# MIGRATION OF NODES IN AN IAB COMMUNICATION SYSTEM

## Field of the Invention

The present invention generally relates to methods for use in a process for migrating nodes and traffic between Integrated Access and Backhaul, IAB, topologies of a wireless communication system involving mobile IAB-nodes. Particularly, the present invention relates to a method for use in a migration process in which a Distributed Unit, DU, of an IAB-node, for example a mobile IAB-node, is migrated between IAB topologies and a method for use in managing transport migration after DU migration of an IAB-node.

## Background

Wireless communication systems are largely deployed to address a wide range of applications, from mobile broadband, massive machine type communications to Ultra Reliable Low Latency Communications (URLLC). Such systems allow a plurality of user equipment (UE) or mobile terminals to share the wireless medium to exchange several types of data content (e.g. video, voice, messaging …) over a radio access network (RAN) through one or more base stations. The base stations are conventionally wired-connected (e.g. through fiber) to a core network, forming an intermediate network, named backhaul (BH).

Examples of such wireless multiple-access communication systems include systems based on 3rd generation partnership project (3GPP - RTM) standards, such as fourth-generation (4G) Long Term Evolution (LTE) or recent fifth-generation (5G) New Radio (NR) systems, or systems based on IEEE 802.11 standards, such as Wi-Fi.

The demand for network densification increases due to the rising number of users and higher throughput requirement.

Facing the issues of high deployment costs and time of the wired backhaul networks with network densification, 3GPP has proposed, from release 16 for 5G NR, a wireless backhaul, also known as Integrated Access and Backhaul, IAB, where part of the wireless (i.e. radio) spectrum is used for the backhaul connection of base stations instead of fiber. The wireless backhaul communications (between base stations) may use the same radio resources as access communications (between a base station and UEs).

IAB turns out to be a competitive alternative to the fiber-based backhauling in dense areas or areas difficult to cover, as it allows scalable and rapid installations without the burden of cabling the base stations.

IAB is most likely to operate in the millimeter wave (mmWave) band to achieve the required Gbps (gigabits per second) data rate. However, millimeter waves are known to be subject to strong attenuations of signal strength in some weather conditions (rain, fog), and to blockage in case of obstacles located in the path between the emitter and the receiver.

To manage these potential radio link failures, a topological redundancy can be provided within the IAB framework, where multiple data paths are set up between the IAB base station directly connected to the core network (also referred to as the "IAB-donor") and the IAB base station serving UEs (also referred to as the "access IAB-node" for the UEs). Several intermediate IAB base stations (also referred to as IAB-nodes) may be involved in each of the several paths between the IAB-donor and the access IAB-node, thus forming alternative data paths within a multi-hop IAB topology.

Besides, 3GPP has been considering inter-donor redundancy, where an IAB-node, referred to as a boundary IAB-node, can access two different parent nodes connected to two different IAB-donors, with each of the IAB-donors managing a different IAB topology (also referred to as IAB network). The boundary IAB-node, even though belonging to a single IAB topology, i.e. belonging to a single IAB-donor for configuration and management, is thus able to route packets from a first IAB topology managed by a first IAB-donor to a second IAB topology managed by a second IAB-donor. The advantage of such inter-donor redundancy lies in the ability for the first IAB-donor to perform offloading by routing some of its packets through the second IAB topology, thus mitigating congestion issues or overcoming radio link failure issues that may arise in the first IAB topology.

There are other situations where an IAB-node becomes a boundary node. For example, in the case of partial migration of an IAB-node, decided by the IAB-donor, where the Mobile Termination (MT) of the IAB-node becomes connected to a single parent IAB-node belonging to another IAB topology controlled by another IAB-donor. This situation may also happen in the case of an IAB-node that experienced radio link failure (RLF) and that has recovered through a parent IAB-node belonging to another IAB topology. In those cases, the migrated IAB-node and its potential descendant IAB-node(s) still belong to the initial IAB topology, and such partial migration may be called MT migration. In order to ensure that traffic can be routed through the other IAB topology, MT migration should be followed by traffic migration where the traffic related to the boundary node and its descendant IAB-nodes is routed through the other IAB topology up to the boundary node (i.e. the migrated IAB-node).

Stationary IAB-nodes should only require a single MT migration. Indeed, a backhaul link (defined between two successive IAB-nodes in the wireless backhaul) may experience radio failure due to fluctuations of radio conditions and, for IAB-nodes that do not move, it should be a temporary situation with possible link recovery after some time. Thus, it should not be required for such stationary IAB-nodes to perform multiple MT migrations in the same IAB topology or toward another IAB topology, and the transmission and the handling of multiple protocol messages can be avoided. For the same reason, the migration of the Distributed Unit (DU) of the IAB-node, leaving the control of the IAB-node to a new IAB-donor, should not be required for stationary nodes. Moreover, it is noted that such DU migration, that may be called full migration, also involves the handover of UEs served by the migrating mobile IAB-node.

Urban environments are usually characterised by a high density of users along with the presence of a significant number of vehicles (e.g. public/private passengers transportation, goods delivery, food trucks …). Some of these vehicles (e.g. buses, trams, trains), may have predictable routes and a significant number of collocated UEs (i.e. passengers' devices). 3GPP is considering that such vehicles could offer an opportunity to increase network coverage and connectivity to the UEs inside the vehicles, or even to UEs in proximity to the vehicles, by installing on these vehicles on-board base stations (or base station elements) that would act as mobile relays. These mobile relays would rely on 5G wireless backhaul (typically IAB, or Integrated Access & Backhaul) for connecting to a fixed donor device.

Thus, based upon the fixed IAB foundations of releases 16 and 17, 3GPP is now considering Mobile IAB systems and architecture, as a part of the release 18 framework, in order to address scenarios focusing on mobile IAB-nodes mounted on vehicles (such as buses, trains, taxis). In such scenarios, mobile IAB-nodes can be referred to as Vehicle Mounted Relays (VMR), providing 5G coverage/capacity to on-board and/or surrounding UEs.

The technical benefits of using VMRs include, among others, is the ability of the VMR to offer good radio link conditions to the nearby UEs. Additionally, comparing with a solution using a UE as relay (i.e. a Sidelink Relay solution), an IAB-node mounted on a vehicle is expected to have better RF/antenna capabilities, and to have less stringent power / battery constraints than a relay UE.

For a mobile IAB-node it may be worth performing multiple MT migrations or DU migration, as the connection to a parent IAB-node belonging to a first IAB topology may not occur again for a long time as the mobile IAB-node moves around or never again in the case where the mobile IAB-node moves away from the parent IAB-node. Besides, for flexible IAB

network management, MT and DU migration should be decorrelated, meaning that a DU migration for an IAB-node may independently occur before or after one or several MT migrations of this IAB-node. Moreover, the DU migration for an IAB-node may be performed toward an IAB-donor different to the IAB-donor associated to the MT of this IAB-node.

In particular, after the MT migration of an IAB-node toward a first IAB-donor, followed by a DU migration of this IAB-node toward a second IAB-donor different from the first IAB-donor, the second IAB-donor may have to request a migration of the traffic related to the IAB-node toward the IAB topology controlled by the first IAB-donor.

Therefore, some new mechanisms are required to provide such flexibility by supporting the DU migration of an IAB-node toward any other IAB-donor, decorrelated to the MT migration(s) of the IAB-node.

Summary

In accordance with an aspect of the present invention, there is provided a method for use in a migration process for migrating a Distributed Unit, DU, of an Integrated Access Backhaul, IAB, node from a source F1-terminating IAB-donor Central Unit, CU, to a target F1-terminating IAB-donor-CU, the method at the target F1-terminating IAB-donor-CU comprising: receiving, from the IAB node, a message including identification information for identifying a RRC-terminating IAB-donor-CU terminating the RRC connection of the IAB-node, the RRC-terminating IAB-donor-CU being a different IAB-donor-CU to the target F1-terminating IAB-donor-CU; based on the identification information, performing transport migration for migrating traffic related to the IAB-node through an IAB topology managed by the RRC-terminating IAB-donor-CU.

The IAB-donor-CU (e.g. RRC donor-CU) serving the MT may be the source IAB-donor-CU if the MT of the IAB-node has not been migrated from the source IAB-donor-CU. Alternatively, the IAB-donor-CU (e.g. non-F1 donor-CU or RRC donor-CU) serving the MT may be another or second IAB-donor-CU managing a second IAB topology. In this latter case, the path between the target IAB-donor-CU and the MT of the IAB-node is through the second IAB topology.

The target IAB-donor-CU may receive the notification from the source IAB-donor-CU, from the IAB-node (e.g. in a F1 setup request) or from the IAB-donor-CU serving the MT (e.g. in a transport migration ready message). The notification received from the source IAB-donor-CU may be received in a DU migration notification message (which may be sent by

the source IAB-donor-CU before or after performing DU migration). In another example, the notification received from the source IAB-donor-CU may be received in a configuration update message. The configuration update message may be sent by the source IAB-donor-CU at any time: for example, before or after performing DU migration, when the source IAB-donor-CU detects a change in the IAB-donor-CU serving the MT. An advantage of being able to send the configuration update message at any time, is that the if the source IAB-donor-CU has already provided, to the target IAB-donor-CU, the address and/or identifier of an 'old' IAB-donor-CU that had previously served the MT of the IAB-node and which is now 'old' because the MT has been migrated to a 'new' IAB-donor-CU, then the source IAB-donor-CU can send an update through the configuration update message including identification information for identifying the new IAB-donor-CU.

In accordance with another aspect of the present invention, there is provided an apparatus for a first IAB-donor-CU as recited in claim 8 of the accompanying claims.

By sending, whether it's by the source IAB-donor-CU or the IAB-node or the IAB-donor-CU serving the MT, a notification to the target IAB-donor-CU, which notification includes identification information for identifying an IAB-donor-CU serving a Mobile Termination, MT, of the IAB-node, the target IAB-donor-CU is informed of the current IAB-donor-CU serving the co-located MT of the IAB-node which enables the target IAB-donor-CU to setup the IAB transport migration toward the topology of the current IAB-donor-CU serving the MT of the IAB-node.

Further example features of the invention are described in other independent and dependent claims.

Any feature in one aspect of the invention may be applied to other aspects of the invention, in any appropriate combination. In particular, method aspects may be applied to apparatus/device/unit aspects, and vice versa.

Furthermore, features implemented in hardware may be implemented in software, and vice versa. Any reference to software and hardware features herein should be construed accordingly. For example, in accordance with other aspects of the invention, there are provided a computer program comprising instructions which, when the program is executed by one or more processing units, cause the one or more processing units to carry out the method of any aspect or example described above and a computer readable storage medium carrying the computer program.

Brief Description of the Drawings

Different aspects of the invention will now be described, by way of example only, and with reference to the following drawings in which:

Figure 1 is a schematic diagram of a communication system in which the present invention may be implemented according to one or more embodiments;

Figure 2a and 2b schematically illustrate stacks of some protocol layers involved into IAB operations;

Figure 3 is a schematic diagram illustrating the format of a BAP Protocol Data Unit (PDU) or packet;

Figure 4 is a block schematic diagram of an example wireless communication device in accordance with embodiments of the present invention;

Figure 5 is a schematic diagram of an example IAB communication system (or IAB network system) in which embodiments and examples of embodiments of the present invention may be implemented;

Figure 6 is a schematic and simplified diagram illustrating an example of IAB-node architecture enabling its DU migration from a source IAB topology to a target IAB topology;

Figure 7 is a simplified diagram illustrating example message flows, according to one or more embodiments of the invention, to perform DU migration of an IAB-node including the handover of UEs served by the migrating IAB-node;

Figure 8 is a simplified diagram illustrating example message flows, according to one or more embodiments of the invention, to identify the non-F1 terminating donor-CU (or RRC terminating donor-CU) to the target F1 terminating donor-CU for the DU migration of an IAB-node;

Figure 9a is a flowchart of an example method in accordance with embodiments of the present invention, for managing, at the source F1 terminating donor-CU of an IAB-node, the DU migration of the IAB-node with the identification of a non-F1 terminating donor-CU (or RRC terminating donor-CU) to the target F1 terminating donor-CU;

Figure 9b is a flowchart of another example method in accordance with embodiments of the present invention, for managing, at the source F1 terminating donor-CU of an IAB-node, the DU migration of the IAB-node with the identification of a non-F1 terminating donor-CU (or RRC terminating donor-CU) to the target F1 terminating donor-CU;

Figure 9c is a flowchart of an example method in accordance with one or more embodiments of the invention, performed at an IAB-node to perform F1 setup request to a

target donor-CU while identifying a non-F1 terminating donor-CU (or RRC terminating donor-CU);

Figure 9d is a flowchart of an example method in accordance with embodiments of the present invention, for managing, at a target IAB-donor-CU, the transport migration after DU migration of an IAB-node;

Figure 10 is a simplified diagram illustrating another example message flow, according to one or more embodiments of the invention, to identify the non-F1 terminating donor-CU (or RRC terminating donor-CU) to the target F1 terminating donor-CU of the DU migration of an IAB-node;

Figure 11a is a flowchart of another example method in accordance with embodiments of the present invention, for managing, at the source F1 terminating donor-CU of an IAB-node, the DU migration of the IAB-node with the identification of the non-F1 terminating donor-CU (or RRC terminating donor-CU) to the target F1 terminating donor-CU;

Figure 11b is a flowchart of an example method in accordance with embodiments of the present invention, for managing, at the non-F1 terminating donor-CU (or RRC terminating donor-CU) of an IAB-node, the transport migration in case of DU migration of the IAB-node;

Figure 11c is a flowchart of another example method in accordance with embodiments of the present invention, for managing, at the target F1 terminating donor-CU of an IAB-node, the transport migration in case of DU migration of the IAB-node.

Figure 12a is a simplified diagram illustrating an example message flow of a procedure to perform the activation of a logical DU according to one or more embodiments of the invention;

Figure 12b is a simplified diagram illustrating an example message flow of a procedure to setup a logical DU;

Figure 12c is a simplified diagram illustrating an example message flow of a procedure to remove a logical DU;

Figure 12d is a simplified diagram illustrating an example message flow of a procedure used by a logical DU to inform RAN node CU about a change of configuration;

Figure 13a is a simplified diagram illustrating an example message flow of a procedure used by a RAN node CU to report configuration information to another RAN node CU;

Figure 13b is a simplified diagram illustrating an example message flow of a procedure used by a RAN node CU to manage the transport migration in coordination with another RAN node CU;

Figure 14 is a flowchart of an example method in accordance with embodiments of the present invention, for managing, at a target IAB-donor-CU, transport migration after DU migration of an IAB-node.

Detailed Description

Figure 1 illustrates an example communication system 100, in particular a mobile radio communication system such as a fifth-generation (5G) New Radio (NR) system including a wireless Integrated Access and Backhaul network supporting mobile IAB-node(s). Although in the following description, embodiments and examples of embodiments of the present invention will be described with respect to a 5G NR system, it will be appreciated that it is not intended that the present invention is limited to 5G NR systems and may be used in any wireless communication systems having a mobile base station. In particular, the following description predominantly uses terminology specific to 5G, but it should be appreciated that such terminology also applies to elements or processes performing an equivalent function in other communication systems.

The system 100 comprises a plurality of UEs (User Equipment) 132, 133, 131 and 134, a remote core network 110, a main Base Station 120, and two Integrated Access and Backhaul (IAB) stations or IAB-nodes 121 and 122 (also referred to in the following as IAB-nodes), and a mobile Integrated Access and Backhaul (IAB) station 123 mounted on a vehicle 105 (for example, a bus, a train, a taxi, a car, etc.).

The main Base Station 120, also referred to as the IAB-donor 120, is connected to the core network 110 through a wired link 101, preferably an optical fiber or any other wired means. In embodiments and examples of embodiments of the invention, IAB-donor 120 is a 5G NR gNB with additional functionality to support IAB features, as defined in 3GPP TS 38.300 v17.2.0 specification document.

