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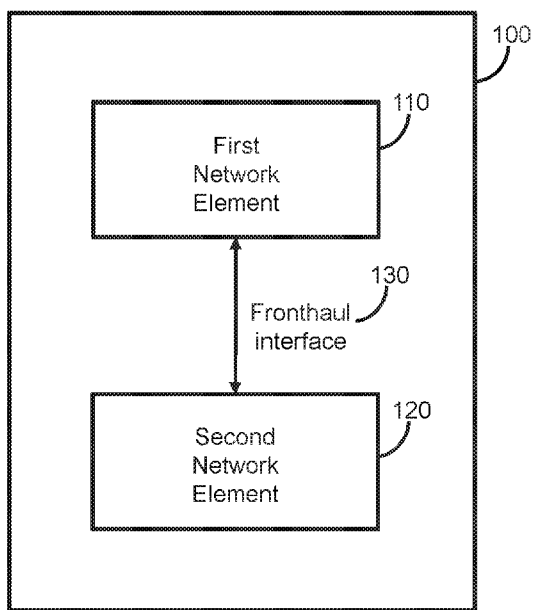


FIG. 1

(57) Abstract: The present disclosure relates to a method and system for managing and exchanging configuration information between two nodes in a wireless network. In one embodiment, a method implemented on a first node is disclosed. The method comprises: generating a first message that comprises first configuration information associated with the first node; and transmitting the first message to a second node for exchanging configuration information with the second node, wherein the first node and the second node cooperate to serve at least one cell in a wireless network as a base station.



**SYSTEM AND METHOD FOR EXCHANGING CONFIGURATION INFORMATION
BETWEEN TWO NODES IN A WIRELESS NETWORK**

TECHNICAL FIELD

[0001] The disclosure relates generally to wireless communications and, more particularly, to
5 systems and methods for managing and exchanging configuration information between two
nodes in a wireless network.

BACKGROUND

[0002] Due to mass connection and higher rate requirements from users in 5G mobile
communications, there is a big challenge to the transmission capacity of the fronthaul interface
10 CPRI (Common Public Radio Interface) between BBU (Baseband Unit) and RRU (Radio
Remote Unit) in LTE. Because CPRI interface transmits an I/Q (real/imaginary) signal that has
been processed by physical layer coding, CPRI interface has a tighter requirement on the
transmission delay and bandwidth. If the 5G air interface rate is increased to tens of Gbps, the
traffic demand of CPRI interface will rise to Tbps level, which will give a big pressure on the
15 cost and difficulty of network deployment. Therefore, in 5G, there is a need to redefine divisions
of the fronthaul interface, in consideration of transmission capacity, transmission delay, easiness
of deployment, and other aspects. For example, taking into account the non-ideal fronthaul
transmission, when dividing a base station (BS), one can put the delay-insensitive network
functions in a first network element, such as a Centralized Unit (CU), and put the delay-sensitive
20 network functions in a second network element, such as a Distributed Unit (DU). There is an
ideal and/or non-ideal fronthaul transmission between the first and second network elements.

[0003] Because CU and DU need a fronthaul interface to communicate with each other, there is a need to perform CU-DU interface establishment by exchanging and updating configuration information between CU and DU. In addition, because one CU manages one or more DUs, there is also a need to perform DU load information management.

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SUMMARY

[0004] The exemplary embodiments disclosed herein are directed to solving the issues relating to one or more of the problems presented in the prior art, as well as providing additional features that will become readily apparent by reference to the following detailed description when taken in conjunction with the accompany drawings. In accordance with various
10 embodiments, exemplary systems, methods, devices and computer program products are disclosed herein. It is understood, however, that these embodiments are presented by way of example and not limitation, and it will be apparent to those of ordinary skill in the art who read the present disclosure that various modifications to the disclosed embodiments can be made while remaining within the scope of the present disclosure.

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[0005] In one embodiment, a method implemented on a first node is disclosed. The method comprises: generating a first message that comprises first configuration information associated with the first node; and transmitting the first message to a second node for exchanging configuration information with the second node, wherein the first node and the second node cooperate to serve one or more cells in a wireless network as a base station.

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[0006] In a further embodiment, a method implemented on a first node is disclosed. The method comprises: receiving a first message from a second node for exchanging configuration information with the second node, wherein the first message comprises first configuration

information associated with the second node, and wherein the first node and the second node cooperate to serve one or more cells in a wireless network as a base station.

[0007] In another embodiment, a first node is disclosed. The first node comprises: a configuration generator configured to generate a first message that comprises first configuration information associated with the first node; and a transmitter configured to transmit the first message to a second node for exchanging configuration information with the second node, wherein the first node and the second node cooperate to serve one or more cells in a wireless network as a base station.

[0008] In yet another embodiment, a first node is disclosed. The first node comprises: a receiver configured to receive a first message from a second node for exchanging configuration information with the second node, wherein the first message comprises first configuration information associated with the second node, and wherein the first node and the second node cooperate to serve one or more cells in a wireless network as a base station.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Various exemplary embodiments of the present disclosure are described in detail below with reference to the following Figures. The drawings are provided for purposes of illustration only and merely depict exemplary embodiments of the present disclosure to facilitate the reader's understanding of the present disclosure. Therefore, the drawings should not be considered limiting of the breadth, scope, or applicability of the present disclosure. It should be noted that for clarity and ease of illustration these drawings are not necessarily drawn to scale.

[0010] FIG. 1 illustrates a fronthaul interface between a first network element and a second network element of a base station, in accordance with some embodiments of the present disclosure.

[0011] FIG. 2 illustrates exemplary functional divisions between the first network element and the second network element, in accordance with some embodiments of the present disclosure.

[0012] FIG. 3 illustrates an exemplary block diagram of a distributed unit (DU), in accordance with some embodiments of the present disclosure.

5 [0013] FIG. 4 illustrates exemplary configuration information of a DU, in accordance with some embodiments of the present disclosure.

[0014] FIG. 5 illustrates exemplary configuration information of a CU, in accordance with some embodiments of the present disclosure.

[0015] FIG. 6 illustrates exemplary resource status information reported by a DU, in
10 accordance with some embodiments of the present disclosure.

[0016] FIG. 7 illustrates an exemplary block diagram of a centralized unit (CU), in accordance with some embodiments of the present disclosure.

[0017] FIG. 8 illustrates an exemplary method for an interface setup between DU and CU, in accordance with some embodiments of the present disclosure.

15 [0018] FIG. 9 illustrates an exemplary method for updating DU configuration between CU and DU, in accordance with some embodiments of the present disclosure.

[0019] FIG. 10 illustrates an exemplary method for updating CU configuration between CU and DU, in accordance with some embodiments of the present disclosure.

[0020] FIG. 11 illustrates an exemplary method for reporting and monitoring DU resource
20 status, in accordance with some embodiments of the present disclosure.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0021] Various exemplary embodiments of the present disclosure are described below with reference to the accompanying figures to enable a person of ordinary skill in the art to make and use the present disclosure. As would be apparent to those of ordinary skill in the art, after
5 reading the present disclosure, various changes or modifications to the examples described herein can be made without departing from the scope of the present disclosure. Thus, the present disclosure is not limited to the exemplary embodiments and applications described and illustrated herein. Additionally, the specific order or hierarchy of steps in the methods disclosed herein are merely exemplary approaches. Based upon design preferences, the specific order or hierarchy of
10 steps of the disclosed methods or processes can be re-arranged while remaining within the scope of the present disclosure. Thus, those of ordinary skill in the art will understand that the methods and techniques disclosed herein present various steps or acts in a sample order, and the present disclosure is not limited to the specific order or hierarchy presented unless expressly stated otherwise.

15 [0022] The present teaching discloses a method to establish an interface between a first network element and a second network element, and update or maintain the interface configuration, to ensure that the interface is initially established and its configuration is updated under a CU-DU separation architecture. In addition, the present teaching discloses a method for reporting and monitoring resource status between the first network element and the second
20 network element, such that the CU can fully understand the resource usage of its connected DUs and make wise decisions, like a radio resource management (RRM) decision, based on the DU resource status.

[0023] In a 5G new radio (NR) network, a base station is separated into a first network element (a centralized network element CU) and a second network element (a distributed network element DU). FIG. 1 illustrates a fronthaul interface between a first network element and a second network element of a base station (BS) 100, in accordance with some embodiments of the present disclosure. As shown in FIG. 1, the BS 100 is divided into a first network element 110 and a second network element 120. The first network element 110 and the second network element 120 communicate through a fronthaul interface 130, where the fronthaul can be an ideal fronthaul or a non-ideal fronthaul according to different delays. An ideal fronthaul transmission has a relatively small delay, such as tens to hundreds of microseconds. A non-ideal fronthaul transmission has a relatively large delay, such as milliseconds. Due to the differences between the ideal and non-ideal fronthaul transmission, there are different ways to divide different network functions into the first network element 110 and the second network element 120.

[0024] In one embodiment, the first network element 110 is a CU and the second network element 120 is a DU, wherein the CU 110 and the DU 120 can cooperate to serve one or more cells as a base station. One CU may control a plurality of DUs at the same time, while a DU can be associated with one cell or a cell list that includes one or more cells. By controlling a number of DUs with a CU, a wireless system can have a baseband centralized processing and provide distributed remote services to users in a cloud architecture.

[0025] In a CU-DU separation network architecture, delay-insensitive network functions may be placed in the CU; and delay-sensitive network functions may be placed in the DU. Accordingly, a CU and a DU may have different hardware and structure for implementing the different network functions.

[0026] For example, a first protocol entity (e.g., a radio resource control (RRC) entity) is located at the CU. The first protocol entity generates control signals, maintains the establishment, modification, and/or release of the radio bearer, and maintains updated parameters of a second protocol entity, a third protocol entity, a fourth protocol entity, and the physical (PHY) layer of the base station. The second protocol entity has a similar or enhanced function compared to the PDCP (Packet Data Convergence Protocol) function of an LTE system. The third protocol entity has a similar or enhanced function compared to the RLC (Radio Link Control) function of an LTE system. The fourth protocol entity has a similar or enhanced function compared to the MAC (Medium Access Control) function of an LTE system. The DU comprises at least one of the second protocol entity, the third protocol entity, the fourth protocol entity, the physical layer, and the radio frequency (RF) unit of the base station.

[0027] FIG. 2 illustrates exemplary functional divisions between the first network element and the second network element, i.e. between the CU 110 and the DU 120, in accordance with some embodiments of the present disclosure. Specifically, FIG. 2 illustrates eight possible functional division options between the CU 110 and the DU 120.

[0028] Option 1 (RRC / PDCP separation): The functional separation of this option is similar to the 1A structure in a dual connection (DC). RRC is located within CU; PDCP, RLC, MAC, PHY and RF functions are located in DU. That is, the entire UP is located in DU.

[0029] Option 2 (PDCP / RLC separation): The functional separation of this option is similar to the 3C structure in a dual connection (DC). RRC and PDCP are located within CU; RLC, MAC, PHY and RF functions are located in DU.

