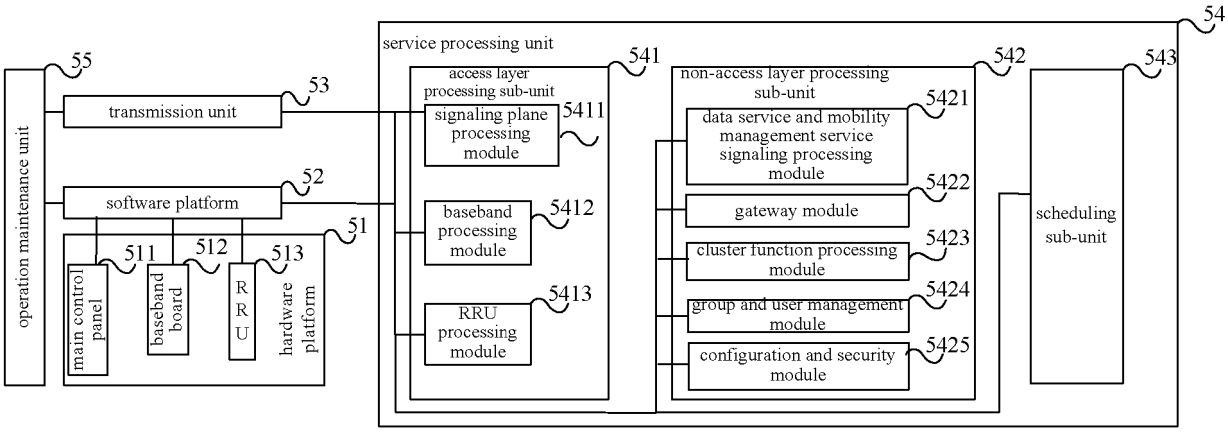

FIG. 5

LTE NETWORK DEVICE

TECHNICAL FIELD

The present invention relates to mobile communication technologies and, in particular, to a long term evolution (Long Term Evolution, LTE for short) network device.

BACKGROUND

In the third generation partnership project (3rd Generation Partnership Project, 3GPP for short) fourth generation mobile communication technology (4th Generation, 4G for short) LTE system, a network side includes a plurality of network element devices. FIG. 1 is a schematic diagram of a network architecture of an existing LTE system. As shown in FIG. 1, the network side of the existing LTE system includes an access layer network element devices and non-access layer network element devices. With reference to FIG. 1, the access layer network element devices mainly includes: an evolved base station (E-UTRAN Node B, eNB for short), which is used to implement the processing of signaling planes and user planes of a physical layer (i.e. layer 1, L1 for short), a media access control (Media Access Control, MAC for short) layer (i.e. layer 2, L2 for short) and layer 3 (L3 for short) of the LTE wireless side; the non-access layer network element devices include: a mobility management entity (Mobility Management Entity, MME for short), a signaling gateway (Signaling Gateway, S-GW for short), a packet data network gateway (Packet Data Network Gateway, P-GW for short) and a home subscriber server (Home Subscriber Server, HSS for short), the non-access layer network element device may also include other functional modules, such as a policy and charging rules function (Policy and Charging Rules Function, PCRF for short) module. The above devices are respectively connected to each other via a variety of interfaces, including: an LTE-Uu interface, an S1-U interface, an S1-MME interface, an S3 interface, an S4

interface, an S5 interface, an S6a interface, an S10 interface, an S11 interface, an S12 interface, an SGi interface, a Gx interface, an Rx interface, etc.

In the existing 3GPP LTE network architecture, a great number of network element devices are provided, which are connected in a complex relationship and are applicable to a large and medium scaled network application environment, such as the LTE system of an operator. Currently, small scaled network application environments grow increasingly, and there are a small number of users in a small scaled network application environment. For example, in a network such as hotspot area coverage or an enterprise network, there are dozens of eNBs and tens of thousands of users. In the small and medium scaled network application environment, the existing 3GPP LTE network architecture is used, since a great number of network element devices are provided, for example, a series of network element devices such as the MME, the HSS, the S-GW and the P-GW need to be deployed as non-access layer devices, as for the small and medium scaled network application environment, the cost of the solution is too high, all operations such as deployment, installation, startup and parameter configuration performed to the amount of network element devices are complicated, thereby resulting in a high network overall maintenance cost, moreover, there are many signaling exchanges between the amount of network element devices, thereby resulting in a severe time delay of service signalings.

SUMMARY

The present invention provides an LTE network device, which is used for solving the defects in the prior art and saving the cost of an LTE system.

The present invention provides a long term evolution (LTE) network device including:

a software platform, configured to provide a service processing unit with software support on a hardware platform, drive and configure the hardware platform and the service processing unit, and perform hardware adaptation on the service processing unit according to the hardware platform;

a transmission unit, configured to provide a transmission interface between the service processing unit of the LTE network device and other devices on the software platform; and

the service processing unit, configured to implement an access layer processing function and/or a non-access layer processing function on the software platform.

The device as described above, where,

the device also includes: an operation maintenance unit, configured to manage and maintain, on the software platform, an operation of the service processing unit according to control of a network management device;

the transmission unit is also configured to provide a transmission interface between the operation maintenance unit of the present device and the network management device on the software platform.

The device as described above, where,

the service processing unit includes: an access layer processing sub-unit; where the access layer processing sub-unit includes: a signaling plane processing module, configured to implement a signaling plane processing function on the software platform, where the signaling plane processing function includes: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function; a baseband processing module, configured to implement a baseband processing function on the software platform, where the baseband processing function includes: a physical layer signaling processing function during an access procedure and a medium access control MAC layer user plane protocol processing function; and a radio remote unit RRU processing module, configured to implement an RRU processing function on the software platform, where the RRU processing function includes: controlling an RRU of the hardware platform to transmit and receive a wireless signal;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module and the RRU processing module to perform communication therebetween by using a message mechanism..

The device as described above, where,

the service processing unit includes: a non-access layer processing sub-unit, where the non-access layer processing sub-unit includes: a data service and mobility management service signaling processing module, configured to implement a first signaling processing function on the software platform, and the first signaling processing function includes: a data

service signaling processing function and a public process signaling function; a gateway module, configured to implement a gateway function on the software platform, and the gateway function includes: link establishment and data exchange functions of a signaling plane and a user plane;

the software platform is also configured to enable the data service and mobility management service signaling processing module and the gateway module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the non-access layer processing sub-unit further also includes: a cluster function processing module, configured to implement a second signaling processing function on the software platform, and where the second signaling processing function includes: a cluster service signaling processing function; a group and user management module, configured to implement a group and user management function on the software platform, and where the group and user management function includes: management of attribute of a cluster service user and a data service user;

the software platform is also configured to enable the data service and mobility management service signaling processing module, the gateway module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

The device as described above, where, the service processing unit also includes: a scheduling sub-unit;

the scheduling sub-unit includes: an interactive interface module, a conversion interface module and a scheduling control module, where the interactive interface module is configured to acquire a scheduling command in an interactive interface manner, the conversion interface module is configured to perform a protocol format conversion to the scheduling command, and transmit the protocol format-converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module, the scheduling control module receives the protocol format-converted scheduling command , and performs a group scheduling to the cluster function processing module and the group and user management module according to

the scheduling command; the software platform is also configured to enable the interactive interface module, the conversion interface module, the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism;

or, the scheduling sub-unit includes: a scheduling control module, configured to receive a scheduling command from an externally connected scheduling station and perform a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command from the externally connected scheduling station; the software platform is also configured to enable the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the non-access layer processing sub-unit also includes: a configuration and security module, configured to implement a configuration and security function on the software platform, the configuration and security function includes: a parameter configuration and security control function;

the software platform is also configured to enable the data service and mobility management service signaling processing module, the gateway module, and the configuration and security module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the gateway module is also configured to implement a service policy management function on the software platform.