In order to extend the network coverage of IAB-donor 120 and reach the remote UEs 132, 133 and 131, IAB stations 121 and 122, also referred to as IAB-nodes 121 and 122, have been installed by the operator. By acting as relaying nodes between the IAB-donor 120 and the UEs 132 and 133, IAB-nodes 121 and 122 allow overcoming the reachability issue resulting from presence of building 108, which is an obstacle to the propagation of radio waves and hence to the direct attachment and further communications between the UEs and the IAB-donor 120. This is particularly true when the communications between the IAB-

donor 120 and UEs 132 and 133 are operated at millimeter wave frequencies, which are highly sensitive to shadowing phenomena.

The IAB-donor 120 also serves UE 134, which is directly connected to it.

The mobile IAB station 123, also referred to as mobile IAB-node 123 or mIAB-node 123, is an IAB-node that is mounted on vehicle 105 and provides network coverage and capacity extension, allowing the IAB-donor 120 to reach onboard remote UEs, like remote UE 135, as well as surrounding UEs or UEs in the vicinity of the IAB-node 123, like remote UE 136.

The IAB-donor 120 and the IAB-nodes 121, 122 and 123 are thus forming a backhaul network or IAB network, or IAB topology, which accommodates UEs 132, 133, 131, 134, 135 and 136. The terms IAB network and IAB topology will be used interchangeably in the following.

The specification of the Integrated Access and Backhaul (IAB) is spread over several 3GPP standard documents, including:

- TS 38.300 RAN architecture (V17.2.0),
- TS 38.321 MAC protocol (V17.2.0),
- TS 38.331 Radio Resource Control (RRC) protocol (V17.2.0),
- TS 38.340 Backhaul Adaptation Protocol Layer (V17.2.0),
- TS 38.401 RAN architecture (V17.2.0),
- TS 38.423 Xn Application Protocol (V17.2.0),
- TS 38.473 F1 Application Protocol (V17.2.0).

As IAB-donor 120 and IAB-nodes 121, 122 and 123 are respectively connected to UEs 134, 131, 132, 133, 135 and 136, they are considered as Access IAB-nodes for their respectively connected UEs.

The IAB-donor 120 is a logical node that provides the NR-based wireless backhaul and consists of a central unit (CU or gNB-CU functionality) and connected donor distributed unit(s) (DU or gNB-DU functionality). The IAB-donor-CU or donor-CU (also referred to in the following as IAB-donor-CU or IAB-donor-CU) hosts higher layer protocols, such as PDCP (Packet Data Convergence Protocol) and RRC (Radio Resource Control) protocols, for controlling operation of one or more DUs and each of the one or more IAB-donor-DUs or donor-DUs (also referred to in the following as IAB-donor-DU or IAB-donor-DU) includes lower layer protocols, such as the RLC, MAC and physical layer protocols. The IAB-donor-CU or donor-CU and IAB-donor-DU or donor-DU may be located far from the other or may

be located in the same physical device. The gNB-DU functionality is defined in 3GPP TS 38.401. It aims at terminating the NR access interface to the UEs and next-hop IAB-nodes, and at terminating the F1 protocol to the IAB-donor gNB-CU functionality as shown in Figures 2a and 2b discussed below.

The IAB-nodes, which may serve multiple radio sectors, are wireless backhauled to the IAB-donor 120, via one or multiple hops over one or more intermediate IAB-nodes. They form a directed acyclic graph (DAG) topology with the IAB-donor at its root.

The IAB-nodes each consist of an IAB-DU (IAB-Distributed Unit) and an IAB-MT (IAB-Mobile Termination). The gNB-DU functionality on an IAB-node is also referred to as IAB-DU and allows the downstream (toward the UE) connection to the next-hop IAB or to a UE. The IAB-MT functionality includes, e.g., physical layer, layer-2, RRC and Non Access Stratum (NAS) functionalities to connect to the gNB-DU of an upstream IAB-node (including the IAB-donor 120 in which case it connects to the IAB-donor gNB-CU, hence to the core network 110, for instance for initialization, registration and configuration).

In this DAG topology, the neighbour node on the IAB-DU's interface is referred to as child node and the neighbour node on the IAB-MT's interface is referred to as parent node. The direction toward the child node is further referred to as downstream while the direction toward the parent node is referred to as upstream.

The IAB-donor 120 (e.g. the IAB-donor-CU) performs centralized resource, topology and route management for the whole IAB topology. This includes configuring the IAB-nodes according to the network topology, e.g. in order to perform appropriate routing of data packets.

Figures 2a and 2b schematically illustrate stacks of some protocol layers involved in IAB operations.

F1 interface supports the exchange of signalling information (e.g. control traffic) between the endpoints, as well as the data transmission (e.g. user traffic transmission) to the respective endpoints. From a logical standpoint, F1 interface is a point-to-point interface between the endpoints.

In 5G NR, F1-C is the functional interface in the Control Plane (CP) between the IAB-donor -CU and an IAB-node -DU (e.g. of IAB-node 2), and between the IAB-donor-CU and an IAB-donor-DU. F1-U is the functional interface in the User Plane (UP) for the same units. F1-C and F1-U are shown by reference 212 in Figure 2a. In this example, F1-U and F1-C are

carried over two backhaul hops (from IAB-donor to IAB-node1 and then from IAB-node1 to IAB-node2).

In the User Plane, boxes 210 at the IAB-donor-CU and the IAB-node DU refer to the GTP-U layer and boxes 211 refer to the UDP layer. GTP-U stands for GPRS Tunnelling Protocol User Plane. GTP-U Tunnels are used to carry encapsulated PDUs and signalling messages between a given pair of GTP-U Tunnel Endpoints (refer to 3GPP TS 29.281 for more details), here boxes 210 at the IAB-donor-CU and the IAB-node DU. The well-known User Datagram Protocol (UDP) is a transport layer protocol providing a best effort datagram service and fit to use with an IP protocol.

In the Control Plane, boxes 210 indicate the F1AP (F1 Application Protocol) layer and boxes 211 indicate the SCTP (Stream Control Transmission Protocol) layer. The F1 Application Protocol (as defined in 3GPP TS38.473 and TS 38.401) provides signalling services between the IAB-donor-CU and the IAB-node DU, or UE associated services. These services are for example initialization, configuration, and so on. The well-known SCTP layer provides reliable, in sequence transport of messages with congestion control.

F1-U and F1-C rely on an IP transport layer between the IAB-donor-CU and the IAB-node DU as defined in 3GPP TS 38.401.

The transport between the IAB-donor-DU and the IAB-donor-CU also uses an IP transport Layer over various media, like for example wires or optical fiber when the IAB-donor-CU is remote from the IAB-donor-DU, or locally in a virtual instantiation of the IAB-donor-CU and the IAB-donor-DU on the same physical machine. IAB-specific transport between IAB-donor-CU and IAB-donor-DU is specified in 3GPP TS 38.401.

L1 and L2 on the Figure 2a stand respectively for the transport and physical layers appropriate to the medium in use.

The IP layer can also be used for non-F1 traffic, such as Operations, Administration and Maintenance traffic.

On the wireless backhaul, the IP layer is itself carried over the backhaul adaptation protocol (BAP) sublayer, which enables routing over multiple hops. The BAP sublayer is specified in TS 38.340.

The IAB-DU’s IP traffic is routed over the wireless backhaul via the BAP sublayer. In a downstream direction, upper layer packets are encapsulated by the BAP sublayer at the IAB-donor-DU, thus forming BAP packets or packet data units (PDUs) or data packets. The BAP packets are routed by the BAP layer or entity (and corresponding BAP entities in the

IAB-DU and IAB-MT) of the intermediate IAB-nodes, if any. The BAP packets are finally de-encapsulated by the BAP sublayer at the destination IAB-node (which may be an access IAB-node should the upper layer packets in the BAP packets be intended for a UE).

In an upstream direction, upper layer packets are encapsulated by the BAP sublayer at an initiator IAB-node (which may be an access IAB-node should the upper layer packets come from a UE), thus forming BAP packets or data units (PDUs) or data packets. The BAP packets are routed by the BAP layer (and corresponding BAP entities in the IAB-DU and IAB-MT) of the intermediate IAB-nodes, if any. The BAP packets are finally de-encapsulated by the BAP sublayer at the IAB-donor-DU.

On the BAP sublayer, packets are routed based on the BAP routing ID, which is carried in the BAP header of the BAP packets, and which is set by the BAP sublayer of the emitting IAB-donor-DU or initiator IAB-node (e.g. a network node in the IAB network generating the BAP packets). Figure 3 illustrates the format of a BAP Data Protocol Data Unit (PDU) or packet. It is specified in the standardized version paragraph 6.2 of 3GPP TS38.340 release 17.2.0.

The payload section 307 is usually an IP packet. The header 30 includes fields 301 to 306. Field 301, named D/C field, is a Boolean indicating whether the corresponding BAP packet is a BAP Data packet or a BAP Control packet. Fields 302-304 are 1-bit reserved fields, preferably set to 0 (to be ignored by the receiver).

Fields 305 and 306 indicate together the BAP routing ID for the BAP packet. BAP address field 305, also referred to as DESTINATION field, is located in the leftmost 10 bits while BAP path identity field 306, also referred to as PATH field, is located in the rightmost 10 bits.

Field 305 carries the BAP address (i.e. on the BAP sublayer) of the destination IAB-node or IAB-donor-DU for the BAP packet. For the purpose of routing, each IAB-node and IAB-donor-DU in an IAB network is configured (by IAB-donor-CU of the IAB network) with a designated and unique BAP address. Field 306 carries a path ID identifying the routing path the BAP packet should follow to this destination in the IAB topology. For the purpose of routing, the routing paths, including their path ID, are configured (by IAB-donor-CU of the IAB network) in the IAB-nodes of the IAB network.

The BAP header is added to the packet when it arrives from upper layers to the BAP layer, and it is stripped off by the BAP layer when it has reached its destination node. The selection of the packet's BAP routing ID is configured by the IAB-donor-CU.

For instance, when the BAP packet is generated by a node, i.e. either by the IAB-donor-DU for downstream transmission or by an initiator (which may be an access IAB-node should the upper layer packets come from a UE) for upstream transmission, the BAP header with the BAP Routing ID is built by this node according to a configuration table defined in 3GPP TS 38.340. This table is called Downlink Traffic to Routing ID Mapping Configuration table in the IAB-donor-DU or Uplink Traffic to Routing ID Mapping Configuration table in the initiator IAB-node. In intermediate IAB-nodes, the BAP header fields are already specified in the BAP packet to forward.

As mentioned above, these configuration tables defining the BAP paths (hence the routing strategy and the configuration of the IAB-nodes given the IAB network topology) are usually defined by the IAB-donor-CU and transmitted to the IAB-nodes to configure them.

To transport messages over the 5G NR radio medium, three more sublayers (RLC, MAC and PHY) are implemented at each IAB-node below the BAP sublayer. The RLC (Radio Link Control) sublayer is responsible for the segmentation or reconstruction of packets. It is also responsible for requesting retransmissions of missing packets. The RLC layer is further described in TS38.322. The MAC (Media Access Channel) protocol sublayer is responsible for selecting available transmission formats for the user data and for the mapping of logical channel to the transport channels. The MAC handles also a part of the Hybrid Automated Repetition request scheme. The MAC layer is detailed in TS 38.321. On the emitter or transmitter side, the MAC encapsulates the data packet issued from the RLC. It adds a header carrying information necessary to the MAC function. On the receiver side, the MAC decapsulates the data packet issued from the PHY sublayer, deletes its header and passes the remaining data to the RLC. The PHY sublayer provides an electrical interface to the transmission medium (the air) by converting the stream of information into physical modulation signals, modulating a carrier frequency at emitter side. At the receiver side, the PHY sublayer converts the physical modulation signals back to a stream of information. The PHY layer is described in TS 38.201, TS 38.211, TS 38.212, TS 38.213, TS 38.214.

To pass messages towards the user or control plane, two other sublayers are used in the UE and IAB-donor-CU: the PDCP (Packet Data Convergence Protocol) sublayer and either the SDAP (Service Data Adaptation Protocol) sublayer for the User Plane communications or the RRC (Radio Resource Control) sublayer for the Control Plane communications.

The PDCP sublayer handles IP Header compression/decompression, ciphering/deciphering, and handles the integrity on the data packet if necessary. It

mandatorily numbers the packets on the emitter side and reorders the packets on the receiver side. The PDCP sublayer is described in 3GPP TS38.323.

SDAP sublayer 220 for the User Plane handles the Quality of Service. It is described in TS38.324. On the UE side, the SDAP sublayer exchanges the payload data with the user's application (voice, video, etc… - not shown in the Figure). On the IAB-donor-CU side, the SDAP sublayer exchanges the data with the Core Network 110 (Internet traffic, Cloud, etc…).

RRC sublayer 220 for the Control Plane handles the configuration of the protocol entities of the User Plane protocol stack. It is described in TS38.331. It is responsible for the handling of, inter alia, broadcasting information necessary to a UE to communicate with a cell; transmitting paging messages, managing connection, including setting up bearers; mobility functions; measurement configuration and reporting; devices capabilities.

The interface (for both CP and UP) between nodes using the layers PDCP, RLC, MAC and PHY is referenced NR-Uu. This mainly concerns the interface with the UE.

The interface (for both CP and UP) between nodes using the layers BAP, RLC, MAC and PHY is named BackHaul RLC Channel (BH RLC channel). This mainly concerns the interfaces between the IAB-nodes.

NR-Uu is the interface between the UE and the radio access network, i.e. its access IAB-node (for both CP and UP).

Figure 2b comes from 3GPP TS 38.300 v17.2.0 and illustrates the protocol stack for the support of IAB-MT's RRC and NAS connections. The Non-Access Stratum (NAS) protocol handles the messages between the core network and a user equipment, or an IAB-node. It manages the establishment of communication sessions and maintains communications with the IAB-node or the user equipment as it moves. The 5G NAS is described in 3GPP TS 24.501. The 5G Core Access and Mobility Management Function (AMF) is a function within the Core Network that receives all connection and session related information from the UEs connected to the IAB-node, as well as similar information for the IAB-node. AMF is only responsible for handling connection and mobility management tasks.

The IAB-MT establishes signalling Radio Bearers SRBs (bearers carrying RRC and NAS messages) with the IAB-donor-CU. These SRBs are transported between the IAB-MT and its parent node(s) over NR-Uu interface(s).

Figure 4 shows a schematic representation of an example communication device (apparatus) or station, in accordance with one or more example embodiments of the present disclosure.

The communication device 400 may be a device such as a micro-computer, a workstation or a light portable device. The communication device 400 may comprise a communication bus 413 to which there are preferably connected:

- a central processing unit 411, such as a microprocessor, denoted CPU. The central processing unit 411 may be a single processing unit or processor or may comprise two or more processing units or processors carrying out the processing required for the operation of the communication device 400. The number of processors and the allocation of processing functions to the central processing unit 411 is a matter of design choice for a skilled person;

- memory for storing data and computer programs containing instructions for the operation of the communication device 400. The computer programs may contain a number of different program elements (modules) or sub-routines containing instructions for a variety of operations and for implementing the methods in accordance with one or more embodiments of the invention; and

- at least one communication interface 402 for communicating with other devices or nodes in a communication system, such as the communication system of Figure 1. The at least one communication interface 402 may be connected to the radio communication network 403, such as a wireless communication network for 5G NR (e.g. according to release 17 and/or subsequent releases), over which digital data packets or frames or control frames are transmitted. The frames are written from a FIFO sending memory in RAM 412 to the communication interface for transmission or are read from the communication interface for reception and writing into a FIFO receiving memory in RAM 412 under the control of a software application running in the CPU 411.

Each of a donor-CU, a donor-DU, an IAB-node and a UE may be implemented in such a communication device/apparatus 100.