[0030] Option 3 (RLC high-level / low-level separation): The low-level RLC (partial function of the RLC), MAC, PHY, and RF are located within DU; RRC, PDCP and high-level RLC (partial function of the RLC) functions are located in the CU.

[0031] Option 4 (RLC-MAC separation): MAC, PHY and RF parts are located within DU;
5 PDCP and RLC functions are located in the CU.

[0032] Option 5 (MAC internal separation): Some of the MAC functions (such as HARQ), PHY and RF are located in DU; the other upper level functions are located in the CU.

[0033] Option 6 (MAC-PHY): PHY and RF parts are located in DU; RRC, PDCP, RLC and MAC functions are located in the CU.

10 [0034] Option 7 (PHY internal separation): Some of the PHY functions and RF are located in DU; the other upper function is located in the CU.

[0035] Option 8 (PHY-RF separation): The RF part is located within the DU; and the other upper level functions are located in the CU.

[0036] In one embodiment, when a standard supports two or more options for dividing
15 network functions into CU and DU, the wireless system can adaptively switch between the supported options during wireless communications.

[0037] FIG. 3 illustrates an exemplary block diagram of a DU 120, in accordance with some embodiments of the present disclosure. The DU 120 is an example of a device that can be configured to implement the various methods described herein. As shown in FIG. 3, the DU 120
20 includes a housing 340 containing: a system clock 302, a processor 304, a memory 306, a transceiver 310 comprising a transmitter 312 and a receiver 314, a power module 308, a status reporter 320, and a configuration generator 322.

[0038] In this embodiment, the system clock 302 provides the timing signals to the processor 304 for controlling the timing of all operations of the DU 120. The processor 304 controls the general operation of the DU 120 and can include one or more processing circuits or modules such as a central processing unit (CPU) and/or any combination of general-purpose

5 microprocessors, microcontrollers, digital signal processors (DSPs), field programmable gate array (FPGAs), programmable logic devices (PLDs), controllers, state machines, gated logic, discrete hardware components, dedicated hardware finite state machines, or any other suitable circuits, devices and/or structures that can perform calculations or other manipulations of data.

[0039] The memory 306, which can include both read-only memory (ROM) and random
10 access memory (RAM), can provide instructions and data to the processor 304. A portion of the memory 306 can also include non-volatile random access memory (NVRAM). The processor 304 typically performs logical and arithmetic operations based on program instructions stored within the memory 306. The instructions (a.k.a., software) stored in the memory 306 can be executed by the processor 304 to perform the methods described herein. The processor 304 and
15 memory 306 together form a processing system that stores and executes software. As used herein, "software" means any type of instructions, whether referred to as software, firmware, middleware, microcode, etc. which can configure a machine or device to perform one or more desired functions or processes. Instructions can include code (e.g., in source code format, binary code format, executable code format, or any other suitable format of code). The instructions,
20 when executed by the one or more processors, cause the processing system to perform the various functions described herein.

[0040] The transceiver 310, which includes the transmitter 312 and receiver 314, allows the DU 120 to transmit and receive data to and from a remote device (e.g., a CU). In one

embodiment, an antenna 350 may be attached to the housing 340 and electrically coupled to the transceiver 310. In various embodiments, the DU 120 includes (not shown) multiple transmitters, multiple receivers, multiple transceivers, and/or multiple antennas. The transmitter 312 can be configured to wirelessly transmit packets having different packet types or functions, such packets
5 being generated by the processor 304. Similarly, the receiver 314 is configured to receive packets having different packet types or functions, and the processor 304 is configured to process packets of a plurality of different packet types. For example, the processor 304 can be configured to determine the type of packet and to process the packet and/or fields of the packet accordingly. In another embodiment, the DU 120 may communicate with a CU via fiber-optic
10 communication, such that the transmitter 312 and the receiver 314 can be configured to transmit and receive signals respectively through an optical fiber.

[0041] The configuration generator 322 may generate a message that comprises configuration information associated with the DU 120. The configuration generator 322 may send the message to the transmitter 312, and instruct the transmitter 312 to transmit the message
15 to the CU 110 associated with the DU, where the CU 110 and the DU 120 can cooperate to serve one or more cells in a wireless network as a base station. While the transmitter 312 can transmit the message to the CU through transport layer, the DU 120 and the CU 110 need to establish a fronthaul interface (referred as F1 interface herein) at application layer by exchanging application protocol (AP) messages. As such, the message that comprises configuration
20 information associated with the DU 120 can be used as an F1 interface setup request message for the DU 120 to request a setup of an F1 interface between the DU 120 and the CU 110.

[0042] In one embodiment, the configuration information in the F1 interface setup request message includes configuration information of the DU 120 that the CU 110 needs to know to

establish the interface. In addition, to establish the interface between the DU 120 and the CU 110, the DU 120 also needs to know configuration information of the CU 110.

[0043] The receiver 314 may receive either an F1 interface setup response message or an F1 interface setup failure message from the CU 110. The F1 interface setup response message
5 comprises configuration information associated with the CU 110. The F1 interface setup response message also indicates that the CU 110 has obtained the configuration information of the DU 120, and agrees to establish the F1 interface between the DU 120 and the CU 110. After receiving the F1 interface setup response message and obtaining the configuration information associated with the CU 110, the DU 120 successfully establishes an F1 interface with the CU
10 110. In one embodiment, after receiving the F1 interface setup response message and obtaining the configuration information associated with the CU 110, the DU 120 may send a confirmation message to the CU 110 to confirm that the F1 interface is established.

[0044] The F1 interface setup failure message indicates a failure of exchanging configuration information between the DU 120 and the CU 110, i.e. indicates a failure of establishing the F1
15 interface between the DU 120 and the CU 110. In one embodiment, the F1 interface setup failure message comprises a reason for the failure. After receiving the F1 interface setup failure message from the CU 110, the DU 120 may wait for a certain period of time, and then re-send the F1 interface setup request message to the CU 110 for F1 interface setup.

[0045] After the F1 interface is established, the CU 110 and the DU 120 can communicate
20 based on the exchanged configuration information of each other. From time to time, one of the CU 110 and the DU 120 may want to or need to update its configuration information. In this case, the updated configuration information should be exchanged and agreed between the CU

110 and the DU 120, before the updated configuration information can be used on the F1 interface.

[0046] In one embodiment, the configuration generator 322 is further configured to generate a DU configuration update request message that comprises updated configuration information associated with the DU 120. The configuration generator 322 may send the DU configuration update request message to the transmitter 312, and instruct the transmitter 312 to transmit the message to the CU 110. The DU configuration update request message can be used for requesting an update of the DU configuration to be used on the F1 interface between the DU 120 and the CU 110. That is, the DU 120 proposes to use the updated DU configuration on the F1 interface between the DU 120 and the CU 110, e.g. starting from a next time slot or time frame, and asks whether the CU 110 agrees. In one embodiment, the DU configuration update request message may include only the modified DU configuration, but not include the unmodified DU configuration.

[0047] The receiver 314 may receive either a DU configuration update confirmation message or a DU configuration update failure message from the CU 110. The DU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the CU 110 has obtained the updated configuration information of the DU 120, and agrees to use the updated configuration information of the DU 120 on the F1 interface between the DU 120 and the CU 110, e.g. starting from a proposed timing point. After receiving the DU configuration update confirmation message from the CU 110, the DU 120 can start to use the updated configuration from the proposed timing point.

[0048] The DU configuration update failure message indicates a failure of the updating, e.g. indicates that the CU 110 has not successfully obtained the updated configuration information of

the DU 120, or that the CU 110 does not agree to use the updated configuration information of the DU 120 on the F1 interface between the DU 120 and the CU 110 from the proposed timing point. In one embodiment, the DU configuration update failure message comprises a reason for the failure. After receiving the DU configuration update failure message from the CU 110, the
5 DU 120 may wait for a certain period of time, and then re-send the DU configuration update request message to the CU 110 for updating DU configuration. In the meantime, the DU 120 and the CU 110 will still use the old DU configuration for communication via the F1 interface, before the DU configuration is updated successfully.

[0049] In one embodiment, the receiver 314 may receive a CU configuration update request
10 message that comprises updated configuration information associated with the CU 110. The CU configuration update request message is used for the CU 110 to request an update of the CU configuration to be used on the F1 interface between the DU 120 and the CU 110. That is, the CU 110 proposes to use the updated CU configuration on the F1 interface between the DU 120 and the CU 110, e.g. starting from a next time slot or time frame, and asks whether the DU 120
15 agrees. In one embodiment, the CU configuration update request message may include only the modified CU configuration, but not include the unmodified CU configuration.

[0050] The transmitter 312 may transmit either a CU configuration update confirmation
message or a CU configuration update failure message to the CU 110. The CU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the DU
20 120 has obtained the updated configuration information of the CU 110, and agrees to use the updated configuration information of the CU 110 on the F1 interface between the DU 120 and the CU 110, e.g. starting from a proposed timing point. After the CU 110 receives the CU

configuration update confirmation message from the DU 120, the DU 120 and the CU 110 can start to use the updated CU configuration from the proposed timing point.

[0051] The CU configuration update failure message indicates a failure of the updating, e.g. indicates that the DU 120 has not successfully obtained the updated configuration information of the CU 110, or that the DU 120 does not agree to use the updated configuration information of the CU 110 on the F1 interface between the DU 120 and the CU 110 from the proposed timing point. In one embodiment, the CU configuration update failure message comprises a reason for the failure. After the CU 110 receives the CU configuration update failure message from the DU 120, the CU 110 may wait for a certain period of time, and then re-send the CU configuration update request message to the DU 120 for updating CU configuration. In the meantime, the DU 120 and the CU 110 will still use the old CU configuration for communication via the F1 interface, before the CU configuration is updated successfully.

[0052] In a CU-DU separation scenario, one CU manages one or more DUs. So the CU needs to obtain the load information of the DUs connected to the CU. The load information can be used for RRM algorithms, such as CU load balancing, user acceptance, or handover decisions. As such, a CU monitors resource status of each DU associated with the CU; and a DU reports its resource status to the associated CU, either periodically or upon request.

[0053] In one embodiment, the receiver 314 may receive a resource status request message from the CU 110. The resource status request message is sent by the CU 110 for requesting resource status information related to the one or more cells associated with the DU 120. The status reporter 320 in this example can generate a resource status update message that comprises at least some of the resource status information requested by the CU 110. The status reporter

320 may then instruct the transmitter 312 to transmit the resource status update message to the CU 110.

[0054] The CU 110 may request resource status of multiple measurement objects in multiple cells associated with the DU 120. In one situation, the DU 120 encounters a measurement failure
5 in some of the measurement objects or some of the cells. In this situation, the transmitter 312 may transmit, to the CU 110, a resource status response message that indicates a measurement failure of resource status information in these measurement objects or cells. The resource status response message may comprise the failure reasons. In another situation, the DU 120 encounters a measurement failure in all of the measurement objects of all cells. In this situation, the
10 transmitter 312 may transmit, to the CU 110, a resource status failure message that indicates a measurement failure of resource status information in all measurement objects of all cells. The resource status failure message may comprise the failure reasons. In one embodiment, the resource status response message and the resource status failure message may be generated by the status reporter 320 as well.