The device as described above, where,

the service processing unit includes: an access layer processing sub-unit and a non-access layer processing sub-unit; where the access layer processing sub-unit includes: a signaling plane processing module, a baseband processing module, and an RRU processing module; the signaling plane processing module is configured to implement a signaling plane processing function on the software platform, and the signaling plane processing function includes: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function, the baseband processing

module is configured to implement a baseband processing function on the software platform, and the baseband processing function includes: a physical layer signaling processing function during an access procedure and a medium access control MAC layer user plane protocol processing function; and the RRU processing module is configured to implement an RRU processing function on the software platform, and the RRU processing function includes: controlling an RRU of the hardware platform to transmit and receive a wireless signal; the non-access layer processing sub-unit includes: a data service and mobility management service signaling processing module and a gateway module; the data service and mobility management service signaling processing module is configured to implement a first signaling processing function on the software platform, and the first signaling processing function includes: a data service signaling processing function and a public process signaling function; the gateway module is configured to implement a gateway function on the software platform, and the gateway function includes: link establishment and data exchange functions of a signaling plane and a user plane;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, and the gateway module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the non-access layer processing sub-unit also includes: a cluster function processing module, configured to implement a second signaling processing function on the software platform, and where the second signaling processing function includes: a cluster service signaling processing function; a group and user management module, configured to implement a group and user management function on the software platform, and where the group and user management function includes: management of attribute of a cluster service user and a data service user;

the software platform is further configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, the gateway module, the cluster

function processing function, and the group and user management module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the service processing unit further includes: a scheduling sub-unit;

the scheduling sub-unit includes: an interactive interface module, a conversion interface module and a scheduling control module, where the interactive interface module is configured to acquire a scheduling command in an interactive interface manner, the conversion interface module is configured to perform a protocol format conversion to the scheduling command, and transmit the protocol format-converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module, the scheduling control module receives the protocol format-converted scheduling command, and performs a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command; the software platform is also configured to enable the interactive interface module, the conversion interface module, the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism;

or, the scheduling sub-unit includes: the scheduling control module, configured to receive a scheduling command from an externally connected scheduling station and perform a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command from the externally connected scheduling station; the software platform is also configured to enable the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the non-access layer processing sub-unit also includes: a configuration and security module, configured to implement a configuration and security function on the software platform, the configuration and security function includes: a parameter configuration and security control function;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, the gateway module, and the configuration and security module to perform communication therebetween by using a message mechanism.

The device as described above, where,

the gateway module is also configured to implement a service policy management function on the software platform.

It can be seen from contents described above, an LTE network device includes a software platform and a service processing unit provided on the software platform, the service processing unit can implement access layer processing functions of a plurality of access layer network devices and/or non-access layer processing functions of non-access layer network devices on the network side of the existing LTE system. Thus, access layer network devices and/or non-access layer network devices on the network side of the existing LTE system can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of the LTE system.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a schematic diagram of a network architecture of an existing LTE system;

FIG. 2a is a schematic structural diagram of an LTE network device according to Embodiment 1 of the present invention;

FIG. 2b is a schematic structural diagram of another LTE network device according to Embodiment 1 of the present invention;

FIG. 3 is a schematic structural diagram of an LTE network device according to Embodiment 2 of the present invention;

FIG. 4 is a schematic structural diagram of an LTE network device according to Embodiment 3 of the present invention;

FIG. 5 is a schematic structural diagram of an LTE network device according to Embodiment 4 of the present invention.

DESCRIPTION OF EMBODIMENTS

FIG. 2a is a schematic structural diagram of an LTE network device according to Embodiment 1 of the present invention. As shown in FIG. 2a, the device includes at least: a software platform 22, a transmission unit 23 and a service processing unit 24.

The software platform 22 is configured to provide the service processing unit 24 with software support on a hardware platform, drive and configure the hardware platform and the service processing unit 24, and perform hardware adaptation on the service processing unit 24 according to the hardware platform.

The transmission unit 23 is configured to provide a transmission interface between the service processing unit 24 of the LTE network device and other devices on the software platform 22.

The service processing unit 24 is configured to implement an access layer processing function and/or a non-access layer processing function on the software platform 22. The access layer processing function includes a function of an access layer network element device on the network side of the existing LTE system, and the non-access layer processing function includes a function of a non-access layer network element device on the network side of the existing LTE system. The service processing unit 24 is software provided on the software platform 22, the LTE network device according to Embodiment 1 of the present invention implements the access layer processing function and/or the non-access layer processing function by software method, that is, implementing functions of a plurality of access layer network elements and/or non-access layer network elements on the network side of the existing LTE system by software method. Specifically, the access layer processing function may include: a signaling processing function during an access procedure, an air-interface resource management function, a user plane configuration function, a physical layer signaling processing function during an access procedure and an MAC layer user plane protocol processing function , wireless signal transmitting and receiving functions, etc. The non-access layer processing function may include: a data service signaling processing function and a public process signaling function, link establishment and data exchange functions of a signaling plane and a user plane, etc.

Based on the technical solutions described above, in further, the LTE network device may also include: an operation maintenance unit 25. The operation maintenance unit 25 is configured to manage and maintain operations of the service processing unit 24 according to control of a network management device on the software platform 22. The transmission unit 23 is also configured to provide a transmission interface between the operation maintenance unit 25 of the present device and the network management device on the software platform 22. Specifically, the transmission unit 23 may provide a network management interface, perform an interaction with the network management device via the network management interface, and initiate daily management and maintenance operations to the LTE network device via the network management device, for example: operations such as user login security management and software management of the LTE network device.

FIG. 2b is a schematic structural diagram of another LTE network device according to Embodiment 1 of the present invention. With reference to FIG. 2b, the LTE network device as shown in FIG. 2b includes the software platform 22, the transmission unit 23 and the service processing unit 24 in the LTE network device as shown in FIG. 2a, in further, the LTE network device as shown in FIG. 2b also includes a hardware platform 21 bearing the software platform 22, the transmission unit 23 and the service processing unit 24 described above. The hardware platform 21 is configured to provide the service processing unit 24 with hardware support, and implement an access layer processing function and/or a non-access layer processing function under the control of the service processing unit 24. The software platform 22 is configured to provide the service processing unit 24 with software support on the hardware platform 21, drive and configure the hardware platform 21 and the service processing unit 24, and perform hardware adaptation on the service processing unit 24 according to the hardware platform 21. The software platform 22, the transmission unit 23 and the service processing unit 24 in the LTE network device as shown in FIG. 2b are the same as those of the LTE network device as shown in FIG. 2a described above, and will not be repeated herein.

In Embodiment 1 of the present invention, an LTE network device is provided, the network device includes a software platform and a service processing unit provided on the software platform, the service processing unit can implement access layer processing

functions of a plurality of access layer network devices and/or non-access layer processing functions of non-access layer network devices on the network side of the existing LTE system. Thus, access layer network devices and/or non-access layer network devices on the network side of the existing LTE system can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of the LTE system.

In addition, based on the descriptions above, the device may also include a hardware platform, the software platform is provided on the hardware platform, and the hardware platform provides the service processing unit with hardware support. Thus, access layer network devices and/or non-access layer network devices on the network side of the existing LTE system can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of the LTE system.

In the LTE network device according to embodiments of the present invention, the service processing unit may implement an access layer processing function merely, or implement a non-access layer processing function merely, or implement the access layer processing function and the non-access layer processing function simultaneously, the three specific implementations will be described hereunder in detail with reference to Embodiment 2 of the present invention, Embodiment 3 of the present invention and Embodiment 4 of the present invention, respectively.

FIG. 3 is a schematic structural diagram of an LTE network device according to Embodiment 2 of the present invention. In Embodiment 2 of the present invention, a service processing unit 34 implements an access layer processing function merely. As shown in FIG. 3, the LTE network device may be the first LTE network device as described in Embodiment 1 of the present invention, including: a software platform 32, a transmission unit 33 and the service processing unit 34. In further, the LTE network device may also be another LTE network device as described in Embodiment 1 of the present invention, which not only includes the software platform 32, the transmission unit 33 and the service processing unit 34, but also may include a hardware platform 31 bearing the software platform 32, the

transmission unit 33 and the service processing unit 34 described above. In Embodiment 2 of the present invention, an example is only taken where the hardware platform 31 is included.