The memory may include:

- a read only memory 407, denoted ROM, for storing computer programs for implementing methods in accordance with one or more embodiments of the invention;

- a random-access memory 412, denoted RAM, for storing the executable code of methods according to one or more embodiments of the invention as well as the registers

adapted to record variables and parameters necessary for implementing methods according to one or more embodiments of the invention.

Optionally, the communication device 400 may also include the following components:

- a data storage means 404 such as a hard disk, for storing computer programs for implementing methods according to one or more embodiments of the invention;

- a disk drive 405 for a disk 406, the disk drive being adapted to read data from the disk 1106 or to write data onto said disk;

- a screen 409 for displaying decoded data and/or serving as a graphical interface with the user, by means of a keyboard 410 or any other input/output means.

In an example arrangement, the communication bus 413 provides communication and interoperability between the various elements included in the communication device 400 or connected to it. The representation of the bus is not limiting and in particular, the central processing unit is operable to communicate instructions to any element of the communication device 400 directly or by means of another element of the communication device 400.

The disk 406 may optionally be replaced by any information medium such as for example a compact disk (CD-ROM), rewritable or not, a ZIP disk, a USB key or a memory card and, in general terms, by an information storage means that can be read by a microcomputer or by a microprocessor, integrated or not into the communication device, possibly removable and adapted to store one or more programs whose execution enables a method according to embodiments of the invention to be implemented.

The executable code may optionally be stored either in read only memory 407, on the hard disk 404 or on a removable digital medium such as for example a disk 406 as described previously. According to an optional variant, the executable code of the programs can be received by means of the communication network 403, via the interface 402, in order to be stored in one of the storage means of the communication device 400, such as the hard disk 404, before being executed.

The central processing unit 411 may be adapted to control and direct the execution of the instructions or portions of software code of the program or programs according to the invention, which instructions are stored in one of the aforementioned storage means. On powering up, the program or programs that are stored in a non-volatile memory, for example on the hard disk 404 or in the read only memory 407, are transferred into the random-access memory 412, which then contains the executable code of the program or programs, as well as registers for storing the variables and parameters necessary for implementing the invention.

In an example implementation, the communication device (apparatus) is a programmable device/apparatus which uses software to implement the invention. Instructions may be executed by one or more processors of the apparatus, such as one or more digital signal processors (DSPs), general purpose microprocessors, application specific integrated circuits (ASICs), field programmable logic arrays (FPGAs), or other equivalent integrated or discrete logic circuitry to implement the invention for a network node (e.g. IAB-node, IAB-donor-CU). Accordingly, the term "central processing unit" as used herein may refer to any of the foregoing structure or any other structure suitable for implementation of the techniques described herein. However, alternatively, the present invention may be implemented in hardware (for example, in the form of an Application Specific Integrated Circuit or ASIC or other logic element).

Figure 5 illustrates an example of an IAB communication system (or IAB network system) 500 in which embodiments and examples of embodiments of the present invention may be implemented. In one example implementation, the radio links between the IAB-nodes and between the IAB-nodes and the IAB-donor-DUs (referred to as BH radio links) are operated over the millimeter wave frequency band (i.e. above 30 GHz), which is highly sensitive to radio channel disturbance. An IAB network will also be referred to as an IAB topology or topology and so in this application, the terms IAB network and IAB topology and topology will be used interchangeably.

IAB communication system 500 is composed of three IAB networks or IAB topologies 5001, 5002, and 5003 with each IAB topology comprising a set of IAB-nodes (e.g. the set may comprise a plurality of IAB-nodes or at least one IAB-node) and an IAB-donor-CU for controlling or managing the plurality of IAB-nodes. The set of IAB-nodes may include one or more IAB-nodes, such as initiator IAB-nodes which generate BAP packets and also intermediate or relay IAB-nodes. Each of the IAB-nodes communicate with at least one other IAB-node over a wireless backhaul (BH) link. Although Figure 5 shows three IAB topologies 5001, 5002, and 5003, the present invention is not limited to three IAB topologies and may be implemented in an IAB communication system comprising more than two IAB topologies with each topology comprising a set of IAB-nodes and an IAB-donor-CU as discussed above.

As discussed above, each IAB-node comprises a Mobile Termination (MT) part or unit, controlled and configured by the IAB-donor using RRC messaging as defined in 3GPP TS 38.331, and a Distributed Unit (DU) part, controlled and configured by the IAB-donor using

F1-AP messaging as defined in 3GPP TS 38.473. For example, IAB-node 510 comprises a MT part or unit 511 and a DU part 512.

IAB topology 5001 includes IAB-donor-CU 501 (identified as Donor1-CU in Figure 5), and its associated IAB-donor-DU 504 (identified as Donor1-DU1 in Figure 5), and a plurality of IAB-nodes 510 and 520, similar to IAB-nodes 121 and 122.

IAB topology 5002 includes IAB-donor-CU 502 (identified as Donor2-CU in Figure 5), its associated IAB-donor-DUs, IAB-donor-DU 505 (identified as Donor2-DU1 in Figure 5) and IAB-donor-DU 506 (identified as Donor2-DU2 in Figure 5), and a plurality of IAB-nodes 530, 540, 550, similar to IAB-nodes 121 and 122, and IAB-node 570, that may be similar to mobile IAB-node 123. All IAB-nodes can be access nodes serving UEs like the UE 580 served by the mobile IAB-node 570. The IAB topology 5002 is transparent for the UE 580 that connects to the donor-CU 502 through the DU part or unit 572 of the mobile IAB-node 570. Although figure 5 shows only one UE 580, it will be appreciated that there will be a plurality of UEs connected to the network nodes of the IAB communication system 500.

IAB topology 5003 includes IAB-donor-CU 503 (identified as Donor3-CU in Figure 5), and its associated IAB-donor-DU 507 (identified as Donor3-DU1 in Figure 5), and an IAB-node 560, similar to IAB-nodes 121 and 122.

A wired backhaul IP network interconnects the IAB-donor-CUs 501, 502, and 503, and the IAB-donor-DUs 504, 505, 506 and 507 through the wired backhaul 508. For instance, this wired backhaul 508 consists of optical fiber cables.

IAB-donor-CU 501, IAB-donor-DU 504 and IAB-nodes 510 and 520 are part of the same IAB network or IAB topology 5001, which is configured and managed or controlled by IAB-donor-CU 501.

IAB-donor-CU 502, IAB-donor-DUs 505 and 506, and IAB-nodes 530, 540, 550 are part of the same IAB network or IAB topology 5002, which is configured and managed or controlled by IAB-donor-CU 502.

IAB-donor-CU 503, IAB-donor-DU 507, and IAB-node 560 are part of the same IAB network or IAB topology 5003, which is configured and managed or controlled by IAB-donor-CU 803.

Each IAB-DU and IAB-donor-DU supports wireless communication in a coverage area(s) referred to as cell(s) (not shown in figure 5). In other words, each IAB-DU and IAB-donor-DU is associated with cell(s). Wireless communication devices (such as UEs, or other IAB-nodes) located within a cell may establish communication links with the node (i.e. IAB-

DU or IAB-donor-DU) serving the cell in order to communicate with other devices (e.g. other UEs, IAB-nodes, servers providing access to the Internet, etc.) via the node.

It is assumed that the mobile IAB-node 570 had initially a single parent IAB-node 520, and that IAB-node 570 belongs to the IAB topology 5001 controlled by the IAB-donor-CU 501. The IAB-donor-CU is thus operating as the F1 terminating donor-CU (which may also be referred to as a F1-terminating IAB-donor-CU or F1 donor-CU). When moving, and in view of its proximity to IAB topology 5002, in particular to the IAB-node 530 when the mobile IAB-node 570 is in the position shown in dotted lines in figure 5, the mobile IAB-node 570 may be able to establish a wireless BH link with the IAB-node 530. Such a BH link is possible for a stationary IAB-node, and it is very likely to happen for a mobile IAB-node like IAB-node 570, moving, for instance, in the direction of the IAB topology 5002 (shown by arrow 590 in figure 5.

Then, the F1 donor-CU 501 may have decided to perform the migration of the MT part 571 of the IAB-node 570 toward the IAB topology controlled by the donor-CU 502, which became the non-F1 terminating donor-CU (which may also be referred to as a non-F1-terminating IAB-donor-CU or non-F1 donor-CU, or RRC donor-CU, or RRC terminating donor-CU) for the IAB-node 570 (i.e. the MT part 571 of the IAB-node 570 is migrated toward the parent IAB-node 530). For this purpose, the F1 donor-CU 501 may have initiated the inter-CU Topology Adaptation procedure described in TS 38.401 V17.2.0 section 8.17.3.1 or section 8.17.3.2 (when the IAB-node 570 has descendant IAB-nodes). As a result, the IAB-node 570 still belongs to the IAB topology 5001, with its F1 connection to the donor-CU 501, but its RRC connection is now to the donor-CU2 502. After that procedure, the IAB-donor-CU 501 may request the migration toward the IAB topology 5002 (i.e. through the donor-DU 505) of the backhaul traffic (e.g. user traffic, control traffic) related to the IAB-node 570. In this case, the donor-CU 501 triggers the IAB transport migration management procedure specified in TS 38.423 V17.2.0 section 8.5.2. In the IAB communication system, all traffic communicated over backhaul links uses a F1 interface (F1-C or F1-U) between an IAB-donor-CU and an IAB-DU. Thus, the traffic or backhaul traffic that is offloaded or migrated is F1 traffic and can include control and user traffic.

While the mobile IAB-node 570 is still moving in the direction shown by arrow 590, the MT part 571 of the IAB-node 570 may then have been migrated by the non-F1 donor-CU 502 toward the parent IAB-node 550, using the backhaul link 5050 between the IAB-node 550 and the IAB-node 570. For this purpose, the non-F1 donor-CU 502 may have applied the

intra-CU topology adaptation procedure described in TS 38.401 V17.2.0 section 8.2.3.1 (or section 8.17.3.2), resulting in a consecutive MT migration (or another MT migration to another IAB-node) of the IAB-node 570 with a new single parent IAB-node 550. Still, the IAB-node 501 has its F1 connection with the donor-CU 501 and its RRC connection with the donor-CU2 502.

After being informed to use the donor-DU 506 instead of donor-DU 505 to route the F1 traffic related to the IAB-node 570, the donor-CU 501 may request the migration of the traffic related to the IAB-node 570 toward the IAB topology 5002. In this case, the donor-CU 501 triggers the IAB transport migration management procedure specified in TS 38.423 V17.2.0 section 8.5.2.

While further moving, this time in the direction of IAB topology 5003 controlled by the donor-CU 503, the IAB-node 570 may become in a position where a backhaul link 5060 with the IAB-node 560 may have a better quality than the backhaul link 5050 with the IAB-node 550. Thus, the donor-CU 502 may apply the inter-CU Topology Adaptation procedure described in TS 38.401 V17.2.0 section 8.17.3.1 or 8.17.3.2. After this consecutive MT migration, the IAB-node 501 still belongs to the IAB topology 5001, with its F1 connection with the donor-CU 501, but its RRC connection is now with the donor-CU 503 and thus, the donor-CU 503 becomes the non-F1 terminating donor-CU (or RRC terminating donor-CU). However, the donor-CU 501 has to be informed of the new non-F1 donor-CU 503 for the IAB-node 570 and of the new donor-DU 507 to redirect the offloaded traffic (F1 traffic, control and user traffic) through the donor-DU 507 instead of donor-DU 506.

In all the MT migration cases described above, the UE 580 still connects to the donor-CU 501 through the DU part or unit 572 of the mobile IAB-node 570. In case the IAB-node 570 has some child IAB-node(s), such child IAB-node still belongs to the IAB topology 5001, and it is still fully controlled (through F1 and RRC connections) by the donor-CU 501.

At any state of migration of the MT part 571 of the IAB-node 570, thus regardless of whether the MT part 571 of the IAB-node 570 has migrated to IAB topology 5002 or IAB topology 5003 and so regardless of whether the IAB-node 570 has a non-F1 terminating donor-CU and if it does, whether it’s the non-F1 terminating donor-CU 502 or 503, the F1 donor-CU 501 may decide to perform the migration of the DU part of the IAB-node 570. The reason for performing DU migration may be to reduce the processing load at the F1 donor-CU 501, or because the IAB-node 570 is geographically far from the F1 donor-CU 501 and close to an area where there is no more Xn connectivity between the F1 donor-CU 501 and a

target donor-CU. After the decision to perform the DU migration of the IAB-node 570, the F1 donor-CU 501 has also to decide toward which donor-CU (which is referred to as the target F1 donor-CU) the DU migration shall be performed. It may be a DU migration toward the current non-F1 terminating donor-CU (i.e. the default choice) if there is a current non-F1 terminating donor-CU and in this case the non-F1 terminating donor-CU becomes the target F1 donor-CU, or to another target F1 donor-CU. For instance, if the IAB-node 570 is mobile and its trajectory is predictable (e.g. for a bus or a train), the F1 donor-CU 501 may be aware of a suitable target F1-donor-CU controlling cells through which the IAB-node 570 will soon connect to the network. For instance, while the non-F1 terminating donor-CU of the IAB-node 570 is the donor-CU 502, the F1 donor-CU may decide the DU migration of the IAB-node 570 should be directly toward the donor-CU 503, as the IAB-node 570 may rapidly cross and not stay in the IAB topology 5002 controlled by the donor-CU 502. To not perform the DU migration toward the donor-CU 502, and instead perform DU migration toward the donor-CU 503, will avoid protocol messages for the intermediate DU migration of the IAB-node 570. When DU migration is performed, handover of the UEs served by the IAB-node 570 must also be performed. Thus, to not perform the DU migration toward the donor-CU 502 will also avoid the intermediate handover of UEs served by the IAB-node 570 to the donor-CU 502, before a new DU migration and UEs handover toward the donor-CU 503.

The procedure to perform a DU migration and the UEs handover toward a selected target F1 donor-CU is described in more detail with reference to the subsequent figures.

Figure 6 illustrates an example of IAB-node architecture 600 which enables migration of the DU of the IAB-node (DU migration) from a source IAB topology to a target IAB topology.

The IAB-node 601, which may be a mobile IAB-node like the IAB-node 570, is composed of an IAB-MT part or unit IAB-MT 610 (like the MT part or MT 571 of the IAB-node 570 of figure 5), a part or unit IAB-DU1 611, and a part or unit IAB-DU2 612. IAB-DU1 and IAB-DU2 are two logical DU entities (also referred to as logical DUs) that share the same hardware for the BAP, RLC, and MAC layers. In one example, they share the same physical layer (i.e. the same hardware resources), while in another example they rely on separated physical layers. At the DU migration of the IAB-node 601, both logical DUs are active: one of the logical DU terminates the F1 interface with a source F1 donor-CU (like donor-CU 501 in figure 5), while the other logical DU terminates the F1 interface with a target F1 donor-CU (like donor-CU 502 or 503 in figure 5). Otherwise (i.e. when DU

migration is not to be performed), only one logical DU is sufficient for IAB operations. As an example and with reference to the IAB communication system of figure 5, the F1 terminating donor-CU of the IAB-node 601 (i.e. IAB-node 570) may be donor-CU 501 which is thus operating as the source F1 donor-CU. The source F1-donor-CU 501 may identify IAB-donor-CU 502 as a suitable target F1 donor-CU when the source F1-donor-CU 501 determines that the IAB-node 570 is moving towards/through the IAB topology 5002 which includes network nodes (e.g. IAB-donor-DUs 505, 506, IAB-nodes 530, 540, 550) managed by the IAB-donor-CU 502, which network nodes serve cells in IAB topology 5002 to which the IAB-node 570 will soon connect. Alternatively, for an IAB-node which is connected to parent IAB-node or parent IAB-donor-DU of the IAB topology 5001 managed by the donor-CU 501 as the F1 terminating donor-CU and which is stationary but is in proximity to or in the vicinity of one or more IAB-nodes in a neighbouring IAB topology, such as IAB topology 5002, the source F1-donor-CU 501 may determine that IAB-donor-CU 502 is a suitable target F1 donor-CU when source F1-donor-CU 501 determines (e.g. based on signal measurements performed at the IAB-node on radio signals received at the IAB-node from all IAB-nodes in proximity to the IAB-node and which may include IAB-nodes in the neighbouring IAB topology 5002) that the IAB-node may soon connect to an IAB-node in the neighbouring IAB topology 5002.