15 [0055] The power module 308 can include a power source such as one or more batteries, and a power regulator, to provide regulated power to each of the above-described modules in FIG. 3. In some embodiments, if the DU 120 is coupled to a dedicated external power source (e.g., a wall electrical outlet), the power module 308 can include a transformer and a power regulator.

[0056] The various modules discussed above are coupled together by a bus system 330. The
20 bus system 330 can include a data bus and, for example, a power bus, a control signal bus, and/or a status signal bus in addition to the data bus. It is understood that the modules of the DU 120 can be operatively coupled to one another using any suitable techniques and mediums.

[0057] Although a number of separate modules or components are illustrated in FIG. 3, persons of ordinary skill in the art will understand that one or more of the modules can be combined or commonly implemented. For example, the processor 304 can implement not only the functionality described above with respect to the processor 304, but also implement the functionality described above with respect to the status reporter 320. Conversely, each of the modules illustrated in FIG. 3 can be implemented using a plurality of separate components or elements.

[0058] FIG. 4 illustrates exemplary configuration information of a DU, in accordance with some embodiments of the present disclosure. As shown in FIG. 4, the exemplary DU configuration information 400 comprises: DU identification information 410; a list 420 of public land mobile networks (PLMNs) or tracking area identities (TAIs) supported by DU; DU capability information 430; capacity credit information 440 of the one or more cells associated with the DU or capacity credit information of the DU; DU type 450; and network slice information 460 about network slices supported by the DU, per each PLMN or per each TAI.

[0059] In one embodiment, the DU identification information 410 can be used for a CU to identify and manage a connected DU, and may be carried by an ID flag or other ID information, such as the transmission channel between CU and DU. In addition, DU related operation and management information may be collected and reported. For example, alarm information and KPI (key performance indicator) information can be reported per DU to the OAM (operations and management).

[0060] In one embodiment, the DU capacity information 430 includes DU protocol version, maximum number of cells that can be established and supported by DU (related to cell capacity),

band and bandwidth supported by DU, number of antennas (uplink and downlink), maximum downlink transmit power, etc.

[0061] In one embodiment, the DU's CE traffic (Capacity Credit) 440 includes uplink and downlink capacity credit corresponding to a single cell or multiple cells under DU. The DU

5 Type 450 may indicate a type of air interface that DU supports, such as E-UTRA (Evolved Universal Terrestrial Radio Access) or NR (New Radio).

[0062] It can be understood that during F1 interface setup, a DU's configuration information may include one or more of the listed DU configuration information in FIG. 4.

[0063] It can also be understood that a DU configuration update request message may
10 include only the modified DU configuration, but not include the unmodified DU configuration. For example, when the DU modifies the capability information 430, the DU may send the modified capability information in the DU configuration update request message to the CU, without sending other unmodified configuration information listed in FIG. 4.

[0064] It can also be understood that while a DU configuration update request message may
15 include same type of information as an F1 interface setup request message, the CU can distinguish the two messages based on message type information carried by the two messages.

[0065] FIG. 5 illustrates exemplary configuration information of a CU, in accordance with some embodiments of the present disclosure. As shown in FIG. 5, the exemplary CU
20 configuration information 500 comprises: CU identification information 510; a list 520 of public land mobile networks (PLMNs) or tracking area identities (TAIs) supported by CU; network slice information 530 about network slices supported by the CU, per each PLMN or per each TAI; and CU POOL information 540 about a pool that CU belongs to.

[0066] In one embodiment, the CU identification information 510 is a unique identifier for identifying CU, which can be equivalent to the global 5G base station ID, or it can be an independent ID.

[0067] In one embodiment, if the system supports CU POOL, an F1 interface setup response message may include CU POOL information, such as CU GROUP ID, corresponding PLMN ID, and corresponding CU ID information. Optionally, the CU POOL information contains the relative capacity information of the CU at POOL.

[0068] It can be understood that during F1 interface setup, a CU's configuration information may include one or more of the listed CU configuration information in FIG. 5.

[0069] It can also be understood that a CU configuration update request message may include only the modified CU configuration, but not include the unmodified CU configuration. For example, when the CU modifies the network slice information 530, the CU may send the modified network slice information in the CU configuration update request message to the DU, without sending other unmodified configuration information listed in FIG. 5.

[0070] It can also be understood that while a CU configuration update request message may include same type of information as an F1 interface setup response message, the DU can distinguish the two messages based on message type information carried by the two messages.

[0071] FIG. 6 illustrates exemplary resource status information 600 reported by a DU, in accordance with some embodiments of the present disclosure. As shown in FIG. 6, the exemplary resource status information 600 comprises: a global cell ID 610 of each cell related to the resource status information; hardware load information 620 in cell of the one or more cells; status 630 of the F1 interface transport network load experienced by the one or more cells; radio resource usage 640 per cell; overall available resource level in the one or more cells in downlink

and uplink; a first quantity 660 of current users in idle state in each of the one or more cells; and a second quantity 670 of current users in connection state in each of the one or more cells. In one embodiment, the radio resource usage 640 comprises at least one of: physical resource block (PRB) usage in a guaranteed bit rate (GBR) service, PBR usage in a non-GBR service, and total PRB usage.

[0072] FIG. 7 illustrates an exemplary block diagram of a CU 110, in accordance with some embodiments of the present disclosure. The CU 110 is an example of a device that can be configured to implement the various methods described herein. As shown in FIG. 7, the CU 110 includes a housing 740 containing: a system clock 702, a processor 704, a memory 706, a transceiver 710 comprising a transmitter 712 and receiver 714, a power module 708, a status monitor 720, and a configuration generator 722.

[0073] In this embodiment, the system clock 702, the processor 704, the memory 706, the transceiver 710 and the power module 708 work similarly to the system clock 302, the processor 304, the memory 306, the transceiver 310 and the power module 308 in the DU 120.

[0074] In one embodiment, an antenna 750 may be attached to the housing 740 and electrically coupled to the transceiver 710. In various embodiments, the CU 110 includes (not shown) multiple transmitters, multiple receivers, multiple transceivers, and/or multiple antennas. In another embodiment, the CU 110 may communicate with one or more DUs connected to the CU via fiber-optic communication, such that the transmitter 712 and the receiver 714 can be configured to transmit and receive signals respectively through an optical fiber.

[0075] In one embodiment, the receiver 714 may receive a message that comprises configuration information associated with the DU 120. In one embodiment, the message is an F1 interface setup request message for the DU 120 to request a setup of an F1 interface between the

DU 120 and the CU 110. In addition, to establish the interface between the DU 120 and the CU 110, the DU 120 also needs to know configuration information of the CU 110.

[0076] After receiving the F1 interface setup request message, the configuration generator 722 may generate either an F1 interface setup response message or an F1 interface setup failure message, and instruct the transmitter 712 to transmit the generated message to the DU 120. The F1 interface setup response message comprises configuration information associated with the CU 110. The F1 interface setup response message also indicates that the CU 110 has obtained the configuration information of the DU 120, and agrees to establish the F1 interface between the DU 120 and the CU 110.

[0077] The F1 interface setup failure message indicates a failure of exchanging configuration information between the DU 120 and the CU 110, i.e. indicates a failure of establishing the F1 interface between the DU 120 and the CU 110. In one embodiment, the F1 interface setup failure message comprises a reason for the failure.

[0078] After the F1 interface is established, the CU 110 and the DU 120 can communicate based on the exchanged configuration information of each other. From time to time, one of the CU 110 and the DU 120 may want to or need to update its configuration information. In this case, the updated configuration information should be exchanged and agreed between the CU 110 and the DU 120, before the updated configuration information can be used on the F1 interface.

[0079] In one embodiment, the configuration generator 722 is further configured to generate a CU configuration update request message that comprises updated configuration information associated with the CU 110. The configuration generator 722 may send the CU configuration update request message to the transmitter 712, and instruct the transmitter 712 to transmit the

message to the DU 120. The CU configuration update request message can be used for requesting an update of the CU configuration to be used on the F1 interface between the DU 120 and the CU 110. That is, the CU 110 proposes to use the updated CU configuration on the F1 interface between the DU 120 and the CU 110, e.g. starting from a next time slot or time frame, and asks whether the DU 120 agrees. In one embodiment, the CU configuration update request message may include only the modified CU configuration information, but not include the unmodified CU configuration information.

[0080] The receiver 714 may receive either a CU configuration update confirmation message or a CU configuration update failure message from the DU 120. The CU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the DU 120 has obtained the updated configuration information of the CU 110, and agrees to use the updated configuration information of the CU 110 on the F1 interface between the DU 120 and the CU 110, e.g. starting from a proposed timing point. After receiving the CU configuration update confirmation message from the DU 120, the CU 110 can start to use the updated configuration from the proposed timing point.

[0081] The CU configuration update failure message indicates a failure of the updating, e.g. indicates that the DU 120 has not successfully obtained the updated configuration information of the CU 110, or that the DU 120 does not agree to use the updated configuration information of the CU 110 on the F1 interface between the DU 120 and the CU 110 from the proposed timing point. In one embodiment, the CU configuration update failure message comprises a reason for the failure. After receiving the CU configuration update failure message from the DU 120, the CU 110 may wait for a certain period of time, and then re-send the CU configuration update request message to the DU 120 for updating CU configuration. In the meantime, the DU 120

and the CU 110 will still use the old CU configuration for communication via the F1 interface, before the CU configuration is updated successfully.

[0082] In one embodiment, the receiver 714 may receive a DU configuration update request message that comprises updated configuration information associated with the DU 120. The DU configuration update request message is used for the DU 120 to request an update of the DU configuration to be used on the F1 interface between the DU 120 and the CU 110. That is, the DU 120 proposes to use the updated DU configuration on the F1 interface between the DU 120 and the CU 110, e.g. starting from a next time slot or time frame, and asks whether the CU 110 agrees. In one embodiment, the DU configuration update request message may include only the modified DU configuration, but not include the unmodified DU configuration.

[0083] The transmitter 712 may transmit either a DU configuration update confirmation message or a DU configuration update failure message to the DU 120. The DU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the CU 110 has obtained the updated configuration information of the DU 120, and agrees to use the updated configuration information of the DU 120 on the F1 interface between the DU 120 and the CU 110, e.g. starting from a proposed timing point. After the DU 120 receives the DU configuration update confirmation message from the CU 110, the DU 120 and the CU 110 can start to use the updated DU configuration from the proposed timing point.

[0084] The DU configuration update failure message indicates a failure of the updating, e.g. indicates that the CU 110 has not successfully obtained the updated configuration information of the DU 120, or that the CU 110 does not agree to use the updated configuration information of the DU 120 on the F1 interface between the DU 120 and the CU 110 from the proposed timing point. In one embodiment, the DU configuration update failure message comprises a reason for

the failure. After the DU 120 receives the DU configuration update failure message from the CU 110, the DU 120 may wait for a certain period of time, and then re-send the DU configuration update request message to the CU 110 for updating DU configuration. In the meantime, the DU 120 and the CU 110 will still use the old DU configuration for communication via the F1 interface, before the DU configuration is updated successfully.