The hardware platform 31 is configured to provide the service processing unit 34 with hardware support, and implement the access layer processing function under the control of the service processing unit 34. Specific implementations of the hardware platform 31 and the deployment of each functional unit therein may use different hardware selections, machine frames and single boards according to an actual application environment. In a preferred implementation, the hardware platform 31 includes: a main control board 311, a baseband board 312 and a radio remote unit (Radio Remote Unit, RRU for short) 313. The main control board 311 is configured to provide an access layer processing sub-unit 341 with hardware support for a signaling processing function during an access procedure, and may also provide hardware support for resource management, operation maintenance and data processing. The baseband board 312 is configured to provide the access layer sub-unit with the hardware support for a physical layer signaling processing function during an access procedure and an MAC layer user plane protocol processing function. The RRU 313 is configured to transmit and receive wireless signals under the control of an RRU processing module 3413 of the access layer sub-unit. The RRU 313 receives and transmits wireless signals as a wireless transceiver, in further, during a process of receiving and transmitting the wireless signals, the RRU 313 may also perform an intermediate frequency processing and/or a radio frequency processing to the wireless signals under the control of the RRU processing module 3413 of the access layer sub-unit.

The software platform 32 is configured to provide the service processing unit 34 with software support on the hardware platform 31. Specifically, the software platform 32 drives and configures the hardware platform 31 and the service processing unit 34, and performs hardware adaptation on the service processing unit 34 according to the hardware platform 31. Furthermore, the software platform 32 is also configured to enable respective modules inside the service processing unit 34 to perform communication therebetween by using a message mechanism, the software platform 32 provides a signaling channel for communication between the respective modules described above, specifically, the software platform 32 enables a signaling plane processing module 3411, a baseband processing module 3412 and

an RRU processing module 3413 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 32 creates a corresponding mailbox for the signaling plane processing module 3411, the baseband processing module 3412 and the RRU processing module 3413 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 32 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 32 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 34 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 32. In further, the software platform 32 may also be configured to implement functions such as memory management, configuring hardware such as the single board in the hardware platform 31, file downloading and tracking. In practical applications, the software platform 32 may be set according to actual resource conditions of each hardware device in the hardware platform 31.

The transmission unit 33 is configured to provide a transmission interface between the service processing unit 34 of the present device and other devices on the software platform 32. Specifically, in Embodiment 2 of the present invention, only the access layer processing sub-unit 341 is included in the service processing unit 34 of the LTE network device, the LTE network device may act as an eNB, the LTE network device is used to replace an eNB in the existing LTE network architecture, the device may interact with a UE on the terminal side, and may also interact with a device in an LTE core network on the network side, for example, devices such as an MME, an SGSN and an HSS. Then, the transmission unit 33 is specifically configured to provide a transmission interface between the service processing unit 34 of the present LTE network device and the UE and/or the LTE core network device. Specifically, the transmission unit 33 provides an S1 interface connecting the present LTE network device

and the LTE core network device, messages and data from the LTE core network received by the S1 interface are transferred to the service processing unit 34 of the present LTE network device. Furthermore, the transmission unit 33 is also configured to configure and manage the signaling channel, which is used for communication performed between respective modules inside the service processing unit 34 by using the message mechanism, in the software platform 32.

The service processing unit 34 is configured to implement an access layer processing function on the software platform 32. The access layer processing function includes functions of access layer network element devices on the network side of the existing LTE system. The service processing unit 34 is software provided on the software platform 32, the LTE network device according to Embodiment 2 of the present invention implements the access layer processing function by the software method, that is, implementing functions of a plurality of access layer network elements on the network side of the existing LTE system by the software method. Specifically, the service processing unit 34 includes: an access layer processing sub-unit 341. The access layer processing sub-unit 341 includes: a signaling plane processing module 3411, a baseband processing module 3412 and an RRU processing module 3413. The signaling plane processing module 3411 is configured to implement a signaling plane processing function on the software platform 32, where the signaling plane processing function may include: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function. The baseband processing module 3412 is configured to implement a baseband processing function on the software platform 32, where the baseband processing function may include: a physical layer signaling processing function during an access procedure and an MAC layer user plane protocol processing function, and specifically includes: a function of processing data including data on a packet data convergence protocol layer (Packet Data Convergence Protocol, PDCP for short), a radio link control layer (Radio Link Control, RLC for short), the MAC and/or the physical layer (PHY for short), a resource scheduling function and a configuration function. The RRU processing module 3413 is configured to implement an RRU processing function on the software platform 32, where the RRU processing function may include: controlling an RRU 313 of the hardware platform 31 to transmit and receive

wireless signals, which specifically includes: controlling the RRU 313 of the hardware platform 31 to perform the reception, the transmitting and the processing, and configuring the RRU 313 of the hardware platform 31.

In practical applications, varieties of software languages can be used to program software, so as to implement the service processing unit 34 in Embodiment 2 of the present invention, the present invention will not make a limitation to the software languages implementing the service processing unit 34, as long as the access layer processing function described above can be implemented, the software programmed by using any software language is applicable.

Based on the technical solutions described above, in further, the LTE network device may also include: an operation maintenance unit 35. The operation maintenance unit 35 is configured to manage and maintain operations of the service processing unit 34 according to control of a network management device on the software platform 32. The transmission unit 33 is also configured to provide a transmission interface between the operation maintenance unit 35 of the present device and the network management device on the software platform 32. Specifically, the transmission unit 33 may provide a network management interface, perform an interaction with the network management device via the network management interface, and initiate daily management and maintenance operations to the LTE network device via the network management device, for example: operations such as user login security management and software management of the LTE network device.

In Embodiment 2 of the present invention, in the LTE network device, the service processing unit can implement access layer processing functions of a plurality of access layer network devices on the network side of the existing LTE system, thus, the access layer network devices on the network side of the existing LTE system can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of the LTE system. In Embodiment 2 of the present invention, only an access layer processing sub-unit is integrated in the service processing unit, the LTE network device implements access layer processing functions merely, therefore, the LTE network device may act as an eNB, the LTE network device is used to replace an eNB in the existing LTE network

architecture, and interact with a UE on the terminal side and a device in an LTE core network on the network side.

In further, based on the descriptions above, the hardware platform of the LTE network device includes a hardware platform at the bottom layer, a software platform provided on the hardware platform and a service processing unit provided on the software platform, the hardware platform provides the service processing unit with hardware support, the service processing unit replaces the eNB in the existing LTE system by using software method, and implements the access layer processing function. Since the hardware platform of the LTE network device is composed of several single boards only, the LTE network device has a low manufacturing cost, and occupies little space.

FIG. 4 is a schematic structural diagram of an LTE network device according to Embodiment 3 of the present invention. In Embodiment 3 of the present invention, a service processing unit 44 implements a non-access layer processing function merely. As shown in FIG. 4, the LTE network device may be the first LTE network device as described in Embodiment 1 of the present invention, including: a software platform 42, a transmission unit 43 and a service processing unit 44. In further, the LTE network device may also be another LTE network device as described in Embodiment 1 of the present invention, which not only includes the software platform 42, the transmission unit 43 and the service processing unit 44, but also may include a hardware platform 41 bearing the software platform 42, the transmission unit 43 and the service processing unit 44 described above. In Embodiment 3 of the present invention, an example is only taken where the hardware platform 41 is included.

The hardware platform 41 is configured to provide the service processing unit 44 with hardware support, and implement a non-access layer processing function under the control of the service processing unit 44. Specific implementations of the hardware platform 41 and the deployment of each functional unit therein may use different hardware selections, machine frames and single boards according to an actual application environment. In a preferred implementation, the hardware platform 41 includes a main control board 411. The main control board 411 is configured to provide a non-access layer processing sub-unit 442 with hardware support for a data service signaling processing function and a public process signaling function.

The software platform 42 is configured to provide the service processing unit 44 with software support on the hardware platform 41. Specifically the software platform drives and configures the hardware platform 41 and the service processing unit 44, and performs hardware adaptation on the service processing unit 44 according to the hardware platform 41. In further, the software platform 42 is also configured to enable respective modules inside the service processing unit 44 to perform communication therebetween by using a message mechanism, the software platform 42 provides a signaling channel for communication between the respective modules described above, specifically, the software platform 42 enables a data service and mobility management service signaling processing module 4421 and a gateway module 4422 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 42 creates a corresponding mailbox for the data service and mobility management service signaling processing module 4421 and the gateway module 4422 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 42 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 42 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 44 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 42. In further, the software platform 42 may also be configured to implement functions such as memory management, configuring hardware such as the single board in the hardware platform 41, file downloading and tracking. In practical applications, the software platform 42 may be set according to actual resource conditions of each hardware device in the hardware platform 41.