Before the DU migration, a UE 602 (like UE 580 of figure 5) is for instance connected to the source F1 donor-CU 501 through the logical DU IAB-DU1 611 with the access link 621 in the cell served by the logical DU IAB-DU1 611, and the logical DU IAB-DU2 612 is deactivated. At the DU migration, the logical DU IAB-DU2 612 is activated and connects to the target F1 donor-CU 502, to which the UE 602 may also connect through the logical DU IAB-DU2 612 with the link 622 in the cell served by the logical DU IAB-DU2 612. The activation of the logical DU IAB-DU2 612 may be triggered by the source F1 donor-CU and executed with the procedures described with reference to the figures 12a and 12b. Once the handover of UE 602 is completed from a cell controlled by the logical DU IAB-DU1 611 to a cell controlled by the logical DU IAB-DU2 612, the logical DU IAB-DU1 611 may be deactivated. The deactivation may be triggered by the source F1 donor-CU 501with the procedure described with reference to figure 12c, after the detection of the completion of the handover for all UEs served by the IAB-DU1 611.

Examples of methods, in accordance with one or more embodiments of the present invention, which enable DU migration of an IAB-node to be performed, with or without (multiple) MT migration(s), and which include notifying the IAB-node about the identity of

target donor-CU to enable the handover of UEs served by the IAB-node to the target donor-CU will now be described. Although the following methods/apparatus' will be described primarily with respect to a mobile IAB-node, it will be appreciated that it is not intended that the invention is limited to mobile IAB-nodes. The methods in accordance with one or more embodiments of the present invention may apply to stationary IAB-nodes e.g. that are at the edge of one IAB topology and in the proximity of or in the vicinity of one or more IAB-nodes in a neighbouring IAB topology.

Figure 7 is a schematic and simplified diagram 700 illustrating some example message flows according to one or more embodiments of the invention, to perform the DU migration of an IAB-node, with or without (multiple) MT migration(s), and which includes the setup of data path(s) for packets routing between the target F1 donor-CU and the IAB-node through an IAB topology controlled by the non-F1 donor-CU (or RRC donor-CU) of the IAB-node.

This figure 7 shows a UE 708 like the UE 580, a source F1 donor-CU 703 like the donor-CU 501, a target F1 donor-CU 707 like the donor-CU 503, a non-F1/RRC donor-CU 709, the core network (5GC) 702 like the core network 110 of figure 1. This figure 7 also shows an IAB-node 701 that may be a mobile IAB-node like the IAB-node 570 composed of a MT part or unit IAB-MT 704, a DU part or unit IAB-DU1 705 (e.g. source or first logical DU entity or DU), and a DU part or unit IAB-DU2 706 (e.g. target or second logical DU entity or DU). Each of the first 705 and second 706 logical DU entities serve one or more cells which are identified by identifiers (e.g. Physical Cell Identifier (PCI), New Radio Cell Group Identifier (NCGI)). The cell(s) of the IAB-DU1 705 are identified by different values for the identifiers (e.g. Physical Cell Identifier (PCI), New Radio Cell Group Identifier (NCGI)) compared to the values for the cell(s) of the IAB-DU2 706. IAB-DU1 705 and IAB-DU2 706 are two logical DU entities that share the same hardware for the BAP, RLC, and MAC layers. In one example, they share the same physical layer (i.e. the same hardware resources), while in another example they rely on separated physical layers. The non-F1 donor-CU 709 for the IAB-node 701 may be the source F1 donor-CU 703 itself (e.g. donor-CU 501) if the IAB-MT 704 was not migrated. The non-F1 donor-CU for the IAB-node 701 may be the target F1 donor-CU 707 (e.g. donor-CU 703) if the IAB-MT 704 was previously migrated toward the target F1 donor-CU 707, or another donor-CU (e.g. donor-CU 502) if the IAB-MT 704 was previously migrated toward this other donor-CU (e.g. donor-CU 502).

At the beginning of the flow, the IAB-node 701 belongs to the source IAB topology controlled by the source F1 donor-CU 703. The UE 708 is served by the IAB-node 701

through a cell of IAB-DU1 705 (e.g. the DU of the IAB-node 701 has an active IAB-DU1 705 having a F1 connection with the source F1 IAB-donor-CU 703), while the logical IAB-DU2 706 is inactive. The user data in the downstream direction are provided by the 5GC 702 to the source F1 donor-CU 703 through the bearer 710, then the data are transmitted to the logical DU IAB-DU1 705 of the IAB-node 701 through the backhaul bearer 711, and finally to the UE 708 through the data radio bearer 712. The backhaul bearer 711 may be established in the source IAB topology controlled by the source F1 donor-CU 703, or in the IAB topology controlled by the non-F1 donor-CU 709 of the IAB-node 701 (if the IAB-MT 704 was previously migrated toward this non-F1 donor-CU). User data in the upstream direction (not represented in the figure) are transmitted through similar bearers in the opposite direction.

The IAB-MT 704 may send measurement reports (not represented in the figure 7) to its non-F1 terminating donor-CU 709 as the result of the measurements regularly performed by IAB-MT 704 on signals received from the serving cell and one or more target cells, such as the Signal Synchronization Block (SSB) transmitted in the serving cell and in the target cells. The non-F1 terminating donor-CU will be the F1 terminating donor-CU for the IAB-node (e.g. source F1 donor-CU 703) if the MT has not been migrated from its F1 terminating donor-CU. The target cells may be neighbouring cells to the serving or source cell (i.e. the current serving cell). Once the IAB-MT 704 discovers at least one SSB that meets predefined criteria (for instance a received power that exceeds a predefined threshold), a measurement report may be generated and transmitted to provide radio link quality information for different cells in the vicinity of the IAB-node 701. The identity of each cell is included in the measurement report to allow the non-F1 donor-CU if the IAB-MT 704 has been migrated, or F1 terminating donor-CU 703 if the IAB-MT 704 has not been migrated, to identify the target donor-CU associated with the cell. Indeed, the identification of a donor-CU can be deduced from the Physical Cell identity (PCI) broadcasted in each cell managed by this donor-CU in a synchronization signal, and/or from the New Radio Cell Group Identifier (NCGI) also broadcasted in each cell managed by this donor-CU in a System Information Block (SIB) message. The PCI and/or the NCGI may be reported by the IAB-node 701 in the measurement report.

Based on the received measurement reports, the non-F1 donor-CU 709 if the IAB-MT 704 has been migrated, or F1 terminating donor-CU 703 if the IAB-MT 704 has not been migrated, may detect that the IAB-node 701 receives radio signals in a target cell of a target

parent IAB-node with a better quality than in the source serving cell. The non-F1 donor-CU 709 if the IAB-MT 704 has been migrated, or F1 terminating donor-CU 703 if the IAB-MT 704 has not been migrated, may decide to apply a procedure to perform the IAB-MT 704 migration toward a target parent IAB-node that belongs either to the same IAB topology (intra-CU topology adaptation), or to another IAB topology (inter-CU topology adaptation). In any case, the source F1 donor-CU 703 will be informed about this MT migration by the non-F1 donor-CU 709 if the IAB-MT 704 has been migrated or the source F1 donor-CU 703 will be informed since it made the decision to perform MT migration directly from the measurement reports received from the IAB-node 701 if the IAB-MT 704 has not been migrated, and this information may be used by the source F1 donor-CU 703 to trigger a DU migration of the IAB-node 701. In another example, the non-F1 donor-CU 709 may relay the information in the measurement reports received from the IAB-node 701 to the source F1 donor-CU 703. Thus, the source F1 donor-CU 703 may base its decision for DU migration of the IAB-node 701 directly from these measurement reports relayed by the non-F1 donor-CU 709.

Thus, the source F1 donor-CU 703 determines the DU of the IAB-node is to be migrated from the IAB topology (also referred to as the source IAB topology) of the source F1 donor-CU 703 to another IAB topology (also referred to as the target IAB topology) of a target IAB-donor-CU. The determination may be based on determining that a migration of a MT of the IAB-node toward a new parent IAB-node has been completed. Another example of a triggering event for determining the DU of the IAB-node is to be migrated may include the decision for DU migration may be based on the detection of a MT migration from a one IAB topology (e.g. first IAB topology) towards another IAB topology (e.g. second IAB topology), and on a known (predefined) trajectory of the IAB-node that indicates to the source F1 donor-CU that the MT will be migrated later to a yet another IAB topology (e.g. third IAB topology). In this case, to avoid signaling messages for DU migration/UEs handover toward the another IAB topology (e.g. second IAB topology), the DU is directly migrated toward the yet another IAB topology (e.g. third IAB topology). Another example of a triggering event for determining the DU of the IAB-node is to be migrated may include the processing load level being detected above a predefined threshold in the source F1 donor-CU. Then DU migration is triggered and the choice of target F1 donor-CU is based on the processing load of other donor-CUs connected to the source F1 donor-CU.

Upon the decision of or determination by the source F1 donor-CU 703 to perform the DU migration of the IAB-node 701 toward another IAB topology managed by another donor-CU which becomes the target F1 donor-CU 707, the first step 720 corresponds to sending a request to the IAB-node 701 to establish a new F1 connection between the target F1 donor-CU 707 and the mobile IAB-node 701. This may require activation of the second logical IAB-DU2 706 in the mobile IAB-node 701 and thus the first step 720 may include the activation of the second logical DU IAB-DU2 706 in the mobile IAB-node 701. This operation is performed using, for example, the procedures described with reference to the figures 12a and 12b. In particular, the message sent by the source F1 donor-CU 703 to the IAB-node 701 for the activation of the IAB-DU2 706 (e.g. 1203 in figure 12a) may include identification information for identifying the target donor-CU, such as the TNL address (i.e. IP address) of the target F1 donor-CU 707, so that a new F1 connection or F1 association (e.g. a F1AP interface connection) may be set up with the target donor-CU 707 (between the IAB-DU2 706 and the target donor-CU 707). If the address of the target F1 donor-CU is not included in the request for activation, then by default and in the case where the IAB-MT 704 has been migrated to a non-F1 donor-CU 709, the non-F1 donor-CU 709 is considered as the target F1 donor-CU. In this case, the IAB-node 701 has already been informed of the identity (e.g. the TNL address/IP address) of the target F1 donor-CU when the IAB-MT 704 was migrated to the non-F1 donor-CU 709. In other words, the source F1 donor-CU 703 may send identification information for identifying the target F1 donor-CU 707 if the IAB-MT 704 has been migrated to a non-F1 donor-CU 709 different from (i.e. not the same as) the target F1 donor-CU 707. Alternatively, the source F1 donor-CU 703 may send identification information for identifying the non-F1 donor-CU 709 as the target IAB-donor-CU.

After determining the DU of the IAB-node 701 is to be migrated and once the IAB-DU2 706 has been activated, then, the IAB-DU2 706 may send a F1 setup request message (e.g. 1213 in figure 12b) to the target F1 donor-CU 707 for requesting set up of the F1 connection between the IAB-node 701 and the target F1 donor-CU 707. This message may include identification information for identifying the source IAB-donor-CU, such as the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the source F1 donor-CU 703 of the IAB-node 701. The destination address of the F1 setup request message is the target F1 donor-CU 707, and when this IP packet is received by the donor-DU in the F1 path for the IAB-node 701, it can be routed in the wired backhaul (508 in the figure 5) up to the target F1 donor-CU 707. For

instance, in an example where the IAB-node 701 is the IAB-node 570 of figure 5 which is connected to IAB-node 550 via backhaul link 5050 and where the MT (MT 571 which corresponds to IAB-MT 704 in figure 7) of the IAB-node 570 has been migrated to the non-F1 donor-CU 502 and the IAB-donor-CU 501 is the source F1 donor-CU, the F1 path between the F1 donor-CU 501 to the IAB-node 570 uses the donor-DU 506. In the case where the IAB-donor-CU 503 has been identified (by F1 donor-CU 501) as the target F1 donor-CU (e.g. target F1 donor-CU 707), the F1 setup request message for the target F1 donor-CU (for instance donor-CU 503) is sent through the IAB-nodes 550, 540 and then to the donor-DU 506 from where it can be routed in the wired backhaul (508 in the figure 5) up to the target F1 donor-CU 503. In the F1 setup response (e.g. 1214 in figure 12b), the target F1 donor-CU 707 (e.g. donor-CU 503 in the example described above with reference to figure 5) may request the IAB-DU2 706 to activate new cell(s) with associated identifiers (PCI, NCGI). Usually the DU activates/deactivates cell(s) under the control of the donor-CU which is controlling the DU. See, for example, TS 38.473 section 8.2.3.2.

After the procedure described with reference to figure 12b, and using, for example, the procedure described with reference figure 13a, the target F1 donor-CU 707 (e.g. in the configuration update message 1303) may inform the source F1 donor-CU 705 about the activation of new cell(s) from the IAB-DU2 706 of the IAB-node 701.

The next step 730 consists in the handover of UEs (e.g. UE 708 in figure 7) served by the IAB-node 701, from the cell(s) of the first logical DU IAB-DU1 705 to the cell(s) of the second logical DU IAB-DU2 706. This procedure may be the standardized procedure described in TS 38.300 section 9.2.3.2 (handover), or the standardized procedure described in TS 38.300 section 9.2.3.4 (conditional handover). In an example, to trigger the handover of the UE 708, the source F1 donor-CU 703 sends a HANDOVER REQUEST message to the target F1 donor-CU 707 including the necessary information related to the UE 708 to hand over (e.g. identification information identifying the UE, UE context information, such as the security context (e.g. security parameters such as security key, UE security capabilities), measurement configuration, radio configuration (e.g. UE radio capability), information about bearers, etc.). TS 38.423, section 9.1.1.1 provides details as to the content of a HANDOVER REQUEST message. After an admission control step in which the target F1 donor-CU 707 determines whether the donor-CU can accept the handover of the UE 708, when the target F1 donor-CU 707 accepts the request, the target F1 donor-CU 707 sends a handover acknowledgement message to the source F1 donor-CU 705, including configuration

information for the UE 708 for the handover. The configuration may include radio configuration information indicating the radio configuration to be used by the UE 708 to connect to the second logical DU IAB-DU2 706 of the IAB-node 701 in an identified target cell of the second logical DU IAB-DU2 706 (e.g. the radio configuration may include frequency, radio bearer configuration, etc.). The handover acknowledgement may include an identifier for each of the one or more new cells (e.g. the target cell(s)) that have been activated at the second logical DU IAB-DU2 706. Then, the source F1 donor-CU 705 sends this configuration information to the UE 708 via the IAB-node 701 in a RRC Reconfiguration message, including the identifier of the target cell of IAB-DU2 706 to which the UE 708 is to connect. The RRC Reconfiguration message (specified in TS 38.331) is embedded in a F1 message DL RRC MESSAGE TRANSFER (specified in TS 38.473), sent to the IAB-DU1 705 and relayed by the IAB-DU1 705 to the UE 708. Upon reception of this configuration information, the UE 708 performs a random-access procedure in the indicated target cell of IAB-DU2 706 to obtain uplink resources, and then to transmit a RRC Reconfiguration Complete message to the target F1 donor-CU 707. The RRC Reconfiguration Complete message (specified in TS 38.331) is sent to the IAB-DU2 706, and then embedded in a F1 message UL RRC MESSAGE TRANSFER (specified in TS 38.473), sent to the target F1 donor-CU 707. The source F1 donor-CU 705 may be informed about the completion of the UE 708 handover through the HANDOVER SUCCESS message (specified in TS 38.423) received from the target F1 donor-CU 707.