[0085] In a CU-DU separation scenario, one CU manages one or more DUs. So the CU needs to obtain the load information of the DUs connected to the CU. The load information can be used for RRM algorithms, such as CU load balancing, user acceptance, or handover decisions. As such, a CU monitors resource status of each DU associated with the CU; and a DU reports its resource status to the associated CU, either periodically or upon request.

[0086] In one embodiment, the status monitor 720 may generate a resource status request message for requesting resource status information related to the one or more cells associated with the DU 120. The status monitor 720 may instruct the transmitter 712 to transmit the resource status request message to the DU 120.

[0087] The receiver 714 in this example can receive a resource status update message from the DU 120. The resource status update message comprises at least some of the resource status information requested by the CU 110.

[0088] The CU 110 may request resource status of multiple measurement objects in multiple cells associated with the DU 120. In one situation, the DU 120 encounters a measurement failure in some of the measurement objects or some of the cells. In this situation, the receiver 714 may receive, from the DU 120, a resource status response message that indicates a measurement failure of resource status information in these measurement objects or cells. The resource status response message may comprise the failure reasons. In another situation, the DU 120 encounters

a measurement failure in all of the measurement objects of all cells. In this situation, the receiver 714 may receive, from the DU 120, a resource status failure message that indicates a measurement failure of resource status information in all measurement objects of all cells. The resource status failure message may comprise the failure reasons. In one embodiment, the receiver 714 may forward the resource status response message and the resource status failure message to the status monitor 720, such that the status monitor 720 can keep monitoring the resource status related to the DU 120.

[0089] The various modules discussed above are coupled together by a bus system 730. The bus system 730 can include a data bus and, for example, a power bus, a control signal bus, and/or a status signal bus in addition to the data bus. It is understood that the modules of the CU 110 can be operatively coupled to one another using any suitable techniques and mediums.

[0090] Although a number of separate modules or components are illustrated in FIG. 7, persons of ordinary skill in the art will understand that one or more of the modules can be combined or commonly implemented. For example, the processor 704 can implement not only the functionality described above with respect to the processor 704, but also implement the functionality described above with respect to the status monitor 720. Conversely, each of the modules illustrated in FIG. 7 can be implemented using a plurality of separate components or elements.

[0091] FIG. 8 illustrates an exemplary method for an interface setup between DU and CU, in accordance with some embodiments of the present disclosure. In one embodiment, the CU 810 may have a structure as shown in FIG. 3; and the DU 820 may have a structure as shown in FIG. 7. As shown in FIG. 8, at step 832, the DU 820 sends an F1 interface setup request message to the CU 810 for establishing an F1 interface with the CU 810. The CU 810 may either send an F1

interface setup response message at step 834 or send an F1 interface setup failure message at step 836. The F1 interface setup response message comprises configuration information associated with the CU 810 and indicates that: the CU 810 has obtained the configuration information of the DU 820 and agrees to establish the F1 interface between the DU 820 and the CU 810. The F1 interface setup failure message indicates a failure of exchanging configuration information between the DU 820 and the CU 810, i.e. indicates a failure of establishing the F1 interface between the DU 820 and the CU 810. In one embodiment, the F1 interface setup failure message comprises: (a) CU ID: a unique identifier for identifying CU, which can be equivalent to the global 5G base station ID, or it can be an independent ID; and (b) causes of the failure.

10 [0092] It can be understood that, although typically an interface setup request is sent from a lower layer node to a higher layer node, e.g. from DU to CU here, the disclosed method and system are applicable similarly to a situation when the interface setup request is sent from a higher layer node to a lower layer node, e.g. from CU to DU.

[0093] FIG. 9 illustrates an exemplary method for updating DU configuration between CU and DU, in accordance with some embodiments of the present disclosure. In one embodiment, the CU 910 may have a structure as shown in FIG. 3; and the DU 920 may have a structure as shown in FIG. 7. As shown in FIG. 9, at step 932, the DU 920 sends a DU configuration update request message to the CU 910 for requesting to use updated DU configuration on the established F1 interface with the CU 910. The DU configuration update request message comprises what is updated in the information carried previously in the F1 interface setup request message. The CU 910 may either send a DU configuration update confirmation message at step 934 or send a DU configuration update failure message at step 936. The DU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the CU

910 has obtained the updated configuration information of the DU 920, and agrees to use the updated configuration information of the DU 920 on the F1 interface between the DU 920 and the CU 910, e.g. starting from a proposed timing point. The DU configuration update failure message indicates a failure of the updating, e.g. indicates that the CU 910 has not successfully
5 obtained the updated configuration information of the DU 920, or that the CU 910 does not agree to use the updated configuration information of the DU 920 on the F1 interface between the DU 920 and the CU 910 from the proposed timing point. In one embodiment, the DU configuration update failure message comprises a reason for the failure.

[0094] FIG. 10 illustrates an exemplary method for updating CU configuration between CU
10 and DU, in accordance with some embodiments of the present disclosure. In one embodiment, the CU 1010 may have a structure as shown in FIG. 3; and the DU 1020 may have a structure as shown in FIG. 7. As shown in FIG. 10, at step 1032, the CU 1010 sends a CU configuration update request message to the DU 1020 for requesting to use updated CU configuration on the established F1 interface with the DU 1020. The CU configuration update request message
15 comprises what is updated in the information carried previously in the F1 interface setup response message. The DU 1020 may either send a CU configuration update confirmation message at step 1034 or send a CU configuration update failure message at step 1036. The CU configuration update confirmation message indicates a confirmation of the updating, i.e. indicates that the DU 1020 has obtained the updated configuration information of the CU 1010,
20 and agrees to use the updated configuration information of the CU 1010 on the F1 interface between the CU 1010 and the DU 1020, e.g. starting from a proposed timing point. The CU configuration update failure message indicates a failure of the updating, e.g. indicates that the DU 1020 has not successfully obtained the updated configuration information of the CU 1010, or

that the DU 1020 does not agree to use the updated configuration information of the CU 1010 on the F1 interface between the CU 1010 and the DU 1020 from the proposed timing point. In one embodiment, the CU configuration update failure message comprises a reason for the failure.

[0095] FIG. 11 illustrates an exemplary method for reporting and monitoring DU resource status, in accordance with some embodiments of the present disclosure. In one embodiment, the CU 1110 may have a structure as shown in FIG. 3; and the DU 1120 may have a structure as shown in FIG. 7. As shown in FIG. 11, at step 1132, the CU 1110 sends a resource status request message to the DU 1120 for requesting updated resource status under the DU 1120. The DU 1120 may, optionally, either send a resource status response message at step 1134 to the CU 1110, or send a resource status failure message at step 1136 to the CU 1110. The resource status response message indicates a measurement failure of resource status information in some measurement objects or cells. The resource status response message may comprise measurement failure information for the failed parts of requested cell resources. The resource status failure message indicates a measurement failure of resource status information in all measurement objects of all cells. The resource status failure message may comprise measurement failure information for all requested cell resources. Based on the request type, the cell list information, the resource report measurement objects, and the resource report measurement configuration in the resource status request message, the DU 1120 sends at least some of the requested resource status information of the one or more cells under the DU 1120 to the CU 1110 as a feedback, via a resource status update message. As shown in FIG. 11, if there is some updated resource status without measurement failure, the DU 1120 sends, at step 1138, a resource status update message to the CU 1110. The resource status update message comprises at least some of the resource status information requested by the CU 1110.

[0096] In addition, for a CU-DU separation of an evolved LTE base station, i.e., supporting simultaneous connection to the Evolved Packet Core (EPC) and the Next Generation Core (NGC), there is a need to distinguish types of measurement objects. In this case, there are two types of reported load information: load information of LTE and load information of NR.

5 [0097] Further, in a scenario of multiple shared PLMNs, the CU may consider sending the measurement configuration according to the different PLMNs when the measurement request is issued. Alternatively, the DU can report the status of resources according to different PLMNs.

[0098] Further, in a scenario of network slicing, the CU can also report the corresponding load information, in accordance with different Network Slice Selection Assistance Information
10 (NSSAI) requirements.

[0099] Further, in a CU-DU separation scenario, the wireless system can utilize CE (Capacity Credit) to realize resource usage report of one or more cells under the DU. This includes information report of current uplink/downlink Capacity Credit in one or more cells under the DU, which can be reported periodically by DU, or reported in real-time based on the
15 CU request. The Capacity Credit information can help the CU to learn the resource configuration and utilization status on the DU when new calls come in.

[00100] While various embodiments of the present disclosure have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. Likewise, the various diagrams may depict an example architectural or configuration,
20 which are provided to enable persons of ordinary skill in the art to understand exemplary features and functions of the present disclosure. Such persons would understand, however, that the present disclosure is not restricted to the illustrated example architectures or configurations, but can be implemented using a variety of alternative architectures and configurations. Additionally,

as would be understood by persons of ordinary skill in the art, one or more features of one embodiment can be combined with one or more features of another embodiment described herein. Thus, the breadth and scope of the present disclosure should not be limited by any of the above-described exemplary embodiments.

5 [00101] It is also understood that any reference to an element herein using a designation such as "first," "second," and so forth does not generally limit the quantity or order of those elements. Rather, these designations can be used herein as a convenient means of distinguishing between two or more elements or instances of an element. Thus, a reference to first and second elements does not mean that only two elements can be employed, or that the first element must precede the
10 second element in some manner.

[00102] Additionally, a person having ordinary skill in the art would understand that information and signals can be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits and symbols, for example, which may be referenced in the above description can be represented by voltages,
15 currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[00103] A person of ordinary skill in the art would further appreciate that any of the various illustrative logical blocks, modules, processors, means, circuits, methods and functions described in connection with the aspects disclosed herein can be implemented by electronic hardware (e.g.,
20 a digital implementation, an analog implementation, or a combination of the two), firmware, various forms of program or design code incorporating instructions (which can be referred to herein, for convenience, as "software" or a "software module), or any combination of these techniques.

[00104] To clearly illustrate this interchangeability of hardware, firmware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware, firmware or software, or a combination of these techniques, depends upon the particular application and design constraints imposed on the overall system. Skilled artisans can implement the described functionality in various ways for each particular application, but such implementation decisions do not cause a departure from the scope of the present disclosure. In accordance with various embodiments, a processor, device, component, circuit, structure, machine, module, etc. can be configured to perform one or more of the functions described herein. The term “configured to” or “configured for” as used herein with respect to a specified operation or function refers to a processor, device, component, circuit, structure, machine, module, etc. that is physically constructed, programmed and/or arranged to perform the specified operation or function.