The transmission unit 43 is configured to provide a transmission interface between the service processing unit 44 of the present device and other devices on the software platform 42.

Specifically, in Embodiment 3 of the present invention, only the non-access layer processing sub-unit 442 is included in the service processing unit 44 of the LTE network device, the LTE network device may act as an LTE core network, the LTE network device is used to replace an LTE core network in the existing LTE network architecture, the device may interact with an eNB on a network side. Then, the transmission unit 43 is specifically configured to provide a transmission interface between the service processing unit 44 of the present LTE network device and the eNB. Specifically, the transmission unit 43 provides an S1 interface connecting the present LTE network device and the eNB, messages and data from the eNB received by the S1 interface are transferred to the service processing unit 44 of the present LTE network device. Furthermore, the LTE network device is used to replace an LTE core network in the existing LTE network architecture, the device may also interact with other network devices such as an application server on the network side. Then, the transmission unit 43 is also specifically configured to provide a transmission interface between the service processing unit 44 of the present LTE network device and other network devices. Specifically, the transmission unit 43 provides an internet protocol (Internet Protocol, IP for short) interface connecting the present LTE network device and other network devices, messages and data from other network devices received by the IP interface are transferred to the service processing unit 44 of the present LTE network device. In further, the transmission unit 43 is also configured to configure and manage the signaling channel, which is used for communication performed between respective modules inside the service processing unit 44 by using the message mechanism, in the software platform 42.

The service processing unit 44 is configured to implement a non-access layer processing function on the software platform 42. The non-access layer processing functions includes functions of non-access layer network element devices on the network side of the existing LTE system, for example, devices such as an MME, an HSS and an SGSN. The service processing unit 44 is software provided on the software platform 42, the LTE network device according to Embodiment 3 of the present invention implements the non-access layer processing function by the software method, that is, implementing functions of a plurality of non-access layer network elements on the network side of the existing LTE system by the software method. Specifically, the service processing unit 44 includes a non-access layer

processing sub-unit 442. The non-access layer processing sub-unit 442 includes: the data service and mobility management service signaling processing module 4421 and the gateway module 4422. Specifically, the data service and mobility management service signaling processing module 4421 is configured to implement a first signaling processing function on the software platform 42, and the first signaling processing function may include: a data service signaling processing function and a public process signaling function. Specifically, the data service may include: establishment, modification and deletion of the data service, UE attachment, tracking area update (Tracking Area Update, TAU for short), and mobility management, etc, the data service and mobility management service signaling processing module 4421 processes a signaling related to the data service described above and a signaling related to the public process. The gateway module 4422 is configured to implement a gateway function on the software platform 42, and the gateway function may include: link establishment and data exchange functions of a signaling plane and a user plane.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 442 may also include: a cluster function processing module 4423 and a group and user management module 4424. Specifically, the cluster function processing module 4423 is configured to implement a second signaling processing function on the software platform 42, the second signaling processing function may include: a cluster service signaling processing function. Specifically, the cluster service may include functions such as group establishment, speaking right application, speaking right grant and group shutdown, the cluster function processing module 4423 processes a signaling related to the cluster service described above. The group and user management module 4424 is configured to implement a group and user management function on the software platform 42, the group and user management function may include: management of attribute of a cluster service user and a data service user. Specifically, the management for the user may include: determining users in a newly-established group, adding a group user, deleting a group user, modifying a group user, opening a user, logging off a user, etc., the group and user management module 4424 processes a signaling related to the above management procedure. Correspondingly, the software platform 42 is configured to enable the data service and mobility management service signaling processing module 4421, the gateway module 4422, the cluster function

processing module 4423, and the group and user management module 4424 to perform communication therebetween by using a message mechanism, the software platform 42 provides a signaling channel for communication between respective modules described above. The software platform 42 creates a corresponding mailbox for the data service and mobility management service signaling processing module 4421, the gateway module 4422, the cluster function processing module 4423, and the group and user management module 4424 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 42 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 42 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 44 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 42.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 442 may also include a configuration and security module 4425. The configuration and security module 4425 is configured to implement a configuration and security function on the software platform 42, where the configuration and security function may include: a parameter configuration and security control function. For example, the configuration and security module 4425 may configure a service parameter, and may also implement an authentication, authorization and accounting (Authentication, Authorization and Accounting, AAA for short) function. Correspondingly, the software platform 42 is configured to enable the data service and mobility management service signaling processing module 4421, the gateway module 4422, and the configuration and security module 4425 to perform communication therebetween by using a message mechanism; in a case that the cluster function processing module 4423 and the group and user management module 4424 are included in the non-access layer processing sub-unit 442, the software platform 42 is

configured to enable the data service and mobility management service signaling processing module 4421, the gateway module 4422, the cluster function processing module 4423, the group and user management module 4424, and the configuration and security module 4425 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 42 creates a corresponding mailbox for the data service and mobility management service signaling processing module 4421, the gateway module 4422, the cluster function processing module 4423, the group and user management module 4424, and the configuration and security module 4425 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message respectively. The software platform 42 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 42 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 44 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 42.

Based on the technical solutions described above, in further, the gateway module 4422 is also configured to implement a service policy management function on the software platform 42. For example, the service policy management function may be a service-carried PCRF specifically.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 442 may also include: a scheduling sub-unit 443, which is configured to implement a cluster scheduling function. The software platform 42 is also configured to enable the respective modules inside the scheduling sub-unit 443, and the respective modules inside the scheduling sub-unit 443 and the respective modules of the non-access layer processing sub-unit 442 described above to perform communication therebetween by using a

message mechanism. Specifically, the scheduling sub-unit 443 may use the following two implementation manners.

In manner 1, the scheduling sub-unit 443 may include: an interactive interface module, a conversion interface module and a scheduling control module, where the interactive interface module is configured to implement a human-computer interaction in an interactive interface manner, and acquire a scheduling command issued by scheduling personnel. The conversion interface module is configured to perform a protocol format conversion to the scheduling command issued by the scheduling personnel, and transmit the converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module. The scheduling control module receives the protocol format-converted scheduling command, and performs a group scheduling to the cluster function processing module 4423 and the group and user management module 4424 according to the scheduling command, for example, the scheduling control module transmits group and/or user configuration information to the group and user management module 4424 according to the scheduling command, and the scheduling control module transmits a group establishment and/or shutdown command to the cluster function processing module 4423 according to the scheduling command. The software platform 42 is further configured to enable the conversion interface module, the scheduling control module, the cluster function processing module 4423, and the group and user management module 4424 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 42 creates a corresponding mailbox for the conversion interface module, the scheduling control module, the cluster function processing module 4423, and the group and user management module 4424 respectively, when a message needs to be transmitted between the modules described above, a message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 42 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 42 uses a message queue communication

mechanism, and implements message communication between the described modules by encapsulating adaptation layer software on an operating system. The hardware platform 41 is further configured to provide the service processing unit 44 with hardware support, specifically, provide the scheduling sub-unit 443 in the service processing unit 44 with hardware support, and implement a scheduling function under the control of the service processing unit 44.