Once the handover of all UEs served by the IAB-DU1 705 of the IAB-node 701 is completed, the source F1 donor-CU 703 may deactivate the logical DU IAB-DU1 705 of the mobile IAB-node 701 through the procedure described with reference to figure 12c. This is represented generally by the procedure 735 in figure 7.

Also, the source F1 donor-CU 705 may release the traffic (user traffic, control traffic) related to the UEs that were served by the IAB-node 701 through the IAB-DU1 705 and the source F1 donor-CU 705. If the traffic was offloaded in an IAB topology controlled by the non-F1 donor-CU 709 (e.g. when the MT of the IAB-node 701 is migrated to the non-F1 donor-CU 709), the source F1 donor-CU 705 may apply the procedure described with reference to figure 13b to request the traffic release to the non-F1 donor-CU 709. This is represented generally by the procedure 735 in figure 7.

Finally, the target F1 donor-CU 707 has to setup the data path(s) to/from the migrated IAB-node 701, either in its own topology if there is a backhaul path to reach the IAB-node

701 in the IAB topology controlled by the target F1 donor-CU 707 (i.e. the target F1 donor-CU 707 is a non-F1 terminating donor-CU for the IAB-node 701 as the IAB-MT 704 has previously been migrated to the target F1 donor-CU 707), or through the IAB topology of the non-F1 donor-CU 709 of the IAB-node 701 if there is no backhaul path to reach the IAB-node 701 in the IAB topology controlled by the target F1 donor-CU 707 (i.e. IAB-MT 704 and IAB-DU2 706 are connected to different donor-CUs). In this latter case, the target F1 donor-CU 707 may trigger the transport migration and path switch procedure 731 including the request of traffic migration to the non-F1 donor-CU 709 of the IAB-node 701, described with reference to figure 13b, and the path switch procedure toward the core network 702. As an example of this latter case with reference to figure 5, the IAB-node 701 is the IAB-node 570 of figure 5 connected to IAB-node 550 via backhaul link 5050 and where the MT (MT 571 which corresponds to IAB-MT 704 in figure 7) of the IAB-node 570 has been migrated to the non-F1 donor-CU 502 and the IAB-donor-CU 501 is the F1 donor-CU. When the DU (DU 572 which corresponds to IAB-DU2 706 in figure 7) of the IAB-node 570 has been migrated to the target donor-CU 503, and so has a F1 connection to the F1 donor-CU 503, but the MT 571 remains connected through its RRC connection to the non-F1 donor-CU 502, (its RRC connection), the data path(s) or backhaul path(s) to/from the IAB-node 570 is set up in the IAB topology 5002 controlled by the IAB-donor-CU 502 (i.e. a backhaul path to the IAB-node 570 through the IAB-donor-DU 506, IAB-nodes 540 and 550) by performing the traffic migration procedure (e.g. as described with reference to figure 13b). Also, the target donor-CU 503 may perform a path switch procedure toward the core network 702 to request the delivery of the user data related to the UE 708/580. For example, target donor-CU 503 may perform the path switch handshake procedure described in 3GPP TS 38.413 v17.2.0 section 8.4.4.

After the handover of UE 708 and the setup of the new data paths has been performed (731), the user data in the downstream direction are transmitted by the core network 702 to the target F1 donor-CU 707 through the bearer 740, then they are transmitted to the logical DU IAB-DU2 706 of the IAB-node 701 through the backhaul bearer 741, and finally to the UE 708 through the data radio bearer 742. The backhaul bearer 741 may be established in the IAB topology controlled by the target F1 donor-CU 707, or in the IAB topology controlled by the non-F1 donor-CU 709 of the IAB-node 707 (e.g. depending on whether the IAB-MT 704 and IAB-DU2 706 of IAB-node 701 are connected to different donor-CUs). User data in the

upstream direction (not represented in the figure) are transmitted through similar bearers in the opposite direction.

To request traffic migration to a donor-CU (such as the non-F1 donor-CU 709 if the MT has migrated or the F1 donor-CU 703 if the MT has not migrated) of the IAB-node 701 when the target F1 donor-CU 707 is different (i.e. is not the same donor-CU) from the F1 donor-CU of the IAB-node (e.g. non-F1 donor-CU 709), the target F1 donor-CU 707 needs to be able to identify the non-F1 donor-CU 709.

Figure 14 is a flowchart showing an example method 1400 in accordance with one or more embodiments of the invention, performed at a target IAB-donor-CU for use in managing transport migration for traffic related to an IAB-node. The transport migration is to be performed after a DU of the IAB-node has been migrated from a source IAB topology managed by a source IAB-donor-CU to a target IAB topology managed by the target IAB-donor-CU. Method 1400 may be performed as part of a DU migration process for migrating the DU of the IAB-node. For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the source IAB-donor-CU performing the method 1400 may be the IAB-donor-CU 501 (e.g a F1 terminating donor-CU of the IAB-node 570 with which the IAB-node 570 retains a F1 connection). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (e.g. source IAB topology) controlled by the IAB-donor-CU 501 (e.g. the source F1 IAB-donor-CU). The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (e.g. target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. The method 1400 as shown in and described with respect to figure 14 may be performed by software elements and/or hardware elements. The source IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 14 being performed by an apparatus for the target IAB-donor-CU including one or more processing units, such as the central processing unit 411.

Briefly, at step 1402, the target IAB-donor-CU 503 receives a notification including identification information for identifying an IAB-donor-CU serving a MT of the IAB-node 570 (e.g. the MT, such as MT 571, that is co-located with the DU of the IAB-node, such as DU 572). The IAB-donor-CU serving the MT of the IAB-node is a different IAB-donor-CU to the target IAB-donor-CU. The IAB-donor-CU serving the MT of the IAB-node 570 may be the source IAB-donor-CU (e.g. the source F1 IAB-donor-CU such as IAB-donor-CU 501

is the non-F1 IAB-donor-CU) when the MT of the IAB-node 570 has not been migrated from the source IAB-donor-CU). Alternatively, the IAB-donor-CU serving the MT of the IAB-node 570 may be another or a second IAB-donor-CU (e.g. the non-F1 IAB-donor-CU or RRC IAB-donor CU such as IAB-donor-CU 502) when the MT of the IAB-node 570 has been migrated to the second IAB-donor-CU, such as IAB-donor-CU 502. Whether the non-F1 IAB-donor-CU for the migrated MT of the IAB-node 570 is the source F1-donor-CU 501 or the non-F1 IAB-donor-CU 502, in either case, the target IAB-donor-CU is the different IAB-donor-CU 503.

As will be discussed in more detail below with reference to figures 8, 9a-9d, the target IAB-donor-CU 503 may receive the notification from the source IAB-donor-CU 501, such as in a DU migration notification which includes the identification information or in a configuration update notification which includes the identification information or from the IAB-node 570, such as in a F1 setup request which includes the identification information. The DU migration notification sent by the source IAB-donor-CU 501 may be the DU migration notification message 811 as discussed below with reference to figure 8 and figures 9a and 9d. The configuration update notification sent by the source IAB-donor-CU 501 may be the configuration update notification message 817 as discussed below with reference to figure 8 and figures 9a and 9d. The F1 setup request sent by the IAB-node 570 may be the F1 setup request message 814 as discussed below with reference to figure 8 and figures 9b, 9c and 9d. The F1 setup request is sent, by the IAB-node, after receiving, from the source IAB-donor-CU 501, a request for establishing a F1 connection (e.g. a new F1 connection) and for informing the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT of the IAB-node. The request from the source IAB-donor-CU 501 may be sent in the DU activation request 813. The request from the source IAB-donor-CU 501 may indicate (explicitly or implicitly) to the IAB-node that the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT of the IAB-node. For example, the request from the source IAB-donor-CU 501 may include information for indicating to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT. The information may include an Information Element, IE, for indicating the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT of the IAB-node as discussed below with respect to figure 12a and the configuration request message 1203. The presence of the IE in the request for establishing a F1 connection may indicate to the IAB-node the IAB-node is to inform the

target IAB-donor-CU of the identity of the IAB-donor-CU, or when the IE has a certain value (e.g. the IE may be one bit and the certain value may be '1' or '0'), it may indicate to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU. In another example, the information may include identification information for identifying the IAB-donor-CU serving the MT of the IAB-node 570 and the presence of the identification information in the request may itself indicate to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU.

As will be discussed in more detail below with reference to figures 10, 11a-11c, when the IAB-donor-CU serving the MT of the IAB-node 570 is another IAB-donor-CU managing another IAB topology (e.g. the MT has migrated to another IAB-donor-CU, such as second IAB-donor-CU 502 managing a second IAB topology 5002), the target IAB-donor-CU 503 may receive the notification from the second IAB-donor-CU 502 (e.g. a non-F1 donor-CU or RRC donor-CU). In this case, the notification may be sent in a transport migration ready notification which includes the identification information, such as in a transport migration ready message 1013 as discussed below with reference to figure 10 and figures 11a-11c.

The identification information for identifying an IAB-donor-CU serving the MT of the IAB-node 570 may be an identifier such as the TNL address (i.e. IP address) of the IAB-donor-CU serving the MT of the IAB-node and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3).

The notification may also include identification information for identifying the MT 571 of the IAB-node 570. For example, the identification information may be an identifier of the MT 571 of the IAB-node 570 known by the IAB-donor-CU serving the MT 571 of the IAB-node 570 (e.g. known by the F1 donor-CU 501 (when the MT has not been migrated) or by the non-F1 donor-CU 502 (when the MT has been migrated)). When the MT has been migrated, the identifier is known by the non-F1 donor-CU 502 by the information element *non-F1-Terminating IAB-donor UE XnAP ID*, defined in TS 38.423 section 9.2.3.16, or RRC-*Terminating IAB-donor UE XnAP ID information element*, as a *NG-RAN* node UE XnAP ID that uniquely identifies a UE over the Xn interface within the NG-RAN node. Thus, each donor-CU assigns a value to each MT of an IAB-node in its IAB topology (as the IAB-MT is considered as a UE). Another identifier of the MT of an IAB-node known by the non-F1 donor-CU (or RRC donor-CU) is the BAP address that is assigned by this non-F1 donor-CU. Indeed, each IAB-donor-CU that terminates a RRC connection with an IAB-node has to assign a BAP address to this IAB-node (to use it as the destination BAP address for the

BAP packets to be routed to this IAB-node in the IAB topology controlled by this IAB-donor-CU).

At step 1404, the target IAB-donor-CU 503 then, based on the identification information included in the notification (received from the source IAB-donor-CU 501 or the IAB-node 570 as discussed above) and after the DU 572 of the IAB-node 570 has been migrated to the target IAB topology 5003, performs transport migration for migrating traffic (e.g. F1 traffic which may include control and user traffic) related to or associated with the IAB-node 570 for routing over at least one path between the target IAB-donor-CU 503 and the IAB-node 570 through the IAB topology managed by the IAB-donor-CU serving the MT 571 of the IAB-node 570 (e.g. through IAB topology 5001 managed by source IAB-donor-CU 501 when the MT has not been migrated from the source F1 IAB-donor-CU 501 or through IAB topology 5002 managed by non-F1 IAB-donor-CU 502 when the MT has been migrated to the non-F1 IAB-donor-CU 502). For example, the target IAB-donor-CU 503 sends, to the IAB-donor-CU serving the MT 571 of the IAB-node 570, a traffic migration request (e.g. message 1014 in figure 10, message 1313 in figure 13b).

Figure 8 is a simplified diagram 800 illustrating example message flows, according to one or more embodiments of the invention, for providing identification information identifying a IAB-donor-CU that is serving a MT of a IAB-node (e.g. a non-F1 terminating donor-CU or a RRC terminating donor-CU) to a target IAB-donor-CU (e.g. the F1 terminating donor-CU) of a DU migration of the IAB-node, as part of a DU migration process of the IAB-node for use in managing or facilitating transport migration. The target IAB-donor-CU may be provided the identification information in a notification received from the source IAB-donor-CU, such as in a DU migration notification or a configuration update notification, or in a notification received from the IAB-node, such as in a F1 setup request. These examples are discussed below.

This figure 8 shows a source F1 donor-CU 803 like the donor-CU 501, a target F1 donor-CU 807 like the donor-CU 503, and an IAB-node 801 that may be a mobile IAB-node like the IAB-node 570 composed of a MT part or unit IAB-MT 804, a DU part or unit IAB-DU1 805 (e.g. source or first logical DU entity or DU), and a DU part or unit IAB-DU2 806 (e.g. target or second logical DU entity or DU). Each of the first 805 and second 806 logical DU entities serve one or more cells. IAB-DU1 805 and IAB-DU2 806 are two logical DU entities that share the same hardware for the BAP, RLC, and MAC layers. In one example,

they share the same physical layer (i.e. the same hardware resources), while in another example they rely on separated physical layers.

At the beginning of the flow, the IAB-node 801 belongs to the source IAB topology controlled by the source F1 donor-CU 803. Upon the decision of or determination by the source F1 donor-CU 803 to perform the DU migration of the IAB-node 801 toward the IAB topology managed by the target F1 donor-CU 807, the first step corresponds to sending a DU activation request message 813 to the IAB-node 801, to establish a new F1 connection between the target F1 donor-CU 807 and the mobile IAB-node 801, through the second logical DU IAB-DU2 804. The activation of the second logical IAB-DU2 806 in the mobile IAB-node 801 is performed with the operation 810. The message 813 sent by the source F1 donor-CU 803 to the IAB-node 801 for the activation of the IAB-DU2 806 is sent to the first logical DU IAB-DU1 805 as the source F1 donor-CU 803 has a F1 connection with this first logical DU of the IAB-node 801. The DU activation request message 813 may be a configuration request message 1203 as shown in figure 12a. This message 813 includes a request for establishing a F1 connection and for informing the target donor-CU 807 of the identity of the IAB-donor-CU serving the MT 804 of the IAB-node 801. The request may indicate (explicitly or implicitly) to the IAB-node 801 that the IAB-node is to inform the target donor-CU 807 of the identity of the IAB-donor-CU serving the MT of the IAB-node (e.g. when the target donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node).

After activation of the second logical DU IAB-DU2 806, the information contained in the message 813 may be transmitted from the first logical DU IAB-DU1 805 to the second logical DU IAB-DU2 806.

In particular, the message 813 may include identification information for identifying the target donor-CU 807, such as the TNL address (i.e. IP address) of the target F1 donor-CU 807, so that a new F1 connection or F1 association (e.g. a F1AP interface connection) may be set up with the target donor-CU 807 (between the IAB-DU2 806 and the target donor-CU 807). This message 813 may also include a request to inform the identified target F1 donor-CU 807 of the identity of the IAB-donor-CU that is serving the MT 804 of the IAB-node 801, such as the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the IAB-donor-CU that is serving the MT 804 of the IAB-node 801. The message 813 may include information for indicating to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-

donor-CU serving the MT. The information may include an Information Element (IE) for indicating the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT of the IAB-node (see discussions below with respect to figure 12a and configuration request message 1203). For example, when the MT has not been migrated from the source F1 donor-CU 803, the IAB-donor-CU serving the MT 804 is the source F1 donor-CU 803 of the IAB-node 801 and when the MT has been migrated, the IAB-donor-CU serving the MT 804 is a non-F1/RRC donor-CU of the IAB-node 801 (the non-F1 donor-CU is not shown in figure 8). The message 813 may also include identification information for identifying the IAB-donor-CU that is serving the MT 804 of the IAB-node 801, such as the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the IAB-donor-CU that is serving the MT 804 of the IAB-node 801. In an example, the information for indicating to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT 804 may include the identification information for identifying the IAB-donor-CU serving the MT 804 of the IAB-node 801 and the presence of the identification information may itself indicate to the IAB-node 801 that the IAB-node is to inform the target F1 donor-CU 807 of the identity of the IAB-donor-CU serving the MT 804. In addition, the message 813 may include the identifier of the IAB-MT 804 known by the IAB-donor-CU serving the MT 804 of the IAB-node 801. In the case the IAB-donor-CU serving the MT 804 is the non-F1 donor-CU, the message 813 may include the identifier with the information element *non-F1-Terminating IAB-donor UE XnAP ID*, defined in TS 38.423 section 9.2.3.16, or RRC-*Terminating IAB-donor UE XnAP ID information element*, as a *NG-RAN node UE XnAP ID* that uniquely identifies a UE over the Xn interface within the NG-RAN node. Thus, each donor-CU assigns a value to each MT of an IAB-node in its IAB topology (as the IAB-MT is considered as a UE). The F1 donor-CU 803 will have assigned an ID to the IAB-MT 804 when it was admitted in its IAB topology. At MT migration, the non-F1 donor-CU will assign another ID to IAB-MT 804. Both IDs are exchanged in handover request/acknowledge messages.