[00105] Furthermore, a person of ordinary skill in the art would understand that various illustrative logical blocks, modules, devices, components and circuits described herein can be implemented within or performed by an integrated circuit (IC) that can include a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, or any combination thereof. The logical blocks, modules, and circuits can further include antennas and/or transceivers to communicate with various components within the network or within the device. A general purpose processor can be a microprocessor, but in the alternative, the processor can be any conventional processor, controller, or state machine. A processor can also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a

plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other suitable configuration to perform the functions described herein.

[00106] If implemented in software, the functions can be stored as one or more instructions or code on a computer-readable medium. Thus, the steps of a method or algorithm disclosed herein
5 can be implemented as software stored on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that can be enabled to transfer a computer program or code from one place to another. A storage media can be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can include RAM, ROM, EEPROM, CD-ROM or
10 other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store desired program code in the form of instructions or data structures and that can be accessed by a computer.

[00107] In this document, the term "module" as used herein, refers to software, firmware, hardware, and any combination of these elements for performing the associated functions
15 described herein. Additionally, for purpose of discussion, the various modules are described as discrete modules; however, as would be apparent to one of ordinary skill in the art, two or more modules may be combined to form a single module that performs the associated functions according to embodiments of the present disclosure.

[00108] Additionally, memory or other storage, as well as communication components, may
20 be employed in embodiments of the present disclosure. It will be appreciated that, for clarity purposes, the above description has described embodiments of the present disclosure with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processing logic

elements or domains may be used without detracting from the present disclosure. For example, functionality illustrated to be performed by separate processing logic elements, or controllers, may be performed by the same processing logic element, or controller. Hence, references to specific functional units are only references to a suitable means for providing the described
5 functionality, rather than indicative of a strict logical or physical structure or organization.

[00109] Various modifications to the implementations described in this disclosure will be readily apparent to those skilled in the art, and the general principles defined herein can be applied to other implementations without departing from the scope of this disclosure. Thus, the disclosure is not intended to be limited to the implementations shown herein, but is to be
10 accorded the widest scope consistent with the novel features and principles disclosed herein, as recited in the claims below.

CLAIMS

What is claimed is:

1. A method implemented on a first node, the method comprising:
5 generating a first message that comprises first configuration information associated with the first node; and
transmitting the first message to a second node for exchanging configuration information with the second node, wherein the first node and the second node cooperate to serve at least one cell in a wireless network as a base station.
10
2. The method of claim 1, wherein:
the first node is a distributed unit of the base station; and
the second node is a centralized unit of the base station.
- 15 3. The method of claim 1, wherein the first configuration information comprises at least one of:
identification information of the first node for the second node to identify and manage the first node, wherein the identification information is carried by an identity flag or information about a transmission channel between the first node and the second node;
20 a list of public land mobile networks or tracking area identities supported by the first node;
capability information of the first node;
capacity credit information of the at least one cell associated with the first node;

capacity credit information of the first node;

information about network slices supported by the first node, per each public land mobile network or per each tracking area identity; and

a type of air interface supported by the first node.

5

4. The method of claim 1, further comprising:

generating an update request message that comprises updated configuration information associated with the first node;

transmitting the update request message to the second node for updating the first
10 configuration information associated with the first node; and

receiving at least one of a second message and a third message from the second node,
wherein:

the second message indicates a confirmation of the updating, and

the third message indicates a failure of the updating.

15

5. The method of claim 1, further comprising receiving at least one of a second message and
a third message from the second node, wherein:

the second message comprises second configuration information associated with the
second node; and

20 the third message indicates a failure of the exchanging of configuration information.

6. The method of claim 5, wherein the second configuration information comprises at least
one of:

identification information of the second node;

a list of public land mobile networks or tracking area identities supported by the second node;

information about network slices supported by the second node, per each public land mobile network or per each tracking area identity; and

information about a pool that the second node belongs to.

7. The method of claim 5, further comprising:

receiving, from the second node, an update request message for updating the second configuration information associated with the second node, wherein the update request message comprises updated configuration information associated with the second node;

transmitting at least one of a second message and a third message to the second node, wherein:

the second message indicates a confirmation of the updating, and

the third message indicates a failure of the updating.

8. The method of claim 1, further comprising:

receiving a status request message from the second node, wherein the status request message is sent by the second node for requesting resource status information related to the at least one cell associated with the first node;

generating a status update message that comprises at least some of the resource status information requested by the second node; and

transmitting the status update message to the second node.

9. The method of claim 8, wherein the resource status information comprises at least one of following information for the at least one cell:

a global cell identity of each cell related to the resource status information;

5 load information of hardware per cell;

status of fronthaul interface transport network load experienced by the at least one cell;

radio resource usage per cell;

overall available resource level in the at least one cell in downlink and uplink;

a first quantity of current users in idle state per cell; and

10 a second quantity of current users in connection state per cell.

10. The method of claim 8, further comprising transmitting at least one of a second message and a third message to the second node, wherein:

15 the second message indicates a measurement failure of resource status information in some of the at least one cell; and

the third message indicates a measurement failure of resource status information in all of the at least one cell.

11. A method implemented on a first node, the method comprising:

20 receiving a first message from a second node for exchanging configuration information with the second node, wherein the first message comprises first configuration information associated with the second node, and wherein the first node and the second node cooperate to serve at least one cell in a wireless network as a base station.

12. The method of claim 11, wherein:
the first node is a centralized unit of the base station; and
the second node is a distributed unit of the base station.

5

13. The method of claim 11, wherein the first configuration information comprises at least one of:

identification information of the second node for the first node to identify and manage the second node, wherein the identification information is carried by an identity flag or information
10 about a transmission channel between the first node and the second node;

a list of public land mobile networks or tracking area identities supported by the second node;

capability information of the second node;

capacity credit information of the at least one cell associated with the second node;

15 capacity credit information of the second node;

information about network slices supported by the second node, per each public land mobile network or per each tracking area identity; and

a type of air interface supported by the second node.

20 14. The method of claim 11, further comprising:

receiving an update request message from the second node for updating the first configuration information associated with the second node, wherein the update request message comprises updated configuration information associated with the second node; and

transmitting at least one of a second message and a third message to the second node,
wherein:

the second message indicates a confirmation of the updating, and
the third message indicates a failure of the updating.

5

15. The method of claim 11, further comprising transmitting at least one of a second message
and a third message to the second node, wherein:

the second message comprises second configuration information associated with the first
node; and

10 the third message indicates a failure of the exchanging of configuration information.

16. The method of claim 15, wherein the second configuration information comprises at least
one of:

identification information of the first node;

15 a list of public land mobile networks or tracking area identities supported by the first
node;

information about network slices supported by the first node, per each public land mobile
network or per each tracking area identity; and

information about a pool that the first node belongs to.

20

17. The method of claim 15, further comprising:

transmitting, to the second node, an update request message for updating the second
configuration information associated with the first node, wherein the update request message

comprises updated configuration information associated with the first node;

receiving at least one of a second message and a third message from the second node,

wherein:

the second message indicates a confirmation of the updating, and

5 the third message indicates a failure of the updating.

18. The method of claim 11, further comprising:

transmitting, to the second node, a status request message for requesting resource status information related to the at least one cell associated with the second node; and

10 receiving, from the second node, a status update message that comprises at least some of the resource status information requested by the first node.

19. The method of claim 18, wherein the resource status information comprises at least one of following information for the at least one cell:

15 a global cell identity of each cell related to the resource status information;

load information of hardware per cell;

status of fronthaul interface transport network load experienced by the at least one cell;

radio resource usage per cell;

overall available resource level in the at least one cell in downlink and uplink;

20 a first quantity of current users in idle state per cell; and

a second quantity of current users in connection state per cell.

20. The method of claim 18, further comprising receiving at least one of a second message

and a third message from the second node, wherein:

the second message indicates a measurement failure of resource status information in some of the at least one cell; and

5 the third message indicates a measurement failure of resource status information in all of the at least one cell.

21. A first node, comprising:

a configuration generator configured to generate a first message that comprises first configuration information associated with the first node; and

10 a transmitter configured to transmit the first message to a second node for exchanging configuration information with the second node, wherein the first node and the second node cooperate to serve at least one cell in a wireless network as a base station.

22. The first node of claim 21, wherein the first configuration information comprises at least
15 one of:

identification information of the first node for the second node to identify and manage the first node, wherein the identification information is carried by an identity flag or information about a transmission channel between the first node and the second node;

20 a list of public land mobile networks or tracking area identities supported by the first node;

capacity credit information of the at least one cell associated with the first node;

capacity credit information of the first node;

information about network slices supported by the first node, per each public land mobile

network or per each tracking area identity; and

a type of air interface supported by the first node.

23. The first node of claim 21, further comprising:

5 a receiver configured to receive a status request message from the second node, wherein the status request message is sent by the second node for requesting resource status information related to the at least one cell associated with the first node; and

a status reporter configured to generate a status update message that comprises at least some of the resource status information requested by the second node, wherein the transmitter is
10 further configured to transmit the status update message to the second node.

24. The first node of claim 23, wherein the resource status information comprises at least one of following information for the at least one cell:

a global cell identity of each cell related to the resource status information;

15 load information of hardware per cell;

status of fronthaul interface transport network load experienced by the at least one cell;

radio resource usage per cell;

overall available resource level in the at least one cell in downlink and uplink;

a first quantity of current users in idle state per cell; and

20 a second quantity of current users in connection state per cell.

25. A first node, comprising:

a receiver configured to receive a first message from a second node for exchanging

configuration information with the second node, wherein the first message comprises first configuration information associated with the second node, and wherein the first node and the second node cooperate to serve at least one cell in a wireless network as a base station.