In manner 2, the scheduling sub-unit 443 may include the scheduling control module only, and externally connect a scheduling station to the LTE network device, an interactive interface module and a conversion interface module are set in the scheduling station. Functions of the interactive interface module and the conversion interface module are the same as the functions of the interactive interface module and the conversion interface module described in manner 1. Furthermore, the externally connected scheduling station and the present LTE network device may interact by using a present protocol, for example, a common standard protocol or a proprietary protocol agreed by two parties, the conversion interface module, after converting the scheduling command issued by the scheduling personnel to a protocol format which can be recognized by the scheduling control module in the LTE network device of embodiments of the present invention, encapsulates the protocol format-converted scheduling command and transmits to the present LTE network device according to the preset protocol described above, in the present LTE network device, the protocol format-converted scheduling command is transmitted to the scheduling control module via the hardware platform 411 and the software platform 42 in sequence. The scheduling control module is configured to receive the scheduling command from the externally connected scheduling station and perform the group scheduling to the cluster function processing module 5423 and the group and user management module 5424 according to the scheduling command from the externally connected scheduling station. By using manner 2, the scheduling personnel issues the scheduling command via the externally connected scheduling station, the conversion interface module in the externally connected scheduling station performs the protocol format conversion to the scheduling command issued by the scheduling personnel, converts the scheduling command to a protocol format that can be recognized by the scheduling control module in the LTE network device of embodiments

of the present invention, and then transmits to the LTE network device, the scheduling control module of the LTE network device receives the protocol format-converted scheduling command which is transferred via the hardware platform 411 and the software platform 42, and performs the group scheduling according to the scheduling command, for example, the scheduling control module transmits group and/or user configuration information to the group and user management module 4424 according to the scheduling command, and the scheduling control module transmits a group establishment and/or shutdown command to the cluster function processing module 4423 according to the scheduling command. The software platform 42 is also configured to transfer the protocol format-converted scheduling command from the externally connected scheduling station to the scheduling control module, in addition, the software platform 42 is also configured to enable the scheduling control module, the cluster function processing module 4423, and the group and user management module 4424 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 42 creates a corresponding mailbox for the scheduling control module, the cluster function processing module 4423, and the group and user management module 4424 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 42 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 42 uses a message queue communication mechanism, and implements message communication between the described modules by encapsulating adaptation layer software on an operating system. The hardware platform 41 is also configured to provide the service processing unit 44 with hardware support, specifically, provide the scheduling sub-unit 443 in the service processing unit 44 with hardware support, and implement a scheduling function under the control of the service processing unit 44.

In practical applications, varieties of software languages can be used to program software, so as to implement the service processing unit 44 in Embodiment 3 of the present

invention, the present invention will not make a limitation to the software languages implementing the service processing unit 44, as long as the access layer processing function described above can be implemented, the software programmed by using any software language is applicable.

In further, based on the technical solutions described above, the LTE network device also includes an operation maintenance unit 45. The operation maintenance unit 45 is configured to manage and maintain operations of the service processing unit 44 according to control of a network management device on the software platform 42. Correspondingly, the transmission unit 43 is also configured to provide a transmission interface between the operation maintenance unit 45 of the present device and the network management device on the software platform 42. Specifically, the transmission unit 43 may provide a network management interface, perform an interaction with the network management device via the network management interface, and initiate daily management and maintenance operations to the LTE network device via the network management device, for example: operations such as user login security management and software management of the LTE network device.

In Embodiment 3 of the present invention, the service processing unit can implement non-access layer processing functions of a plurality of non-access layer network devices on the network side of the existing LTE system. Thus, non-access layer network devices on the network side of the existing LTE system can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of an LTE system. In the LTE network device, only the non-access layer processing sub-unit is integrated in the service processing unit, the LTE network implements the non-access layer processing functions merely, therefore, the LTE network device may act as an integrated LTE core network, the LTE network device is used to replace the LTE core network in the existing LTE network architecture, and interact with an eNB on the network side.

In further, based on the descriptions above, the hardware platform of the LTE network device includes a hardware platform at the bottom layer, a software platform provided on the hardware platform and a service processing unit provided on the software platform, the hardware platform provides the service processing unit with hardware support, the service

processing unit replaces a plurality of non-access layer devices in the existing LTE core network by using software method, and implements the non-access layer processing function. Since the hardware platform of the LTE network device is composed of several single boards only, the LTE network device has a low manufacturing cost, and occupies little space. By using the LTE network device to replace a plurality of devices in the existing LTE core network, the network architecture cost of the LTE system is saved. In addition, a plurality of devices in the LTE core network are integrated into an LTE network device according to Embodiment 3 of the present invention, a manner that the devices in the original LTE core network perform an interaction therebetween via a hardware communication interface, is changed in the LTE network device to a manner that communication is implemented between composed modules inside a non-access layer processing sub-unit by using a message mechanism via a software platform, thereby avoiding an existing communication time delay resulting from frequent signaling interactions via a communication interface, and thus it is possible to reduce a service signaling time delay of the LTE system.

FIG. 5 is a schematic structural diagram of an LTE network device according to Embodiment 4 of the present invention. In Embodiment 4 of the present invention, a service processing unit 54 implements an access layer processing function and a non-access layer processing function simultaneously. As shown in FIG. 5, the LTE network device may be a first LTE network device as described in Embodiment 1 of the present invention, including: a software platform 52, a transmission unit 53 and the service processing unit 54. In further, the LTE network device may also be another LTE network device as described in Embodiment 1 of the present invention, which not only includes the software platform 52, the transmission unit 53 and the service processing unit 54, but also may include a hardware platform 51 bearing the software platform 52, the transmission unit 53 and the service processing unit 54 described above. In Embodiment 4 of the present invention, an example is only taken where the hardware platform 51 is included.

The hardware platform 51 is configured to provide the service processing unit 54 with hardware support, and implement the access layer processing function and the non-access layer processing function under the control of the service processing unit 54. Specific implementations of the hardware platform 51 and the deployment of each functional unit

therein may use different hardware selections, machine frames and single boards according to an actual application environment. In a preferred implementation, the hardware platform 51 includes: a main control board 511, a baseband board 512 and an RRU 513. The main control board 511 is configured to provide an access layer processing sub-unit 541 with hardware support for a signaling processing function during an access procedure, and also provide the non-access layer processing sub-unit 542 with hardware support for a data service signaling processing function and a public process signaling function, and may also provide hardware support for resource management, operation maintenance and data processing. The baseband board 512 is configured to provide the access layer sub-unit with the hardware support for a physical layer signaling processing function during an access procedure and an MAC layer user plane protocol processing function. The RRU 513 is configured to transmit and receive wireless signals under the control of an RRU processing module 5413 of the access layer sub-unit. The RRU 513 receives and transmits wireless signals as a wireless transceiver, in further, during a process of receiving and transmitting the wireless signals, the RRU 513 may also perform an intermediate frequency processing and/or a radio frequency processing to the wireless signals under the control of the RRU processing module 5413 of the access layer sub-unit.

The software platform 52 is configured to provide the service processing unit 54 with software support on the hardware platform 51. Specifically, the software platform 52 drives and configures the hardware platform 51 and the service processing unit 54, and performs hardware adaptation on the service processing unit 54 according to the hardware platform 51. Furthermore, the software platform 52 is also configured to enable respective modules inside the service processing unit 54 to perform communication therebetween by using a message mechanism, the software platform 52 provides a signaling channel for communication between the respective modules described above, specifically, the software platform 52 is configured to enable a signaling plane processing module 5411, a baseband processing module 5412, an RRU processing module 5413, a data service and mobility management service signaling processing module 5421, and a gateway module 5422 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software

platform 52 creates a corresponding mailbox for the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, and the gateway module 5422 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message respectively. The software platform 52 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 52 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 54 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 52. In further, the software platform 52 may also be configured to implement functions such as memory management, configuring hardware such as the single board in the hardware platform 51, file downloading and tracking. In practical applications, the software platform 52 may be set according to actual resource conditions of each hardware device in the hardware platform 51.

The transmission unit 53 is configured to provide a transmission interface between the service processing unit 54 of the present device and other devices on the software platform 52. Specifically, in Embodiment 4 of the present invention, not only the access layer processing sub-unit 541 but also the non-access layer processing sub-unit 542 are included in the service processing unit 54 of the LTE network device, the LTE network device may act as a base station integrated with an integrated eNB and an LTE core network, the LTE network device may operate as a single station, the LTE network device is used to replace an eNB and an LTE core network in the existing LTE network architecture, the device may interact with a UE on the terminal side. Then, the transmission unit 53 is specifically configured to provide a transmission interface between the service processing unit 54 of the present LTE network device and the UE. Furthermore, the LTE network device is used to replace an eNB and an LTE core network in the existing LTE network architecture, the device may also interact with

other network devices such as an application server on the network side. Then, the transmission unit 53 is also specifically configured to provide a transmission interface between the service processing unit 54 of the present LTE network device and other devices. Specifically, the transmission unit 53 provides an IP interface connecting the present LTE network device and other network devices, messages and data from other network devices received by the IP interface are transferred to the service processing unit 54 of the present LTE network device. Furthermore, the transmission unit 53 is also configured to configure and manage the signaling channel, which is used for communication performed between respective modules inside the service processing unit 54 by using the message mechanism, in the software platform 52.