Once activated, the IAB-DU2 806 may send a F1 setup request message 814 to the target F1 donor-CU 807 for requesting the setup of the F1 connection between the IAB-node 801 and the target F1 donor-CU 807. This message 814, also described with the reference 1213 at the figure 12b, may include identification information for identifying the source F1 donor-CU 803, such as the TNL address (i.e. the IP address) and/or the identifier (i.e. Global

NG-RAN Node ID as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the source F1 donor-CU 803 of the IAB-node 801. This message 814 includes identification information for identifying the IAB-donor-CU serving the MT 804 of the IAB-node 801 (e.g. when the target donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node). If the non-F1 donor-CU is different from the target F1 donor-CU 807, this message 814 includes the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the non-F1 donor-CU of the IAB-node 801. In addition, the message 814 may include the identifier of the IAB-MT 804 known by IAB-donor-CU serving the MT 804 of the IAB-node 801. In the case the IAB-donor-CU serving the MT 804 is the non-F1 donor-CU, the message 814 may include the identifier known by the non-F1 donor-CU with the information element *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC terminating IAB-donor UE XnAP ID*. The message 814 may additionally or alternatively include the identifier of the IAB-MT 804 known by the non-F1 donor-CU with the information element *BAP address* (i.e. the BAP address assigned by the non-F1 donor-CU or RRC donor-CU when the mIAB-MT 804 has established a RRC connection and has received its BAP address in a RRC Reconfiguration message from the non-F1/RRC donor-CU). The BAP address information element is, for instance, described in TS 38.423 V17.2.0 section 9.2.2.89. Finally, the message 814 may include the identifier *gNB-DU ID* of the second logical DU IAB-DU2 806 of the IAB-node 801. As specified in TS 38.473 section 9.3.1.19, the *gNB-DU ID* uniquely identifies the gNB-DU at least within a gNB-CU. Thus, a logical DU of an IAB-node is assigned a unique ID by configuration. The unique ID may be provided to the F1 IAB-donor-CU terminating the F1 connection with the logical DU at F1 setup procedure (described in the figure 12b).

In the F1 setup response 815 (and also described with the reference 1214 in figure 12b), the target F1 donor-CU 807 may request the IAB-DU2 806 to activate new cell(s) with associated identifiers (PCI, NCGI). Usually the DU activates/deactivates cell(s) under the control of the donor-CU which is controlling the DU. See, for example, TS 38.473 section 8.2.3.2.

After reception of the F1 setup response message 815, the IAB-DU2 806 may inform the IAB-DU1 805 about the result of the activation procedure (i.e. activation of IAB-DU2 806 and activation of new cell(s)). Then, the IAB-DU1 805 may relay this information to the source F1 donor-CU 803 through the message DU activation response 816. This

message 816 may include the *gNB-DU ID* of the second logical DU IAB-DU2 806 of the IAB-node 801. The message 816 is further described with the reference 1204 in figure 12a.

As another example method to provide identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target F1 terminating donor-CU for the DU migration of an IAB-node, the source F1 donor-CU 803 may directly send a notification to the target donor-CU 807 including identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. when the target donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node). The notification may be sent in a DU migration notification message 811 to the target F1-donor-CU 807. The message 811 may be sent prior to launching the IAB-DU2 806 setup procedure (reference 720 in figure 7, and references 810, 813, 814, 815, 816 in figure 8). The message 811 may be followed by the DU migration response message 812 sent by the target F1 donor-CU 807 to the source F1 donor-CU 803 as an acknowledgment. The messages 811 and 812 may correspond to the procedure described with reference to figure 13a where message 811 corresponds to message 1303 and message 812 corresponds to message 1304. In another example, the messages 811 and 812 may correspond to the procedure described with reference to figure 13b where message 811 corresponds to message 1313 and message 812 corresponds to message 1314. This message 811 includes identification information for identifying the IAB-donor-CU serving the MT 804 of the IAB-node 801. If the MT 804 has been migrated to a non-F1/RRC donor-CU and if this non-F1 donor-CU is different from the target F1 donor-CU 807, the DU migration notification message 811 may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the non-F1 donor-CU of the IAB-node 801. The message 811 may also include the identifier of IAB-node 801 as known by the source F1 donor-CU 803, either with the information element *F1-Terminating IAB-donor UE XnAP ID* identifying the MT 804 of the IAB-node 801, or with the information element *gNB-DU ID* identifying the first logical DU IAB-DU1 805 of the IAB-node 801. In addition, the message 811 may include the identifier of IAB-node 801 as known by the IAB-donor-CU serving the MT 804 of the IAB-node 801. In the case the IAB-donor-CU serving the MT 804 is the non-F1 donor-CU 803, the message 811 may include the identifier as known by the non-F1 donor-CU, with the information element *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC-Terminating IAB-donor UE XnAP ID* identifying the MT 804 of the IAB-node 801. The

message 811 may also or alternatively include the BAP address assigned by the non-F1/RRC donor-CU. This involves that this BAP address was previously provided to the F1 donor-CU 803, for instance by the non-F1 donor-CU when the MT 804 was migrated (for instance using the procedure described at the figure 13a).

*F1-Terminating IAB-donor UE XnAP ID* and *non-F1-Terminating IAB-donor UE XnAP ID* (or *RRC-Terminating IAB-donor UE XnAP ID)* correspond to a *NG-RAN node UE XnAP ID* as specified in TS 38.423 section 9.2.3.16.

As another example method to provide identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target F1 terminating donor-CU for the DU migration of an IAB-node, the source F1 donor-CU 803 may directly send a notification to the target donor-CU 807 including identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. when the target F1 donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node). The notification may be sent in a configuration update message 817 to the target F1-donor-CU 807. The message 817 may be sent at any time, before or after the launching of IAB-DU2 806 procedure (reference 720 in figure 7, and references 810, 813, 814, 815, 816 in figure 8). It may also be sent when the source F1 donor-CU 803 has detected a change of non-F1/RRC donor-CU for the IAB-node 801. For instance, if a MT migration process of the IAB-node 801 is performed during the DU migration of the IAB-node 801, and if the source F1 donor-CU 803 has already provided the address and/or identifier of the old non-F1/RRC donor-CU to the target F1 donor-CU 807, then the source F1 donor-CU can send an update through the message 817 including the address/identifier of the new non-F1/RRC donor-CU.

Thus, the configuration update message 817 includes identification information for identifying the IAB-donor-CU serving the MT 804 of the IAB-node 801. For example, the message 817 may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the non-F1 donor-CU of the IAB-node 801 if this non-F1 donor-CU is different from the target F1 donor-CU 807. In addition, the message 817 may include the identifier of IAB-node 801 as known by the IAB-donor-CU serving the MT 804 of the IAB-node 801. In the case the IAB-donor-CU serving the MT 804 is the non-F1 donor-CU 803, the message 817 may include the identifier as known by the non-F1 donor-CU, with the information element *non-F1-Terminating IAB-donor UE XnAP ID* (or *RRC-Terminating IAB-donor UE XnAP ID*)

identifying the MT 804 of the IAB-node 801. The message 817 may also or alternatively include the BAP address assigned by the non-F1/RRC donor-CU. This involves that this BAP address was previously provided to the F1 donor-CU 803, for instance by the non-F1 donor-CU when the MT 804 was migrated (for instance using the procedure described at the figure 13a). The message 817 may also include the *gNB-DU ID* identifying the first logical DU IAB-DU1 805 of the IAB-node 801 and/or the *gNB-DU ID* identifying the second logical DU IAB-DU2 806 of the IAB-node 801.

The information identifying the IAB-donor-CU that is serving the MT of the IAB-node and the identifier of IAB-node 801 as known by the IAB-donor-CU serving the MT 804 may also be present in the message 817 when the target F1 donor-CU 807 is the IAB-donor-CU serving the MT of the IAB-node 801. This would avoid any confusion at the target F1 donor-CU 807 to understand that the DU migration is related to the same IAB-node 801 as the MT 804.

The message 817 may be followed by the configuration acknowledgment message 818 sent by the target F1 donor-CU 807 to the source F1 donor-CU 803.

The messages 817 and 818 may correspond to the procedure described at the figure 13a with message 817 corresponding to configuration update message 1303 and message 818 corresponding to configuration acknowledge message 1304.

To communicate the identifier of the non-F1 donor-CU to the target F1 donor-CU 807, the source F1 donor-CU 803 will need to know this identifier. In case the MT 804 of the IAB-node 801 was previously migrated and the source F1 donor-CU 803 was the source non-F1/RRC donor-CU for this MT migration, or in case the MT 804 of the IAB-node 801 is migrated during the DU migration and the source F1 donor-CU 803 is also the source non-F1/RRC donor-CU for this MT migration, then the source F1 donor-CU 803 automatically knows the identifier of the target non-F1/RRC donor-CU, which can be indicated to the target F1 donor-CU through the message 817. In case of consecutive MT migration, the source non-F1 donor-CU for the MT migration is not the source F1 donor-CU 803. To be informed of the identifier of the target non-F1 donor-CU (i.e. the new non-F1 donor-CU), the source F1 donor-CU 803 may receive a message (not represented in the figure) from the source non-F1/RRC donor-CU, for instance when the MT migration is completed. To inform the target F1 donor-CU of the identifier of the non-F1 donor-CU, the source F1 donor-CU 803 may relay the message received from the source non-F1 donor-CU. The source non-F1 donor-CU for the MT migration of an IAB-node may inform the F1 donor-CU of the IAB-node about

the identifier of the target non-F1/RRC donor-CU through the procedure described with reference to the figure 13a.

With a consecutive MT migration for a mobile IAB-node, the F1 donor-CU of an IAB-node may not be the source donor-CU of the previous MT migration. Besides, it can be noted that during the DU migration of an IAB-node, there may be two different donor-CUs serving the two logical DUs of the IAB-node. Then the question that can be raised is how does the source non-F1 donor-CU for a MT migration identify the F1 donor-CU for the IAB-node.

It can be proposed that a F1 donor-CU for an IAB-node is a donor-CU that has triggered a transport migration management (TMM) procedure for traffic related to the IAB-node. Indeed, a MT migration process includes a MT handover process similar to a UE handover, followed by a TMM procedure initiated by the F1 donor-CU to transmit/receive packets related to the IAB-node through the IAB topology controlling the non-F1 donor-CU. The TMM procedure corresponds to the procedure described in the figure 13b.

However, it has to be considered the particular case where there is no active transport migration established for a migrated IAB-node. Therefore, it is proposed that the source non-F1 donor-CU for a MT migration informs the target non-F1 donor-CU about the F1 donor-CU of the migrated IAB-node. This can be performed through the procedure described with the figure 13a.

Besides, if a DU migration occurs while there is no active transport migration, the non-F1 donor-CU should be informed about the new F1 donor-CU. Then, it may be considered that at DU migration of an IAB-node, the source F1 donor-CU informs the non-F1 donor-CU serving the collocated MT about the target-F1 donor-CU. This can be performed through the procedure described with the figure 13a.

As another example method to provide identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target F1 terminating donor-CU for the DU migration of an IAB-node, the IAB-node 801 may directly send a notification to the target F1 donor-CU 807 including identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. when the target donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node). The notification may be sent in a configuration update message 819 from the IAB-DU2 806 to the target F1-donor-CU 807. The information identifying the IAB-donor-CU that is serving the MT of the IAB-node may also be present in the configuration update message 819 when the target F1 donor-

CU 807 is the IAB-donor-CU serving the MT of the IAB-node 801. This would avoid any confusion at the target F1 donor-CU 807 to understand that the DU migration is related to the same IAB-node 801 as the MT 804. The configuration update message 819 may be sent at any time after the completion of IAB-DU2 806 setup procedure (reference 720 in figure 7, and references 810, 813, 814, 815, 816 in figure 8). It may also be sent when the IAB-node 801 has detected a change of non-F1/RRC donor-CU. For instance, if a MT migration process of the IAB-node 801 is performed during the DU migration of the IAB-node 801. This example method assumes that the IAB-MT 804 informs the IAB-DU2 806 of the current non-F1 donor-CU through an internal communication in the IAB-node 801 between IAB-MT 804 and IAB-DU2 806.

Thus, the configuration update message 819 includes identification information for identifying the IAB-donor-CU serving the MT 804 of the IAB-node 801. For example, the configuration update message 819 may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the non-F1 donor-CU of the IAB-node 801. In addition, the configuration update message 819 may include the identifier of IAB-node 801 as known by the IAB-donor-CU serving the MT 804 of the IAB-node 801 (e.g. the *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC-Terminating IAB-donor UE XnAP ID* identifying the MT 804, and/or the BAP address identifying the MT 804). It may also include the gNB-DU ID identifying the first logical DU IAB-DU1 805 of the IAB-node 801 and/or the gNB-DU ID identifying the second logical DU IAB-DU2 806 of the IAB-node 801.

The identification information (i.e. the identifier of the IAB-donor-CU serving the MT 804 and the identifier of the MT 804 as known by this IAB-donor-CU) may be provided to the MT 804 by the IAB-donor-CU serving the MT 804. For instance, the IAB-donor-CU serving the MT 804 may use the message RRCReconfiguration, specified in TS 38.331 V17.2.0, and amended to include an information element for its TNL address (i.e. the IP address) and/or its identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3), and its identifier for the MT 804 (i.e. *non-F1-Terminating IAB-donor UE XnAP ID,* defined in TS 38.423 section 9.2.3.16 or *RRC-Terminating IAB-donor UE XnAP ID*). For instance, the RRCReconfiguration message is sent when the IAB-node 801 is integrated to the network (i.e. at the first connection to an IAB-donor-CU), and following a migration of the MT 804 of the IAB-node 801. In this latter case, the RRCReconfiguration message is sent by the target non-F1 donor-CU during the IAB inter-CU topology adaptation

procedure described in TS 38.401 V17.2.0 section 8.17.3. RRCReconfiguration message may also indicate the BAP address assigned to the IAB-node 801 by the non-F1 donor-CU.

The configuration update message 819 may be followed by a configuration acknowledgment message 820 sent by the target F1 donor-CU 807 to IAB-DU2 806.

The messages 819 and 820 may correspond to the procedure described with reference to the figure 12d with the configuration update message 819 corresponding to configuration update message 1233 and the configuration acknowledgment message 820 corresponding to configuration acknowledge message 1234.

Figure 9a is a flowchart of an example method 900 in accordance with embodiments of the present invention, for managing, at the source IAB-donor-CU (e.g. F1 terminating donor-CU) of an IAB-node, the DU migration of the IAB-node with the indication of a IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1/RRC terminating donor-CU) to the target IAB-donor-CU (e.g. F1 terminating donor-CU). For example, method 900 in accordance with embodiments of the present invention is performed at the source IAB-donor-CU and is for use in managing, or as part of, a migration process/procedure for migrating a DU of an IAB-node to a target IAB-donor-CU and for providing identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target IAB-donor-CU (e.g. the F1 terminating donor-CU) for use in managing or facilitating transport migration which is performed after DU migration of the IAB-node.