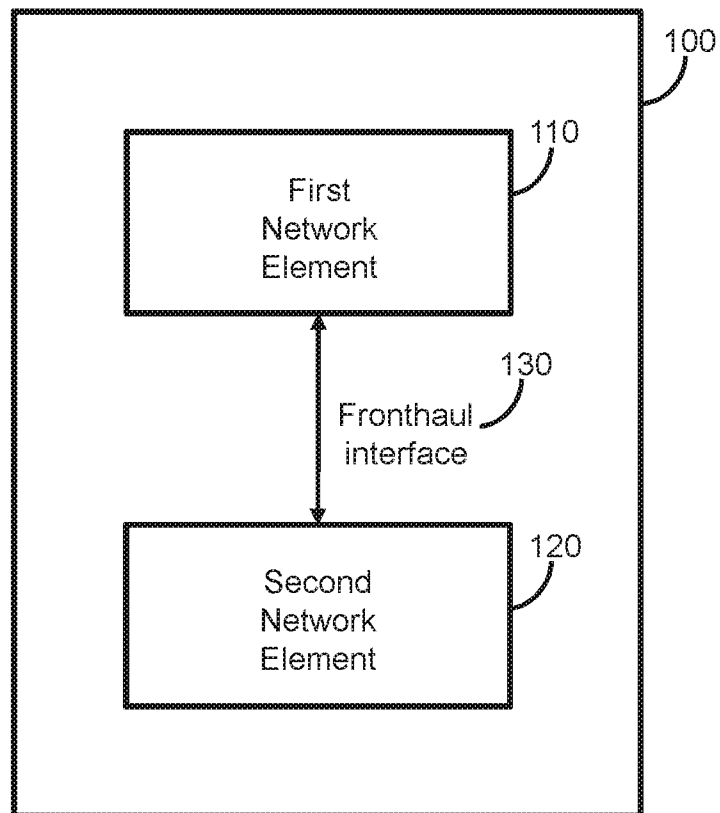


FIG. 1

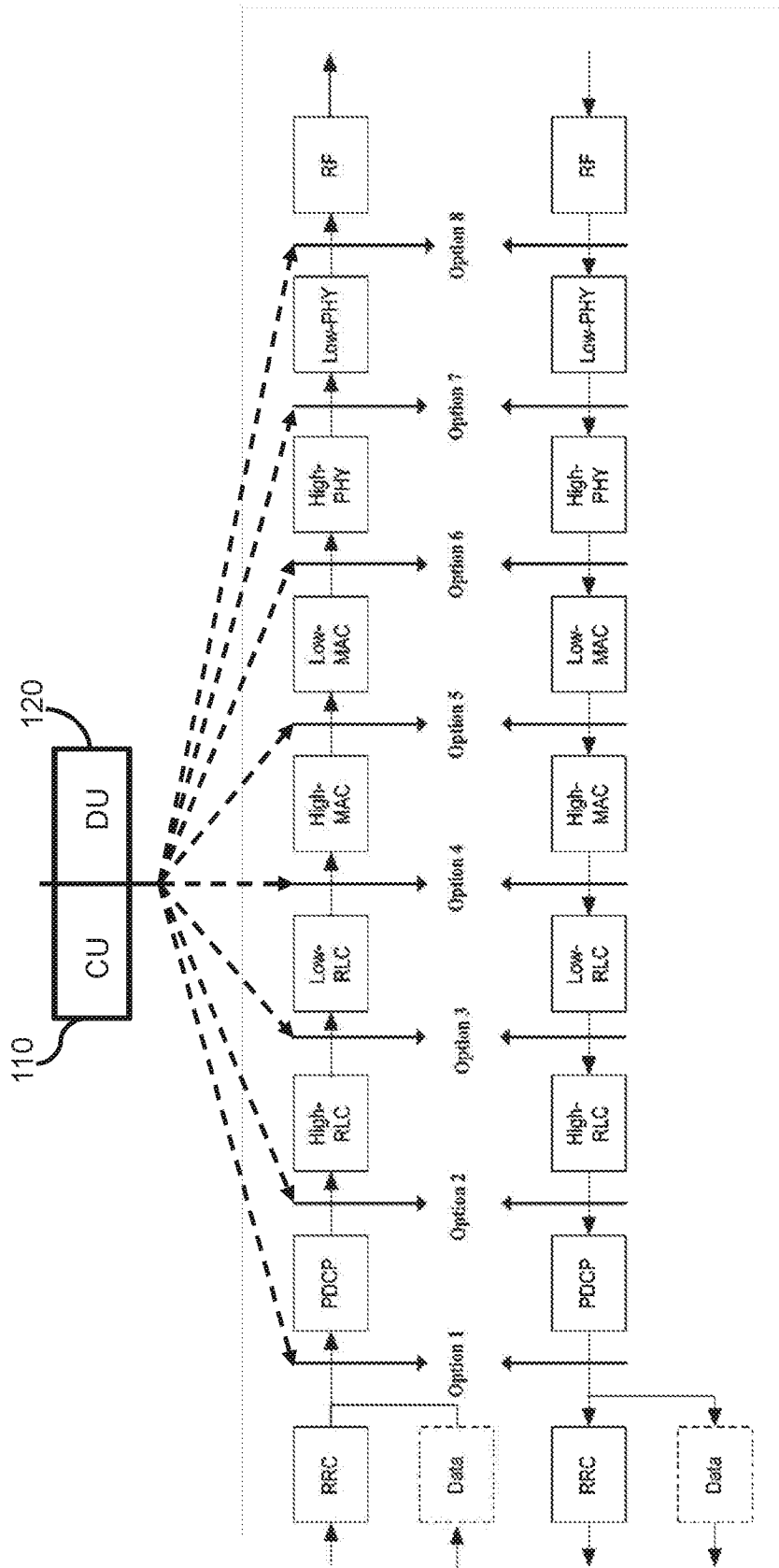


FIG. 2

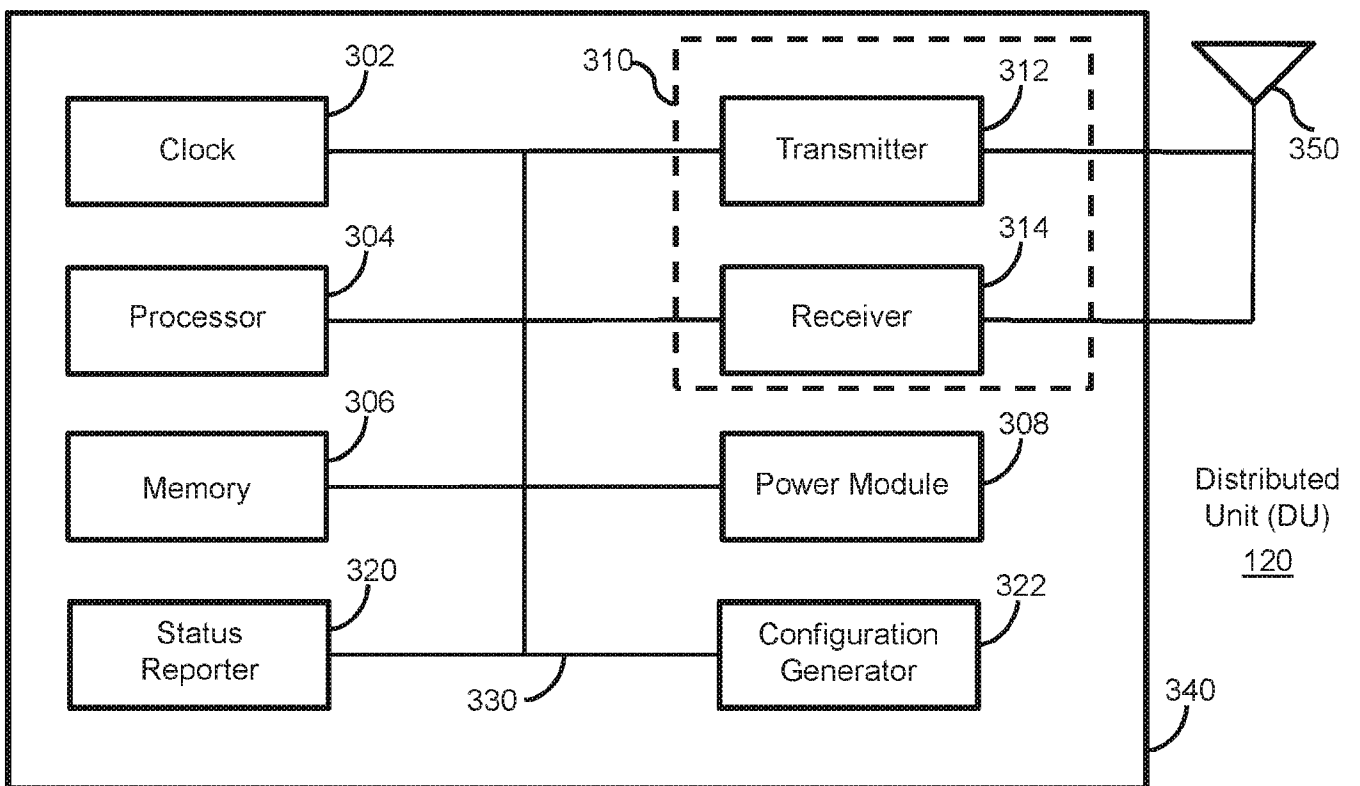


FIG. 3

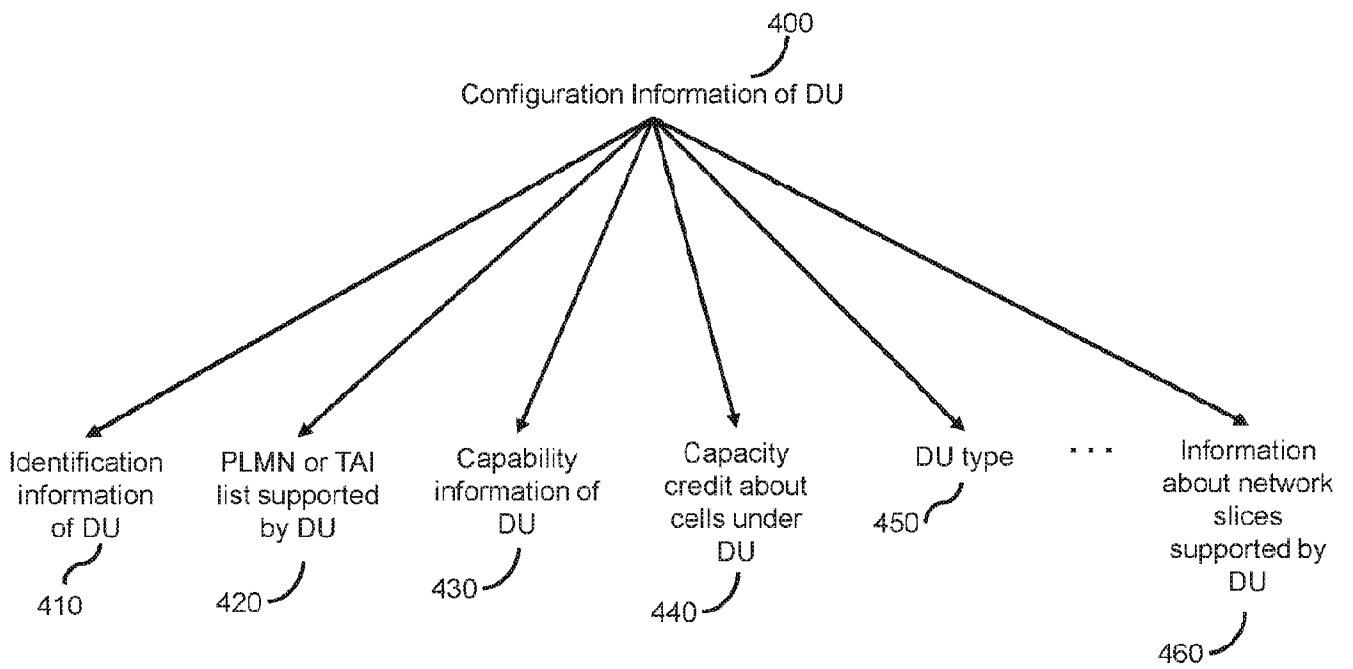


FIG. 4

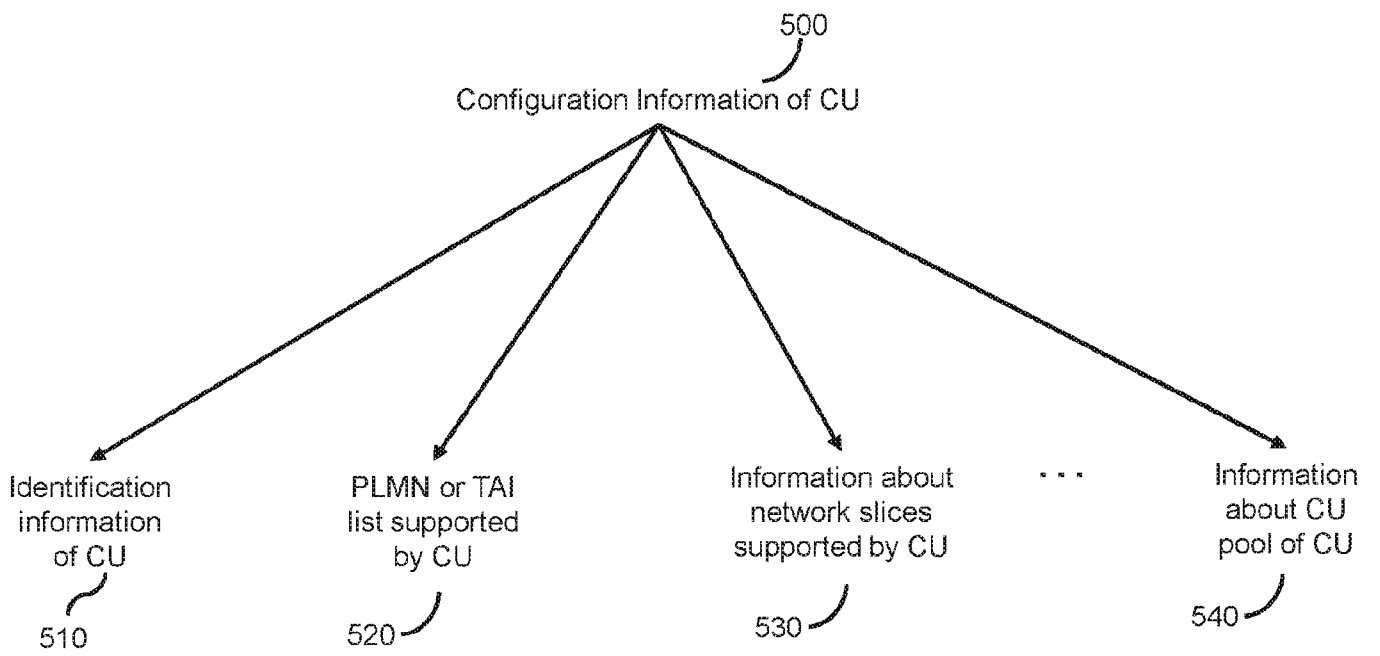


FIG. 5

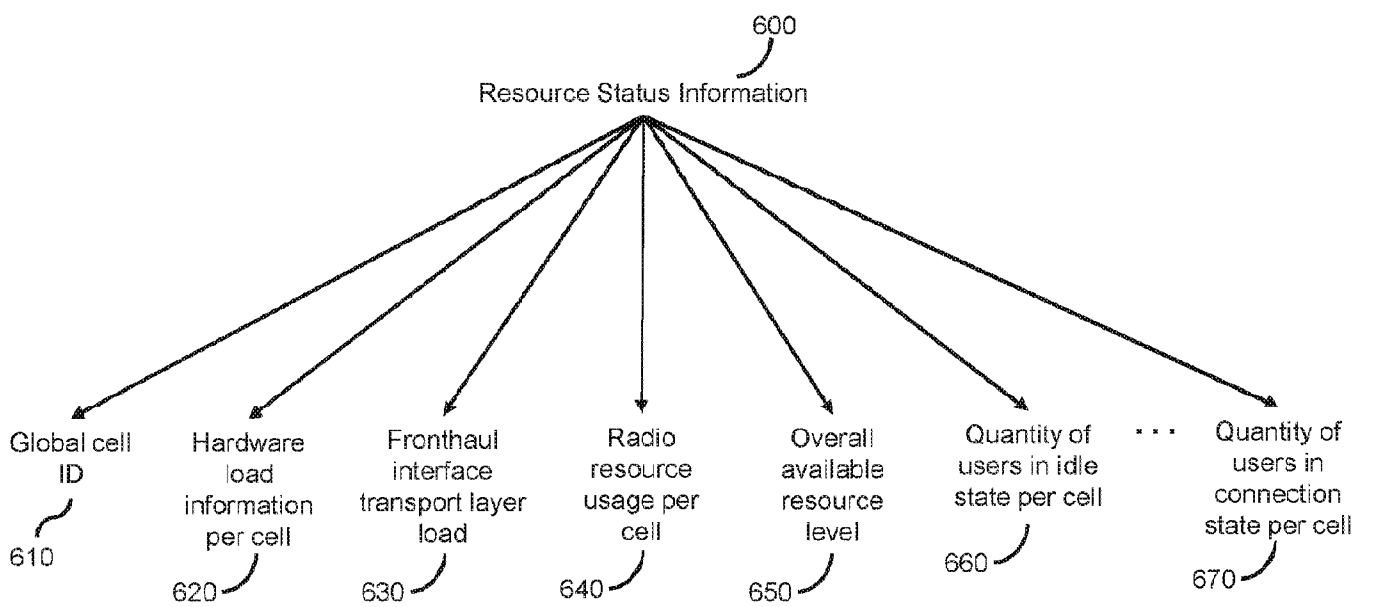


FIG. 6

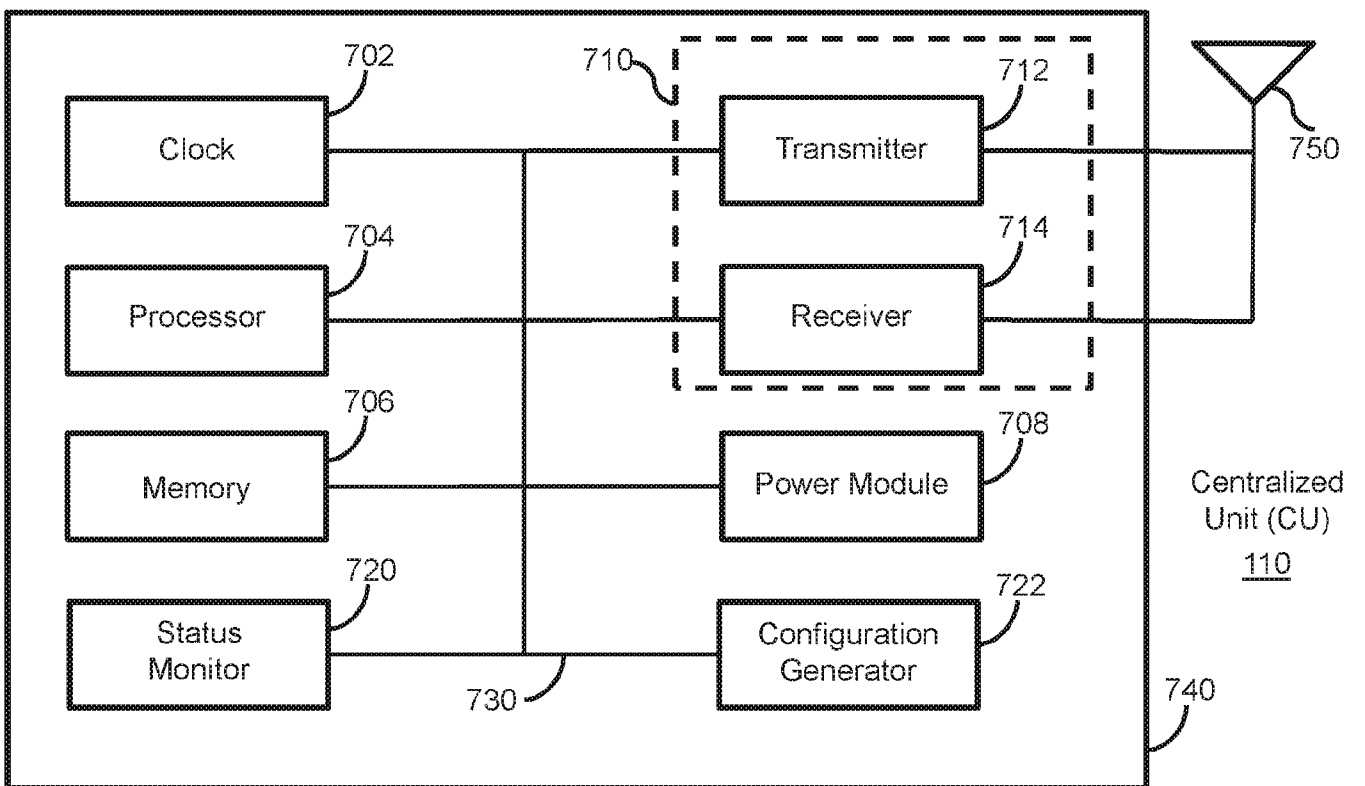


FIG. 7

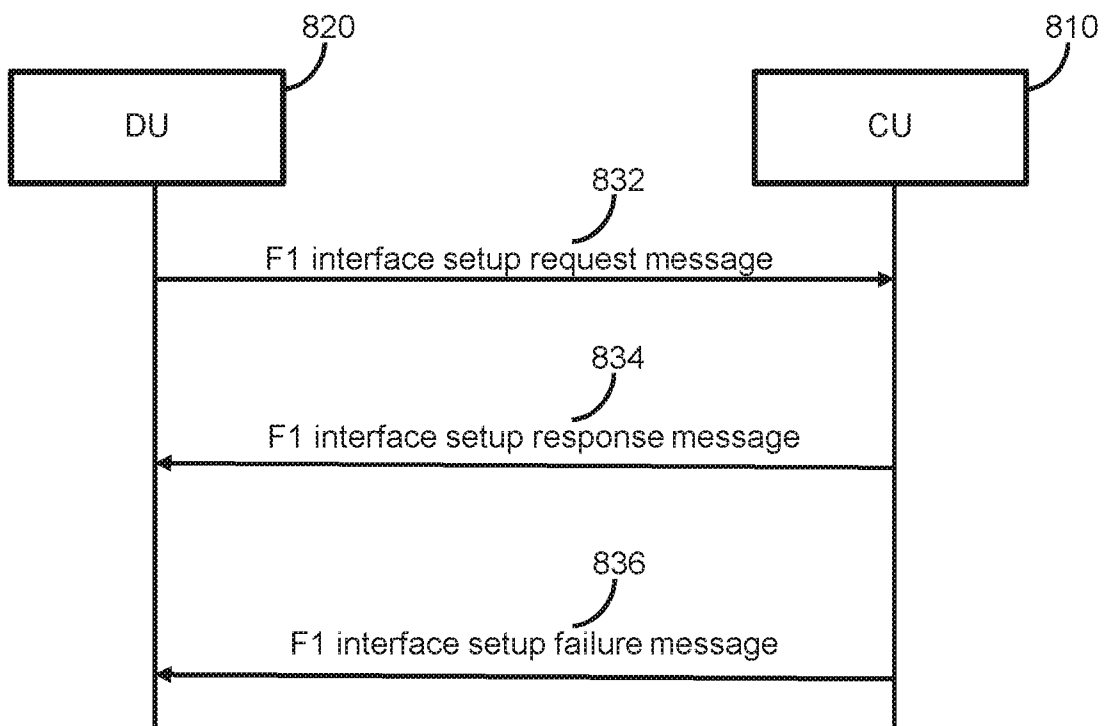


FIG. 8

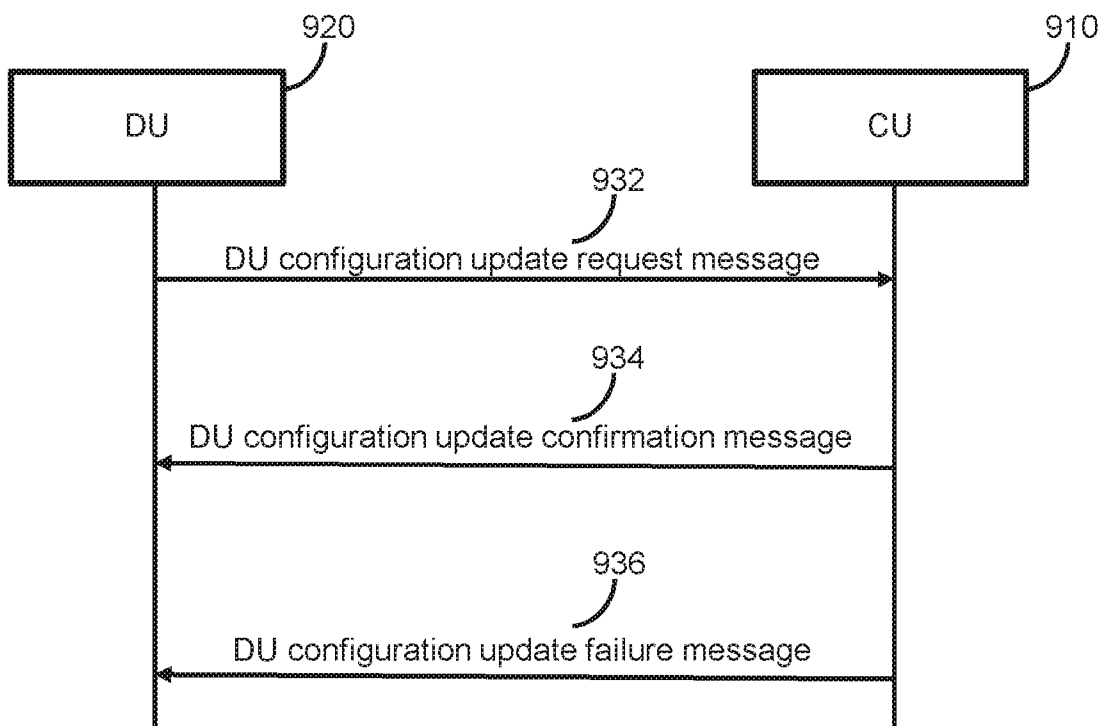


FIG. 9

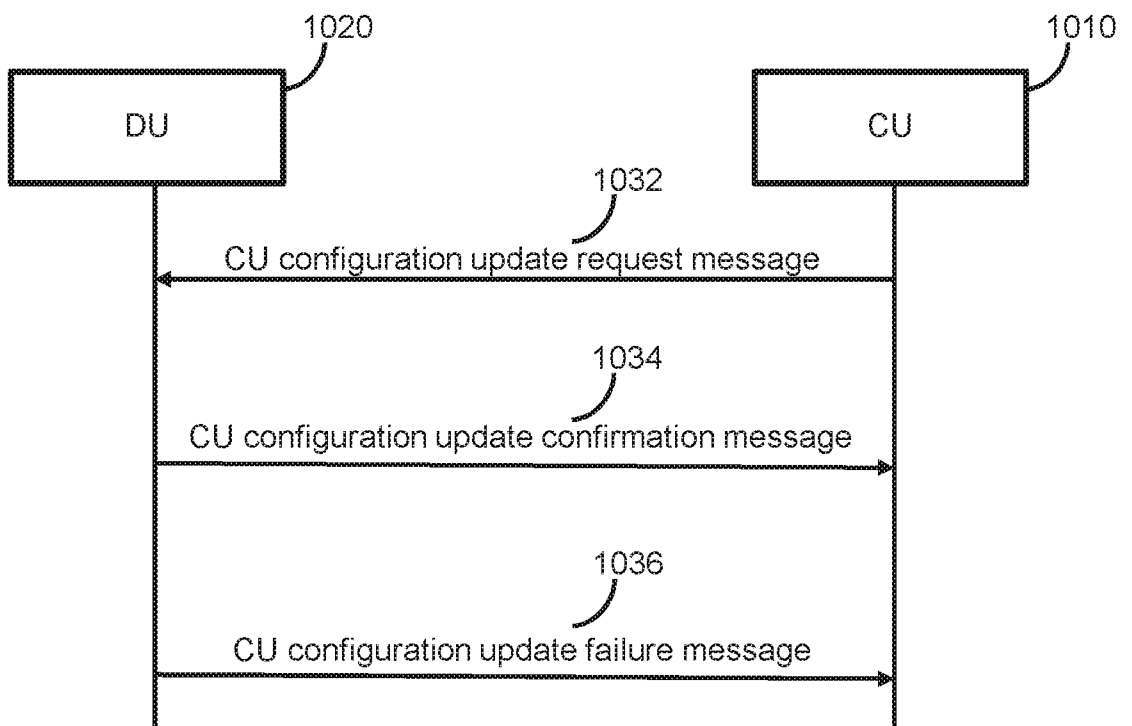


FIG. 10

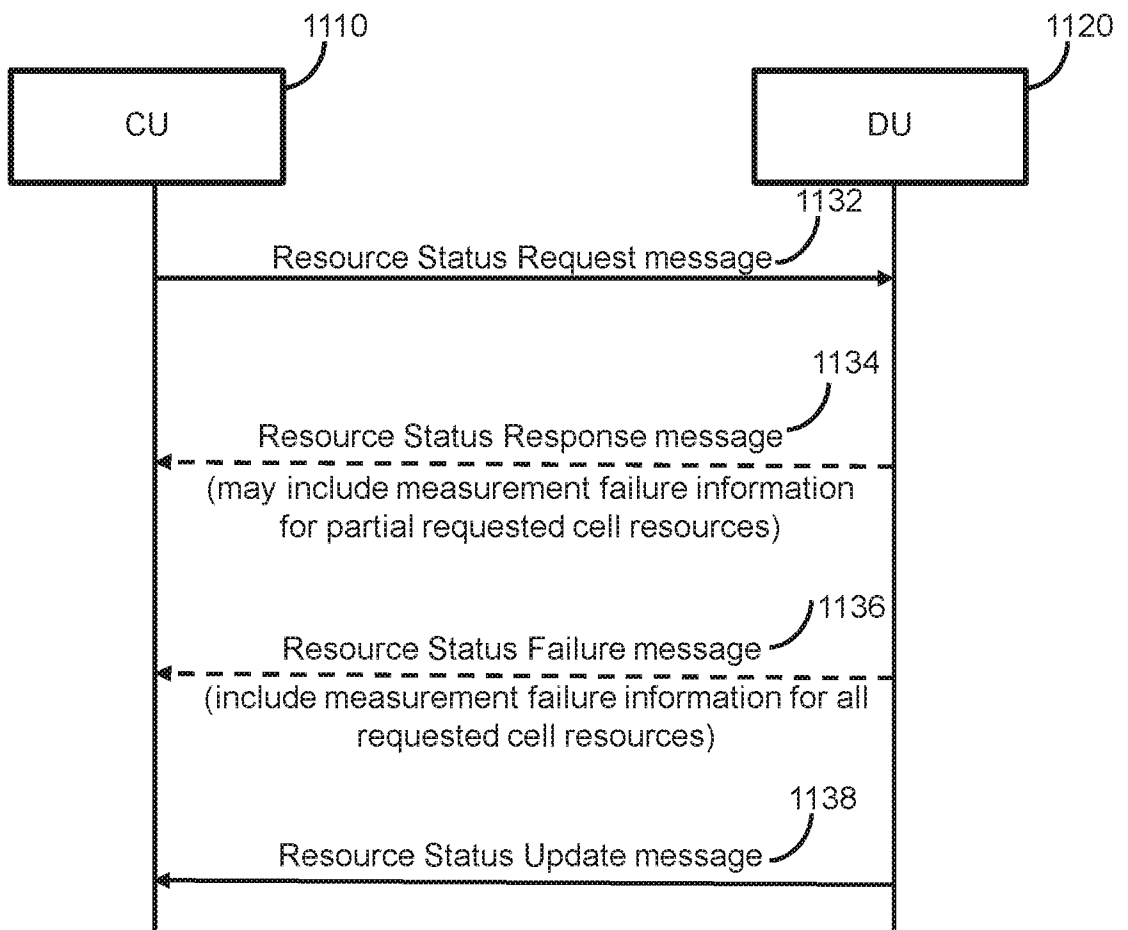


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/088440

A. CLASSIFICATION OF SUBJECT MATTER

H04W 48/16(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)

H04W; H04Q; H04L

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)