The service processing unit 54 is configured to implement an access layer processing function and a non-access layer processing function on the software platform 52. The access layer processing function includes functions of access layer network element devices on the network side of the existing LTE system. The non-access layer processing function includes functions of non-access layer network element devices on the network side of the existing LTE system, for example, devices such as an MME, an HSS and an SGSN. The service processing unit 54 is software provided on the software platform 52, the LTE network device according to Embodiment 4 of the present invention implements the access layer processing function by the software method, that is, implementing functions of a plurality of access layer network elements on the network side of the existing LTE system by the software method. Specifically, the service processing unit 54 includes: an access layer processing sub-unit 541 and a non-access layer processing sub-unit 542. The access layer processing sub-unit 541 includes: a signaling plane processing module 5411, a baseband processing module 5412 and an RRU processing module 5413.

The signaling plane processing module 5411 is configured to implement a signaling plane processing function on the software platform 52, where the signaling plane processing function may include: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function. The baseband processing module 5412 is configured to implement a baseband processing function on the software platform 52, where the baseband processing function may include: a physical

layer signaling processing function during an access procedure and an MAC layer user plane protocol processing function, and specifically includes: a function of processing data including data on a PDCP, an RLC, the MAC and/or the physical layer, a resource scheduling function and a configuration function. The RRU processing module 5413 is configured to implement an RRU processing function on the software platform 52, where the RRU processing function may include: controlling an RRU 513 of the hardware platform 51 to transmit and receive wireless signals, which specifically includes: controlling the RRU 513 of the hardware platform 51 to perform the reception, the transmitting and the processing, and configuring the RRU 513 of the hardware platform 51. The non-access layer processing sub-unit 542 includes: the data service and mobility management service signaling processing module 5421 and the gateway module 5422. Specifically, the data service and mobility management service signaling processing module 5421 is configured to implement a first signaling processing function on the software platform 52, and the first signaling processing function may include: a data service signaling processing function and a public process signaling function. Specifically, the data service may include: establishment, modification and deletion of the data service, UE attachment, TAU, and mobility management, etc, the data service and mobility management service signaling processing module 5421 processes a signaling related to the data service described above and a signaling related to the public process. The gateway module 5422 is configured to implement a gateway function on the software platform 52, and the gateway function may include: link establishment and data exchange functions of a signaling plane and a user plane.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 542 may also include: a cluster function processing module 5423 and a group and user management module 5424. Specifically, the cluster function processing module 5423 is configured to implement a second signaling processing function on the software platform 52, the second signaling processing function may include: a cluster service signaling processing function. Specifically, the cluster service may include functions such as group establishment, speaking right application, speaking right grant and group shutdown, the cluster function processing module 5423 processes a signaling related to the cluster service described above. The group and user management module 5424 is configured to implement a

group and user management function on the software platform 52, the group and user management function may include: management of attribute of a cluster service user and a data service user. Specifically, the management for the user may include: determining users in a newly-established group, adding a group user, deleting a group user, modifying a group user, opening a user, logging off a user, etc., the group and user management module 5424 processes a signaling related to the above management procedure. Correspondingly, the software platform 52 is configured to enable the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, the gateway module 5422, the cluster function processing module 5423, and the group and user management module 5424 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 52 creates a corresponding mailbox for the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, the gateway module 5422, the cluster function processing module 5423, and the group and user management module 5424 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message respectively. The software platform 52 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 52 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 54 by encapsulating adaptation layer software on an operating system. A specific implementation of the message queue communication mechanism may be determined according to the operating system employed by the software platform 52.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 542 may also include a configuration and security module 5425. The configuration and security module 5425 is configured to implement a configuration and

security function on the software platform 52, where the configuration and security function may include: a parameter configuration and security control function. For example, the configuration and security module 5425 may configure a service parameter, and may also implement an AAA function. Correspondingly, the software platform 52 is configured to enable the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, the gateway module 5422, and the configuration and security module 5425 to perform communication therebetween by using a message mechanism; in a case that the cluster function processing module 5423 and the group and user management module 5424 are included in the non-access layer processing sub-unit 542, the software platform 52 is configured to enable the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, the gateway module 5422, the cluster function processing module 5423, the group and user management module 5424, and the configuration and security module 5425 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 52 creates a corresponding mailbox for the signaling plane processing module 5411, the baseband processing module 5412, the RRU processing module 5413, the data service and mobility management service signaling processing module 5421, the gateway module 5422, the cluster function processing module 5423, the group and user management module 5424, and the configuration and security module 5425 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message respectively. The software platform 52 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 52 uses a message queue communication mechanism, and implements message communication between respective modules of the service processing unit 54 by encapsulating adaptation layer software on an operating system. A specific implementation of

the message queue communication mechanism may be determined according to the operating system employed by the software platform 52.

Based on the technical solutions described above, in further, the gateway module 5422 is also configured to implement a service policy management function on the software platform 52. For example, the service policy management function may be a service-carried PCRF specifically.

Based on the technical solutions described above, in further, the non-access layer processing sub-unit 542 may also include: a scheduling sub-unit 543, which is configured to implement a cluster scheduling function. The software platform 52 is also configured to enable the respective modules inside the scheduling sub-unit 543, and the respective modules inside the scheduling sub-unit 543 and the respective modules of the non-access layer processing sub-unit 542 described above to perform communication therebetween by using a message mechanism. Specifically, the scheduling sub-unit 543 may use the following two implementation manners.

In manner 1, the scheduling sub-unit 543 may include: an interactive interface module, a conversion interface module and a scheduling control module, where the interactive interface module is configured to implement a human-computer interaction in an interactive interface manner, and acquire a scheduling command issued by scheduling personnel. The conversion interface module is configured to perform a protocol format conversion to the scheduling command issued by the scheduling personnel, and transmit the converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module. The scheduling control module receives the protocol format-converted scheduling command, and performs a group scheduling to the cluster function processing module 5423 and the group and user management module 5424 according to the scheduling command, for example, the scheduling control module transmits group and/or user configuration information to the group and user management module 5424 according to the scheduling command, and the scheduling control module transmits a group establishment and/or shutdown command to the cluster function processing module 5423 according to the scheduling command. The software platform 52 is further configured to enable the conversion interface module, the scheduling control module,

the cluster function processing module 5423, and the group and user management module 5424 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 52 creates a corresponding mailbox for the conversion interface module, the scheduling control module, the cluster function processing module 5423, and the group and user management module 5424 respectively, when a message needs to be transmitted between the modules described above, the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 52 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 52 uses a message queue communication mechanism, and implements message communication between the described modules by encapsulating adaptation layer software on an operating system. The hardware platform 51 is further configured to provide the service processing unit 54 with hardware support, specifically, provide the scheduling sub-unit 543 in the service processing unit 54 with hardware support, and implement a scheduling function under the control of the service processing unit 54.

In manner 2, the scheduling sub-unit 543 may include the scheduling control module only, and externally connect a scheduling station to the LTE network device, an interactive interface module and a conversion interface module are set in the scheduling station. Functions of the interactive interface module and the conversion interface module are the same as the functions of the interactive interface module and the conversion interface module described in manner 1. Furthermore, the externally connected scheduling station and the present LTE network device may interact by using a present protocol, for example, a common standard protocol or a proprietary protocol agreed by two parties, the conversion interface module, after converting the scheduling command issued by the scheduling personnel to a protocol format which can be recognized by the scheduling control module in the LTE network device of embodiments of the present invention, encapsulates the protocol format-converted scheduling command and transmits to the present LTE network device