For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the source IAB-donor-CU performing the method 900 may be the IAB-donor-CU 501 (e.g a F1 terminating donor-CU or F1 donor-CU of the IAB-node 570 with which the IAB-node 570 retains a F1 connection). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (also referred to as target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. With reference to figures 7 and 8, the IAB-node may be IAB-node 701, 801 and the migration process may involve the migration of the DU of the IAB-node 701, 801 from the source F1 donor-CU 703, 803 to the target F1 donor-CU 707, 807. The method 900 as shown in and described with respect to figure 9a may be performed by software elements and/or hardware elements. The source IAB-donor-CU may be implemented in a

communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 9a being performed by an apparatus for the source IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 901, the source F1 terminating donor-CU, like the donor-CU 501 of figure 5 (703, 803), determines that the DU of the IAB-node, like the IAB-node 570 of figure 5 (701, 801) is to be migrated from the source F1 donor-CU 501, 703, 803 to a target F1 donor-CU, like the donor-CU 503 of figure 5 (707, 807). For example, the source F1 donor-CU 501, 703, 803 decides the DU migration of an IAB-node, like the IAB-node 570, toward a target F1 donor-CU, like the donor-CU 503, 707, 807. For example, the source F1 donor-CU 501, 703, 803 may determine that the DU 572 of the IAB-node 570, 701, 801 is to be migrated in response to determining the migration of the MT 571, 704, 804 of the IAB-node 570, 701, 801 toward a new parent IAB-node (which may be a new IAB-node or a new IAB-donor-DU) has been completed. Examples of other triggers for determining the DU is to be migrated are described above. Details of how the source F1 donor-CU 501, 703, 803 determines the target F1 terminating donor-CU 503, 707, 807 is also described above.

At step 902, the source F1 terminating donor-CU 501, 703, 803 may execute or perform the DU migration of the IAB-node through the procedure described with the reference 720 in figure 7. Besides, the step 902 may be executed after the step 903 or step 904.

At step 903, the source F1 terminating donor-CU 501, 703, 803 sends to the target F1 donor-CU 503, 707, 807 a notification including identification information for identifying the IAB-donor-CU serving the MT 571 of the IAB-node 570. For example, when the MT 571 has been migrated to a non-F1/RRC terminating donor-CU, the notification includes identification information for identifying the non-F1 terminating donor-CU of the IAB-node 570, 701, 801. The non-F1/RRC terminating donor-CU may be the donor-CU 502 in figure 5 (the donor-CU 709 in figure 7). The indication of the non-F1 terminating donor-CU 502, 709 may be sent only if this non-F1 terminating donor-CU 502, 709 is different from the target F1 donor-CU 503, 707, 807 (in other words, when the non-F1 donor-CU 502, 709 is not the same IAB-donor-CU as the target F1 donor-CU 503, 707, 807). The message sent at step 903 may be the message 811 or the message 817 in figure 8.

At step 904, the source F1 terminating donor-CU 501, 703, 803 may receive an acknowledgment from the target F1 terminating donor-CU 503, 707, 807. The message received at step 904 may be the message 812 or the message 818 in figure 8.

Figure 9b is a flowchart of another example method 910 in accordance with embodiments of the present invention, for managing, at the source IAB-donor-CU (e.g. F1 terminating donor-CU) of an IAB-node, the DU migration of the IAB-node with the indication of a IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or a RRC terminating donor-CU) to the target IAB-donor-CU (e.g. F1 terminating donor-CU). For example, method 910 in accordance with embodiments of the present invention is performed at the source IAB-donor-CU and is for use in managing, or as part, of a migration process/procedure for migrating a DU of an IAB-node to a target IAB-donor-CU and for providing identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target IAB-donor-CU (e.g. the F1 terminating donor-CU) for use in managing or facilitating transport migration which is performed after DU migration of the IAB-node.

For example, with reference to the IAB communication system shown 500 in and described with respect to figure 5, the source IAB-donor-CU performing the method 910 may be the IAB-donor-CU 501 (e.g a F1 terminating donor-CU or F1 donor-CU of the IAB-node 570 with which the IAB-node 570 retains a F1 connection). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (also referred to as target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. With reference to figures 7 and 8, the IAB-node may be IAB-node 701, 801 and the migration process may involve the migration of the DU of the IAB-node 701, 801 from the source F1 donor-CU 703, 803 to the target F1 donor-CU 707, 807. The method 910 as shown in and described with respect to figure 9b may be performed by software elements and/or hardware elements. The source IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 9b being performed by an apparatus for the source IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 911, the source F1 terminating donor-CU, like the donor-CU 501 of figure 5 (703, 803), determines that the DU of the IAB-node, like the IAB-node 570 of figure 5 (701, 801) is to be migrated from the source F1 donor-CU 501, 703, 803 to a target F1 donor-CU,

like the donor-CU 503 of figure 5 (707, 807). For example, the source F1 donor-CU 501, 703, 803 decides the DU migration of an IAB-node, like the IAB-node 570, 701, 801, toward a target F1 donor-CU, like the donor-CU 503, 703, 803. For example, the source F1 donor-CU 501, 703, 803 may determine that the DU of the IAB-node 570, 701, 801 is to be migrated in response to determining the migration of the MT 571, 704, 804 of the IAB-node 570, 701, 801 toward a new parent IAB-node (which may be a new IAB-node or a new IAB-donor-DU) has been completed. Examples of other triggers for determining the DU is to be migrated are described above. Details of how the source F1 donor-CU 501, 703, 803 determines the target F1 terminating donor-CU 503, 707, 807 is also described above.

At step 912, the source F1 terminating donor-CU 501, 703, 803 sends to the IAB-node 570, 701, 801 a request for establishing a F1 connection (i.e. a new F1 connection) between the target IAB-donor-CU 503, 707, 807 and the IAB-node 570, 701, 801 (e.g. a new F1 association with the target IAB-donor-CU) and for informing the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node 570, 701, 801. For example, the source F1 terminating donor-CU 501, 703, 803 sends to the IAB-node 570, 701, 801 to be migrated, a request for a new F1 connection. The request from the source F1 terminating donor-CU 501, 703, 803 may indicate (explicitly or implicitly) to the IAB-node 570, 701, 801 that the IAB-node is to inform the target IAB-donor-CU 503, 707, 807 of the identity of the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node 570, 701, 801. For example, the request from the source IAB-donor-CU 501 may include information for indicating to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT. The information may include an Information Element, IE, for indicating the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT of the IAB-node as discussed below with respect to figure 12a and the configuration request message 1203. The presence of the IE in the request for establishing a F1 connection may indicate to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU or when the IE has a certain value (e.g. the IE may be one bit and the certain value may be ‘1’ or ‘0’) may indicate to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU. The request may also include identification information for identifying an IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node 570, 701, 801 (such as the non-F1/RRC terminating donor-CU 502 when the MT has been migrated to the IAB-donor-CU 502 or the F1 terminating donor-CU 501 when the MT has not been migrated). In another example, the

information may include identification information for identifying the IAB-donor-CU serving the MT of the IAB-node 570 and the presence of the identification information in the request may itself indicate to the IAB-node the IAB-node is to inform the target IAB-donor-CU of the identity of the IAB-donor-CU. The request may be the message 813 described with reference to figure 8. With this message, the source F1 donor-CU 501, 703, 803 may send, to the IAB-node 570, 701, 801 the request to indicate a non-F1/RRC terminating donor-CU to the target F1 terminating donor-CU 503, 707, 807. The non-F1/RRC terminating donor-CU may be the donor-CU 502 in figure 5 (709 in figure 7).

At step 913, the source F1 terminating donor-CU 501, 703, 803 may receive an acknowledgment of activation from the IAB-node 570, 701, 801. The message received at step 913 may be the message 816 shown in and described with respect to figure 8.

Figure 9c is a flowchart of an example method 920 in accordance with one or more embodiments of the invention, performed at an IAB-node to perform F1 setup request to a target donor-CU while indicating the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or a RRC terminating donor-CU). For example, method 920 in accordance with embodiments of the present invention is performed at the IAB-node and is for use in, or as part of, a migration process/procedure for migrating a DU of an IAB-node to a target IAB-donor and for providing identification information identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) to the target IAB-donor-CU (e.g. the F1 terminating donor-CU) for use in managing or facilitating transport migration which is performed after DU migration of the IAB-node.

For example, with reference to the IAB communication system shown 500 in and described with respect to figure 5, the IAB-node performing the method 920 may be the mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501 (e.g. a F1 terminating donor-CU of the mobile IAB-node 570 with which the mobile IAB-node 570 retains a F1 connection) which is the source IAB-donor-CU. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (also referred to as target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. With reference to figures 7 and 8, the IAB-node may be mobile IAB-node 701, 801 and the migration process may involve the migration of the DU of the IAB-node 701, 801 from the source F1 donor-CU 703, 803 to the target F1 donor-CU 707, 807. The method 920 as shown

in and described with respect to figure 9c may be performed by software elements and/or hardware elements. The IAB-node may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 9c being performed by an apparatus for the IAB-node including one or more processing units, such as the central processing unit 411.

At step 921, an IAB-node, like the IAB-node 570 of figure 5 (701, 801), receives from a source F1 terminating donor-CU, like the donor-CU 501 of figure 5 (703, 803), a request for establishing a F1 connection or a new F1 connection (for example, a F1 connection between the IAB-node 570, 701, 801 and a target F1 donor-CU, like the donor-CU 503 of figure 5 (707, 807)) and for informing the target IAB-donor-CU of the identity of the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node. The request may be the message 813 described with reference to figure 8, and the request includes a request to indicate the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node (e.g. a non-F1/RRC terminating donor-CU) to the target F1 donor-CU 503, 707, 807. The non-F1/RRC terminating donor-CU may be the donor-CU 502 in figure 5 or the donor-CU 709 in figure 7. The request may include identification information for identifying the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node. Alternatively to receiving the identity from the request sent by the source F1 terminating donor-CU 501, 703, 803, the IAB-node may already know the identity of the IAB-donor-CU serving the MT 571, 704, 804 of the IAB-node. For example, the IAB-node may obtain this information at MT migration. In another example, the IAB-node may obtain the NR Cell Global Identifier (NCGI) from a System Information Block (SIB) broadcasted in a cell controlled by the parent IAB-node in the IAB topology controlled by the non-F1 terminating donor-CU. This identifier (NCGI) may be sufficient for the target F1 donor-CU to identify the non-F1 terminating donor-CU.

At step 922, in response to (or after) receiving a request for a new F1 connection, the IAB-node 570, 701, 801 then sends, to the target F1 donor-CU 503, 707, 807, a F1 setup request requesting the setup of the F1 connection. The F1 setup request message sent by the IAB-node includes identification information for identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU) (e.g. when the target donor-CU 807 is a different IAB-donor-CU to the IAB-donor-CU serving the MT of the IAB-node). The F1 setup request message may also include identification information for identifying the source F1 terminating donor-CU 501, 703, 803. The message sent at the step 922 may be the message 814 in figure 8.

Figure 9d is a flowchart of an example method 930 in accordance with embodiments of the present invention, for managing, at a target IAB-donor-CU, the transport migration after DU migration of an IAB-node. Method 930 is an example of method 1400 described above.

For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the target IAB-donor-CU performing the method 930 may be the IAB-donor-CU 503 which controls IAB topology 5003. The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003. With reference to figures 7 and 8, the IAB-node may be IAB-node 701, 801 and the migration process may involve the migration of the DU of the IAB-node 701, 801 from the source F1 donor-CU 703, 803 to the target F1 donor-CU 707, 807. The method 930 as shown in and described with respect to figure 9d may be performed by software elements and/or hardware elements. The target IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 9d being performed by an apparatus for the target IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 931, the target F1 terminating donor-CU, like IAB-donor-CU 503 of figure 5 (707, 807), receives from an IAB-node, like IAB-node 570 of figure 5 (701, 801), a F1 setup request for requesting set up of a F1 connection between the target IAB-donor-CU and the IAB-node. The F1 setup request message sent by the IAB-node may include identification information for identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU when a MT of the IAB-node has been migrated to a non-F1 terminating donor-CU different from the target IAB-donor-CU or the source F1 terminating donor-CU when a MT of the IAB-node has not been migrated). The F1 setup request message may also include identification information for identifying the source F1 terminating donor-CU. The non-F1 terminating donor-CU may be the donor-CU 502 in figure 5 or the donor-CU 709 in figure 7.

The message received at the step 931 may be the F1 setup request message 814 as shown in and described with respect to figure 8. The target F1 terminating donor-CU 503, 707, 807, in response to receiving the request at step 931, may send an acknowledgment to the IAB-node 570, 701, 801. The acknowledgment may be the message 815 as shown in and described with respect to figure 8.

In another example, at step 931, the target F1 terminating donor-CU, like IAB-donor-CU 503 of figure 5 (707, 807), receives a notification from the source IAB-donor-CU, such as IAB-donor-CU 501 of figure 5 (703, 803) with the notification including identification information for identifying the IAB-donor-CU that is serving the MT of the IAB-node (e.g. a non-F1 terminating donor-CU when a MT of the IAB-node has been migrated to a non-F1 terminating donor-CU different from the target IAB-donor-CU or the source F1 terminating donor-CU when a MT of the IAB-node has not been migrated). The notification may be a DU migration notification such as the DU migration notification message 811 as shown in and described with respect to figure 8. Alternatively (and not shown in figure 9d), the notification may be a configuration update notification, such as the configuration update message 817 as shown in and described with respect to figure 8.

At step 932, the target F1 terminating donor-CU 503, 707, 807, based on the identification information and after the DU of the IAB-node has been migrated to the target IAB topology, performs transport migration for migrating traffic related to or associated with the IAB-node for routing over at least one path between the target IAB-donor-CU and the IAB-node through an IAB topology managed by the IAB-donor-CU serving the MT. For example, the target F1 terminating donor-CU 503, 707, 807 sends, to the non-F1 donor-CU, a traffic migration request (e.g. message 1313 in figure 13b) for requesting traffic migration of the traffic associated with the IAB-node 570, 701, 801 that has to be routed via one or more paths in the IAB topology managed by the non-F1 terminating donor-CU 502, 709, indicated in the message received at step 931.

Figure 10 is a simplified diagram 1000 illustrating another example message flows, according to one or more embodiments of the invention, for providing identification information identifying the IAB-donor-CU that is serving a MT of a IAB-node (e.g. a non-F1 terminating donor-CU or the source F1 terminating donor-CU serving the MT) to a target IAB-donor-CU (e.g. the F1 terminating donor-CU) of a DU migration of the IAB-node, as part of a DU migration process of the IAB-node for use in managing or facilitating transport migration. The message flows shown in and described below with respect to figure 10 relate to the case where the MT of the IAB-node has been migrated to another IAB-donor-CU, e.g. a non-F1 IAB-donor-CU, which is different to the source IAB-donor-CU (source F1 donor-CU) and the target IAB-donor-CU (target F1 donor-CU).

This figure 10 shows a source F1 donor-CU 1003 like the donor-CU 501, 703, a target F1 donor-CU 1007 like the donor-CU 503, 707, and a non-F1/RRC donor-CU 1009 like the donor-CU 502, 709.

The beginning of the flow corresponds to the end of UEs handover procedure 730 of the figure 7 after the DU migration of an IAB-node, like the IAB-node 570, 701, when the source F1 donor-CU 1003 of the IAB-node can release the traffic migration toward the non-F1 donor-CU 1009, and when the target F1 donor-CU 1007 can request traffic migration toward the non-F1 donor-CU 1007. It is assumed that the MT of the IAB-node was previously migrated toward the IAB topology managed by the non-F1 donor-CU 1009, and that the traffic related to the UEs served by the IAB-node was routed via the IAB topology managed by the non-F1 donor-CU 1009.