DWPI;SIPOABS;CNABS;CNTXT;EPTXT;USTXT;3GPP:node, indentif+, cell, CPRI, centraliz+, distribut+, message, base, second, station, configuration, cooperate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015215020 A1 (SAMSUNG ELECTRONICS CO LTD) 30 July 2015 (2015-07-30) claims, description, paragraphs [0031] to [0078] and figures 1-8	1-2, 5, 11-12, 15, 21, 25
X	WO 2011126313 A2 (LG ELECTRONICS INC) 13 October 2011 (2011-10-13) claims, description page 5 line 31 to page 20 line 107 and figures 1-9	1-2, 5, 11-12, 15, 21, 25
X	CN 105101273 A (ALCATEL LUCENT SHANGHAI BELL ET AL) 25 November 2015 (2015-11-25) description paragraphs [0043] to [0198], and figures 1-8	1, 5, 11, 15, 21, 25
X	CN 101347005 A (CISCO TECH INC) 14 January 2009 (2009-01-14) description page 11 line 2 to page 20 line 2, and figures 1-8	1, 5, 11, 15, 21, 25
X	CN 101926128 A (MICROSOFT CORP) 22 December 2010 (2010-12-22) description, paragraphs [0028] to [0070] and figures 1-8	1, 5, 11, 15, 21, 25
A	CN 106470417 A (ZTE CORP) 01 March 2017 (2017-03-01) the whole document	1-25
A	US 2016270007 A1 (OFINNO TECHNOLOGIES LLC) 15 September 2016 (2016-09-15) the whole document	1-25

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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

28 February 2018

Date of mailing of the international search report

15 March 2018

Name and mailing address of the ISA/CN

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Telephone No. (86-10)62089557

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2017/088440

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