according to the preset protocol described above, in the present LTE network device, the protocol format-converted scheduling command is transmitted to the scheduling control module via the hardware platform 511 and the software platform 52 in sequence. The scheduling control module is configured to receive the scheduling command from the externally connected scheduling station and perform the group scheduling to the cluster function processing module 5423 and the group and user management module 5424 according to the scheduling command from the externally connected scheduling station. By using manner 2, the scheduling personnel issues the scheduling command via the externally connected scheduling station, the conversion interface module in the externally connected scheduling station performs the protocol format conversion to the scheduling command issued by the scheduling personnel, converts the scheduling command to a protocol format that can be recognized by the scheduling control module in the LTE network device of embodiments of the present invention, and then transmits to the LTE network device, the scheduling control module of the LTE network device receives the protocol format-converted scheduling command which is transferred via the hardware platform 511 and the software platform 52, and performs the group scheduling to the cluster function processing module 5423 and the group and user management module 5424 according to the scheduling command, for example, the scheduling control module transmits group and/or user configuration information to the group and user management module 5424 according to the scheduling command, and the scheduling control module transmits a group establishment and/or shutdown command to the cluster function processing module 5423 according to the scheduling command. The software platform 52 is also configured to transfer the protocol format-converted scheduling command from the externally connected scheduling station to the scheduling control module, in addition, the software platform 52 is also configured to enable the scheduling control module, the cluster function processing module 5423, and the group and user management module 5424 to perform communication therebetween by using a message mechanism. A specific method for performing the communication by using the message mechanism is that: the software platform 52 creates a corresponding mailbox for the scheduling control module, the cluster function processing module 5423, and the group and user management module 5424 respectively, when a message needs to be transmitted between the modules described above,

the message that needs to be transmitted is identified with a destination mailbox and a source mailbox, so as to identify a module receiving the message and a module transmitting the message, respectively. The software platform 52 transmits the message from the module corresponding to the source mailbox to the module corresponding to the destination mailbox according to identifiers of the destination mailbox and the source mailbox. The software platform 52 uses a message queue communication mechanism, and implements message communication between the described modules by encapsulating adaptation layer software on an operating system. The hardware platform 51 is also configured to provide the service processing unit 54 with hardware support, specifically, provide the scheduling sub-unit 543 in the service processing unit 54 with hardware support, and implement a scheduling function under the control of the service processing unit 54.

In practical applications, varieties of software languages can be used to program software, so as to implement the service processing unit 54 in Embodiment 4 of the present invention, the present invention will not make a limitation to the software languages implementing the service processing unit 54, as long as the access layer processing function described above can be implemented, the software programmed by using any software language is applicable.

Based on the technical solutions described above, in further, the LTE network device may also include an operation maintenance unit 55. The operation maintenance unit 55 is configured to manage and maintain operations of the service processing unit 54 according to control of a network management device on the software platform 52. The transmission unit 53 is also configured to provide a transmission interface between the operation maintenance unit 55 of the present device and the network management device on the software platform 52. Specifically, the transmission unit 53 may provide a network management interface, perform an interaction with the network management device via the network management interface, and initiate daily management and maintenance operations to the LTE network device via the network management device, for example: operations such as user login security management and software management of the LTE network device.

In Embodiment 4 of the present invention, the service processing unit can implement access layer processing functions of a plurality of access layer network devices and

non-access layer processing functions of a plurality of non-access layer network devices on the network side of the existing LTE system. Thus, access layer network devices and non-access layer network devices of the existing LTE system network side can be replaced by using an LTE network deice, thereby reducing the number of devices in the LTE system network, simplifying the network side architecture of the LTE system, and saving the manufacturing cost of an LTE system. In the LTE network device, the access layer processing sub-unit and the non-access layer processing sub-unit are integrated in the service processing unit, the LTE network can implement the access layer processing functions and the non-access layer processing functions simultaneously, therefore, the LTE network device may act as an integration base station integrated with an eNB and an LTE core network, the LTE network device is used to replace the eNB and the LTE core network in the existing LTE network architecture, and interact with the UE device on the terminal side.

In further, based on the descriptions above, the hardware platform of the LTE network device includes a hardware platform at the bottom layer, a software platform provided on the hardware platform and a service processing unit provided on the software platform, the hardware platform provides the service processing unit with hardware support, the service processing unit replaces the eNB and the LTE core network in the existing LTE core network by using software method, and implements the access layer processing functions and the non-access layer processing functions. Since the hardware platform of the LTE network device is composed of several single boards only, the LTE network device has a low manufacturing cost, and occupies little space. By using the LTE network device to replace the existing eNB and a plurality of devices in the existing LTE core network, the network architecture cost of the LTE system is saved. In addition, the eNB and a plurality of devices in the LTE core network are integrated into an LTE network device according to Embodiment 4 of the present invention, a manner that the devices in the original eNB and the LTE core network perform an interaction therebetween via a hardware communication interface, is changed in the LTE network device to a manner that communication isimplemented between composed modules inside an access layer processing sub-unit and a non-access layer processing sub-unit by using a message mechanism via a software platform, thereby avoiding an existing communication time delay resulting from frequent signaling interactions via a

communication interface, and thus it is possible to reduce a service signaling time delay of the LTE system.

It can be seen from Embodiment 1 of the present invention to Embodiment 4 of the present invention that, in an LTE network device according to the present invention, based on a hardware platform and a software platform, an access layer processing sub-unit and a non-access layer processing sub-unit in a service processing unit may be deployed flexibly, that is, the two sub-units described above may be integrated in the LTE network device simultaneously, or, only one of the sub-units is integrated in the LTE network device, thereby making an LTE network device having different functions flexibly. If only the access layer processing sub-unit is deployed in the LTE network device without deploying the non-access layer processing sub-unit, then the LTE network device is an LTE base station device, which can replace the eNB in the existing LTE system, and interact with the LTE core network via an S1 interface. If the access layer processing sub-unit and the non-access layer processing sub-unit are deployed in the LTE network device simultaneously, then the LTE network device is an LTE single station device, which can support access layer functions and non-access layer functions in an LTE system simultaneously, the LTE network device may operate as a single station, and replace the eNB and the LTE core network in the existing LTE system, the LTE network device interacts with an external device in an IP method. If only the non-access layer processing sub-unit is deployed in the LTE network device without deploying the access layer processing sub-unit, then the LTE network device is an LTE non-access layer device, which can replace the LTE core network in the existing LTE system, the LTE network device interacts with a base station via an S1 interface, and interacts with other network element devices via IP, the LTE network device may be used as a small scaled core network device.

Furthermore, the LTE network device according to the present invention supports an access layer processing function and a non-access layer processing function of a data service, the LTE network device may support a PS data service. Processing on the network side is transparent for a UE, there is no need to modify an existing LTE Uu interface, and no need to modify the existing UE. The LTE network device can support a PS data service, thus there is no need to deploy an MME in the system separately. The LTE network device may also

support a cluster service, thus there is no need to deploy a cluster processing unit in the system separately. In addition, the LTE network device according to the present invention may also be integrated with a scheduling function, specifically, an interactive interface module, a conversion interface module and a scheduling control module may be integrated into the LTE network device, or, the interactive interface module and the conversion interface module are not integrated into the LTE network device, but only the scheduling control module is integrated into the LTE network device, a scheduling station is externally connected to the LTE network device, where the externally connected scheduling station includes the interactive interface module and the conversion interface module, thereby providing the scheduling of broadband cluster services. By using the LTE network device provided in the present invention, the number of separated network elements in the LTE system is decreased. After integrating the current network elements into an LTE network device, signaling interactions between the existing network elements are simplified to interactions which are performed inside the device by using a message channel in the LTE network device, thereby reducing time delays caused by the signaling interactions, and improving a time delay indicator which is considered as a key performance indicator of a cluster service. By using the LTE network device provided in the present invention, the network deployment is simple, the deployment of a plurality of network elements such as an eNB, an MME, an S-GW, a P-GW and an HSS in an existing network are simplified to use an LTE network device for replacement, and thus it is possible to reduce the network element deployment complexity and the network maintenance cost.

Persons of ordinary skill in the art may understand that, all or a part of the steps of the foregoing method embodiments may be implemented by a program instructing relevant hardware. The foregoing program may be stored in a computer readable storage medium. When the program runs, the steps of the foregoing method embodiments are performed. The foregoing storage medium includes various mediums capable of storing program codes, such as a ROM, a RAM, a magnetic disk, or an optical disc.

Finally, it should be noted that the foregoing embodiments are merely intended for describing the technical solutions of the present invention rather than limiting the present invention. Although the present invention is described in detail with reference to the foregoing

embodiments, persons of ordinary skill in the art should understand that they may still make modifications to the technical solutions described in the foregoing embodiments, or make equivalent replacements to some or all technical features thereof; however, these modifications or replacements do not make the essence of corresponding technical solutions depart from the scope of the technical solutions in the embodiments of the present invention.

CLAIMS

What is claimed is:

1. A long term evolution LTE network device, comprising:

a software platform, configured to provide a service processing unit with software support on a hardware platform, drive and configure the hardware platform and the service processing unit, and perform hardware adaptation on the service processing unit according to the hardware platform;

a transmission unit, configured to provide a transmission interface between the service processing unit of the LTE network device and other devices on the software platform; and

the service processing unit, configured to implement an access layer processing function and/or a non-access layer processing function on the software platform.

2. The device according to claim 1, wherein,

the device also comprises: an operation maintenance unit, configured to manage and maintain, on the software platform, an operation of the service processing unit according to control of a network management device;

the transmission unit is also configured to provide a transmission interface between the operation maintenance unit of the present device and the network management device on the software platform.

3. The device according to claim 1 or 2, wherein,

the service processing unit comprises: an access layer processing sub-unit; wherein the access layer processing sub-unit comprises: a signaling plane processing module, configured to implement a signaling plane processing function on the software platform, wherein the signaling plane processing function comprises: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function; a baseband processing module, configured to implement a baseband processing function on the software platform, wherein the baseband processing function comprises: a physical layer signaling processing function during an access procedure and a medium access control MAC layer user plane protocol processing function; and a radio

remote unit RRU processing module, configured to implement an RRU processing function on the software platform, wherein the RRU processing function comprises: controlling an RRU of the hardware platform to transmit and receive a wireless signal;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module and the RRU processing module to perform communication therebetween by using a message mechanism.

4. The device according to claim 1 or 2, wherein,

the service processing unit comprises: a non-access layer processing sub-unit, wherein the non-access layer processing sub-unit comprises: a data service and mobility management service signaling processing module, configured to implement a first signaling processing function on the software platform, and wherein the first signaling processing function comprises: a data service signaling processing function and a public process signaling function; a gateway module, configured to implement a gateway function on the software platform, and the gateway function comprises: link establishment and data exchange functions of a signaling plane and a user plane;

the software platform is also configured to enable the data service and mobility management service signaling processing module and the gateway module to perform communication therebetween by using a message mechanism.

5. The device according to claim 4, wherein,

the non-access layer processing sub-unit further also comprises: a cluster function processing module, configured to implement a second signaling processing function on the software platform, and wherein the second signaling processing function comprises: a cluster service signaling processing function; a group and user management module, configured to implement a group and user management function on the software platform, and wherein the group and user management function comprises: management of attribute of a cluster service user and a data service user;

the software platform is also configured to enable the data service and mobility management service signaling processing module, the gateway module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

6. The device according to claim 5, wherein, the service processing unit also comprises: a scheduling sub-unit;

the scheduling sub-unit comprises: an interactive interface module, a conversion interface module and a scheduling control module, wherein the interactive interface module is configured to acquire a scheduling command in an interactive interface manner, the conversion interface module is configured to perform a protocol format conversion to the scheduling command, and transmit the protocol format-converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module, the scheduling control module receives the protocol format-converted scheduling command , and performs a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command; the software platform is also configured to enable the interactive interface module, the conversion interface module, the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism;

or, the scheduling sub-unit comprises: a scheduling control module, configured to receive a scheduling command from an externally connected scheduling station and perform a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command from the externally connected scheduling station; the software platform is also configured to enable the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

7. The device according to claim 4, wherein,

the non-access layer processing sub-unit also comprises: a configuration and security module, configured to implement a configuration and security function on the software platform, the configuration and security function comprises: a parameter configuration and security control function;

the software platform is also configured to enable the data service and mobility management service signaling processing module, the gateway module, and the configuration and security module to perform communication therebetween by using a message mechanism.

8. The device according to claim 4, wherein,

the gateway module is also configured to implement a service policy management function on the software platform.

9. The device according to claim 1 or 2, wherein,

the service processing unit comprises: an access layer processing sub-unit and a non-access layer processing sub-unit; wherein the access layer processing sub-unit comprises: a signaling plane processing module, a baseband processing module, and an RRU processing module; the signaling plane processing module is configured to implement a signaling plane processing function on the software platform, and the signaling plane processing function comprises: a signaling processing function during an access procedure, an air-interface resource management function and a user plane configuration function, the baseband processing module is configured to implement a baseband processing function on the software platform, and the baseband processing function comprises: a physical layer signaling processing function during an access procedure and a medium access control MAC layer user plane protocol processing function; and the RRU processing module is configured to implement an RRU processing function on the software platform, and the RRU processing function comprises: controlling an RRU of the hardware platform to transmit and receive a wireless signal; the non-access layer processing sub-unit comprises: a data service and mobility management service signaling processing module and a gateway module; the data service and mobility management service signaling processing module is configured to implement a first signaling processing function on the software platform, and the first signaling processing function comprises: a data service signaling processing function and a public process signaling function; the gateway module is configured to implement a gateway function on the software platform, and the gateway function comprises: link establishment and data exchange functions of a signaling plane and a user plane;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, and the gateway module to perform communication therebetween by using a message mechanism.

10. The device according to claim 9, wherein,

the non-access layer processing sub-unit also comprises: a cluster function processing module, configured to implement a second signaling processing function on the software platform, and wherein the second signaling processing function comprises: a cluster service signaling processing function; a group and user management module, configured to implement a group and user management function on the software platform, and wherein the group and user management function comprises: management of attribute of a cluster service user and a data service user;

the software platform is further configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, the gateway module, the cluster function processing function, and the group and user management module to perform communication therebetween by using a message mechanism.

11. The device according to claim 10, wherein, the service processing unit further comprises: a scheduling sub-unit;

the scheduling sub-unit comprises: an interactive interface module, a conversion interface module and a scheduling control module, wherein the interactive interface module is configured to acquire a scheduling command in an interactive interface manner, the conversion interface module is configured to perform a protocol format conversion to the scheduling command, and transmit the protocol format-converted scheduling command to the scheduling control module after converting the scheduling command to a protocol format which can be recognized by the scheduling control module, the scheduling control module receives the protocol format-converted scheduling command, and performs a group scheduling to the cluster function processing module and the group and user management module according to the scheduling command; the software platform is also configured to enable the interactive interface module, the conversion interface module, the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism;

or, the scheduling sub-unit comprises: the scheduling control module, configured to receive a scheduling command from an externally connected scheduling station and perform a group scheduling to the cluster function processing module and the group and user

management module according to the scheduling command from the externally connected scheduling station; the software platform is also configured to enable the scheduling control module, the cluster function processing module, and the group and user management module to perform communication therebetween by using a message mechanism.

12. The device according to claim 9, wherein,

the non-access layer processing sub-unit also comprises: a configuration and security module, configured to implement a configuration and security function on the software platform, the configuration and security function comprises: a parameter configuration and security control function;

the software platform is also configured to enable the signaling plane processing module, the baseband processing module, the RRU processing module, the data service and mobility management service signaling processing module, the gateway module, and the configuration and security module to perform communication therebetween by using a message mechanism.

13. The device according to claim 9, wherein,

the gateway module is also configured to implement a service policy management function on the software platform.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/085124

A. CLASSIFICATION OF SUBJECT MATTER

H04W 16/18 (2009.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W; H04L; H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CPRSABS, VEN, CNKI: access, layer, baseband, transaction, process, software, platform, transmission, network, equipment, device, cloud

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 102186181 A (UNIV BEIJING POSTS & TELECOMM) 14 September 2011 (14.09.2011) description, page 2, paragraphs [0012]-[0014], page 4, paragraphs [0052]- [0054], figure 3	1, 2
A	US 2011235605 A1 (SAMSUNG ELECTRONICS CO LTD) 03 June 2010 (03.06.2010) the whole document	1-13
A	CN 102340470 A (ZTE CORP.) 01 February 2012 (01.02.2012) the whole document	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 February 2013 (02.02.2013)	07 March 2013 (07.03.2013)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer TANG, Mingming Telephone No. (86-10)62411353

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/085124

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102186181 A	14.09.2011	None	
US 2011235605 A1	03.06.2010	WO 2010062095 A3	19.08.2010
		WO 2010062095 A2	03.06.2010
		KR 20100060800 A	07.06.2010
CN 102340470 A	01.02.2012	WO 2012009899 A1	26.01.2012