Following the handover of UEs served by the IAB-node toward the target F1 donor-CU 1007, the source F1 donor-CU 1003 sends a transport migration release message 1011 to the non-F1 donor-CU 1009 to request the release of traffic related to the handed over UEs, and thus to the IAB-node with migrated DU. For example, the transport migration release message 1011 may include a request for requesting release of transport migration set up by the source IAB-donor-CU for traffic related to the IAB-node. The non-F1 donor-CU 1009 responds with the transport migration response message 1012 to acknowledge the release operation.

According to an example, the message 1011 may include the indication that the traffic migration release is due to the DU migration of an IAB-node toward a target F1 donor-CU 1007. Thus, the message 1011 may include the identifiers of the migrated IAB-node known by the source F1 donor-CU 1003 and the non-F1 donor-CU 1009, with the information elements *F1-Terminating IAB-donor UE XnAP ID* and *non-F1-Terminating IAB-donor UE XnAP ID* (*or RRC-Terminating IAB-donor UE XnAP ID*). The message 1011 may also include the identifier of the target F1 donor-CU 1007 (i.e. TNL/IP address and/or *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3), and the identifier *gNB-DU ID* (as specified in TS 38.473 section 9.3.1.19) of the logical DU of the IAB-node served by the target F1 donor-CU 1007.

Upon reception of the transport migration release message 1011, the non-F1 donor-CU 1009 may release the transport migration (e.g. set up by the source IAB-donor-CU) by deleting the configuration of IAB-nodes involved in the routing of packets to/from the migrated IAB-node within the IAB topology controlled by the non-F1 donor-CU 1009. For

example, the non-F1 donor-CU 1009 may reconfigure the IAB-nodes involved in routing traffic to and/or from the IAB-node (e.g. the IAB-nodes in the routing path(s) to the IAB-node) by sending configuration update information for deleting, at each IAB-node, configuration information associated with routing traffic to and/or from the IAB-node. The non-F1 donor-CU 1009 may send updated configuration information (e.g. routing configuration tables) to the IAB-node(s) in the routing path(s) to the migrated IAB-node so that the configuration at these IAB-node(s) in the routing path(s) for routing of packets to/from the migrated IAB-node within the IAB topology is deleted. With reference to figure 5 where the MT 571 of IAB-node 570 is served by IAB-donor-CU 502, the DU 572 of IAB-node 570 has been migrated to IAB-donor-CU 503 and the IAB-node 570 is connected to IAB-node 550 via backhaul link 505, after DU migration, the IAB-donor-CU 502 as the non-F1 donor-CU may release the transport migration by reconfiguring the configuration information at IAB-donor-DU 506, and IAB-nodes 540 and 550 by deleting the configuration information associated with routing traffic to/from the IAB-node 570. As an alternative method, the non-F1 donor-CU 1009 may only suspend the traffic migration by maintaining the configuration of these IAB-nodes e.g. the IAB-nodes in the routing path are not reconfigured to delete the configuration information associated with routing traffic to/from the migrated IAB-node. Indeed, as the request for traffic migration release is due to a DU migration of the related IAB-node toward a target F1 donor-CU, a request for traffic migration from this target F1 donor-CU should be soon received by the non-F1 donor-CU 1009. And as the traffic to be migrated by the target F1 donor-CU should be equivalent to the traffic that was migrated by the source F1 donor-CU, the same configuration of IAB-nodes in the IAB topology controlled by the non-F1 donor-CU 1009 should still be applicable.

Then, the non-F1 donor-CU 1009 sends a transport migration response 1012 to the source F1 donor-CU 1003 to acknowledge the received message 1011.

The messages 1011 and 1012 may correspond to the procedure described at the figure 13b where message 1011 corresponds to message 1313 and message 1012 corresponds to message 1314.

The non-F1 donor-CU 1009 further sends, to the target F1 donor-CU 1007, a notification for indicating the second IAB-donor-CU is ready to support transport migration, with the notification including identification information for identifying the non-F1 donor-CU 1009 in order to notify the target F1 donor-CU 1007 of the identity of the non-F1 donor-CU 1009 so that traffic, related to the IAB-node, can be migrated to a path (or at least one

path) between the target F1 donor-CU 1007 and the migrated IAB-node 570 through the IAB topology managed by the non-F1 donor-CU 1009. The notification may be included in a transport migration ready message 1013 sent to the target F1 donor-CU 1007 to indicate its role (i.e. the non-F1 donor-CU for the IAB-node), and to indicate the readiness to support the migration of traffic in its IAB topology. Thus, the message 1013 may include the identifier of the IAB-MT 804 known by the non-F1 donor-CU 1009 with the information element *non-F1-Terminating IAB-donor UE XnAP I*D, defined in TS 38.423 section 9.2.3.16, *or RRC-Terminating IAB-donor UE XnAP ID*, and the identifier *gNB-DU ID* of the logical DU having a F1 connection with the target F1 donor-CU 1007. The message 1013 may also or alternatively include the BAP address assigned by the non-F1/RRC donor-CU. 1009. The transport migration ready message 1013 may include the characteristics (e.g. throughput, quality of service) of the traffic ready to be migrated, by taking the same characteristics that was previously migrated by the source F1 donor-CU 1003.

When the UEs served by the IAB-node are handed over toward the target F1 donor-CU 1007, this target F1 donor-CU 1007 sends a transport migration request message 1014 to request the migration of traffic related to the served UEs toward the IAB topology controlled by the non-F1 donor-CU 1009. Upon reception of the message 1014, the non-F1 donor-CU 1009 may accept the migration and may configure the IAB-nodes in its IAB-topology to route packets to/from the IAB-node serving the UEs, according to the traffic characteristics (e.g. throughput, quality of service) provided by the target F1-donor-CU 1007. Then, the non-F1 donor-CU 1009 sends a transport migration response message 1015 to the target F1 donor-CU 1007 to acknowledge the transport migration. In case the non-F1 donor-CU 1009 had maintained the configuration of IAB-nodes upon reception of the message 1011, and in case the characteristics of the traffic to migrate are equivalent to the characteristics of the traffic that was previously migrated by the source F1 donor-CU 1003, the non-F1 donor-CU 1009 has just to resume the transport migration and to send the response 1015 to the target F1 donor-CU 1007.

The messages 1014 and 1015 may correspond to the procedure described at the figure 13b with message 1014 corresponding to message 1313 and message 1015 corresponding to message 1314.

Figure 11a is a flowchart of another example method 1100 in accordance with embodiments of the present invention, for managing, at the source IAB-donor-CU (e.g. F1 terminating donor-CU) of an IAB-node, the DU migration of the IAB-node with the

indication of the IAB-donor-CU that is serving the MT of the IAB-node, the non-F1 terminating donor-CU or RRC terminating donor-CU, to the target IAB-donor-CU (e.g. the F1 terminating donor-CU).

For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the source IAB-donor-CU performing the method 1100 may be the IAB-donor-CU 501 (e.g a F1 terminating donor-CU or F1 donor-CU of the IAB-node 570 with which the IAB-node 570 retains a F1 connection). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (also referred to as target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. With reference to figures 7 and 10, the IAB-node may be IAB-node 701 and the migration process may involve the migration of the DU of the IAB-node 701 from the source F1 donor-CU 703, 1003 to the target F1 donor-CU 707 1007. The method 1100 as shown in and described with respect to figure 11a may be performed by software elements and/or hardware elements. The source IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 11a being performed by an apparatus for the source IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 1101, the source F1 terminating donor-CU, like the donor-CU 501 of figure 5 (703, 1003), determines that the DU of the IAB-node, like the IAB-node 570 of figure 5 (701 of figure 7) is to be migrated from the source F1 donor-CU 501, 703, 1003 to a target F1 donor-CU, like the donor-CU 503 of figure 5 (707, 1007). For example, the source F1 donor-CU 501, 703, 1003 decides the DU migration of an IAB-node, like the IAB-node 570, toward a target F1 donor-CU, like the donor-CU 503, 707, 1007. For example, the source F1 donor-CU 501, 703, 1003 may determine that the DU of the IAB-node 570, 701 is to be migrated in response to determining the migration of the MT of the IAB-node 570, 701 toward a new parent IAB-node (which may be a new IAB-node or a new IAB-donor-DU) has been completed. Examples of other triggers for determining the DU is to be migrated are described above. Details of how the source F1 donor-CU 501, 703, 1003 determines the target F1 terminating donor-CU 503, 707, 1007 is also described above.

At step 1102, the source F1 terminating donor-CU 501, 703, 1003 executes or performs the DU migration of the IAB-node through the procedure described with the reference 720 in figure 7.

At step 1103, the source F1 terminating donor-CU 501, 703, 1003 sends to the non-F1 terminating donor-CU of the IAB-node a transport migration release for the traffic related to the IAB-node 570, 701, and indicating the target F1 donor-CU 503, 707, 1007 for the DU migration of this IAB-node (e.g. providing identification information for identifying the target F1 donor-CU). The indication of the target F1 donor-CU 503, 707, 1007 may be sent only if the non-F1 terminating donor-CU is different from the target F1 donor-CU 503, 707. The message sent at step 1103 may be the message 1011 in figure 10.

Figure 11b is a flowchart of an example method 1110 in accordance with embodiments of the present invention, for managing, at the non-F1/RRC terminating donor-CU of an IAB-node, the transport migration in case of DU migration of the IAB-node. For example, method 1110 in accordance with one or more embodiments of the invention is performed at a IAB-donor-CU to which a MT of the IAB-node has been migrated (e.g. non-F1 terminating donor-CU or RRC terminating donor-CU, and also referred to as a second IAB-donor-CU) and is for use in managing transport migration for traffic related to or associated with an IAB-node. The transport migration is to be performed after a DU of the IAB-node has been migrated from a source IAB topology managed by a source IAB-donor-CU to a target IAB topology managed by the target IAB-donor-CU. The non-F1 terminating donor-CU is a different IAB-donor-CU to the target IAB-donor-CU and the source IAB-donor-CU.

For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the IAB-donor-CU performing the method 1110 may be the IAB-donor-CU 502 (e.g a non-F1/RRC terminating donor-CU or non-F1/RRC donor-CU of the IAB-node 570 with which the IAB-node 570 retains a RRC connection). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003 (also referred to as target IAB topology) managed by IAB-donor-CU 503 which is the target IAB-donor-CU. With reference to figures 7 and 10, the IAB-node may be IAB-node 701 and the migration process may involve the migration of the DU of the IAB-node 701 from the source F1 donor-CU 703, 1003 to the target F1 donor-CU 707, 1007. The method 1110 as shown in and described with respect to figure 11b may be performed by

software elements and/or hardware elements. The source IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 11b being performed by by an apparatus for the non-F1 IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 1111, the non-F1 terminating donor-CU, like the donor-CU 502 of figure 5 (709, 1009), receives from a source F1 terminating donor-CU, like the donor-CU 501 of figure 5 (703, 1003) of an IAB-node, like the IAB-node 570 of figure 5 (701 of figure 7), a transport migration release (e.g. the transport migration release message 1011) for requesting release of transport migration set up by the source F1 donor-CU, 501, 703, 1003 for the traffic related to or associated with the IAB-node. The transport migration release may include identification information for identifying or indicating the target F1 terminating donor-CU for the DU migration of the IAB-node. The target F1 terminating donor-CU may be the donor-CU 503 in figure 5 or the donor-CU 707 in figure 7 or the donor-CU 1007 in figure 10.

At step 1112, the non-F1 terminating donor-CU 502, 709, 1009 releases (or suspends) the transport migration previously setup upon the request of the source F1 terminating donor-CU 501, 703, 1003. As discussed above with reference to figure 10, when the non-F1 terminating donor-CU 502, 709, 1009 releases the transport migration, the terminating donor-CU 502, 709, 1009 reconfigures the IAB-nodes involved in routing traffic to and/or from the IAB-node by deleting, at each IAB-node, configuration information associated with routing traffic to and/or from the IAB-node. When the non-F1 terminating donor-CU 502, 709, 1009 suspends the transport migration, the configurations at the IAB-nodes involved in routing traffic to and/or from the IAB-node are kept.

At step 1113 (e.g. after receiving the transport migration release message 1011), the non-F1 terminating donor-CU 502, 709, 1009 sends to the target F1 donor-CU 503, 707, 1007, a notification for indicating the second IAB-donor-CU is ready for transport migration for the traffic related to the IAB-node 570, with the notification including identification information for identifying the non-F1 donor-CU 1009. The notification may be sent in a transport migration ready message 1013 sent to the target F1 donor-CU 1007 as discussed above.

At step 1114, the non-F1 terminating donor-CU 501, 703, 1003 receives from the target F1 donor-CU 503, 707, 1007 a transport migration request for the traffic related to the IAB-

node 570. The transport migration request may be sent in the transport migration request message 1014 discussed above.

At step 1115, the non-F1 terminating donor-CU 501, 703, 1003 activates (or resumes) the transport migration according to the request from the target F1 terminating donor-CU 503, 707, 1007 so that traffic related to the IAB-node is routed over at least one path between the target F1 terminating donor-CU 503, 707, 1007 and the IAB-node through the IAB topology managed by non-F1 terminating donor-CU 501, 703, 1003 serving the MT.

Figure 11c is a flowchart of another example method 1120 in accordance with embodiments of the present invention, for managing, at the target F1 terminating donor-CU of an IAB-node, the transport migration in case of DU migration of the IAB-node.

For example, with reference to the IAB communication system 500 shown in and described with respect to figure 5, the target IAB-donor-CU performing the method 1120 may be the IAB-donor-CU 503 which controls IAB topology 5003 (also referred to as target IAB topology). The IAB-node may be mobile IAB-node 570 belonging to IAB topology 5001 (also referred to as source IAB topology) controlled by the IAB-donor-CU 501. The migration process may involve the migration of the DU 572 of the IAB-node 570 from IAB topology 5001 to IAB topology 5003. With reference to figures 7 and 10, the IAB-node may be IAB-node 701 and the migration process may involve the migration of the DU of the IAB-node 701 from the source F1 donor-CU 703, 1003 to the target F1 donor-CU 707, 1007. The method 930 as shown in and described with respect to figure 11c may be performed by software elements and/or hardware elements. The target IAB-donor-CU may be implemented in a communication device 400 as shown in and described with reference to figure 4 with the method as shown in and described with respect to figure 11c being performed by an apparatus for the target IAB-donor-CU including one or more processing units, such as the central processing unit 411.

At step 1121, the target F1 terminating donor-CU, like IAB-donor-CU 503 of figure 5 (707, 1007), receives from the non-F1 terminating donor-CU, like the donor-CU 502 of figure 5 (709, 1009), of an IAB-node, like the IAB-node 570 of figure 5 (701 of figure 7), a message indicating the non-F1 terminating donor-CU 502, 709, 1009 is ready for transport migration for the traffic related to the IAB-node 570. For example, the target F1 terminating donor-CU 503, 707, 1007 receives, from the non-F1 terminating donor-CU 502, 709, 1009, a notification for indicating the non-F1 terminating donor-CU 502, 709, 1009 is ready for transport migration for the traffic related to the IAB-node 570, with the notification including

identification information for identifying the non-F1 donor-CU 1009. The notification may be sent in a transport migration ready message 1013 sent to the target F1 donor-CU 1007 as discussed above

At step 1122, after the DU migration of the IAB-node 570, the target F1 terminating donor-CU 503, 707, 1007, performs the transport migration for the traffic related to the IAB-node 570 toward the IAB topology controlled by the non-F1 terminating donor-CU 502, 709, 1009. For example, after DU migration of the IAB-node 570 and based on the identification information for the non-F1 terminating donor-CU 502, 709, 1009, the target F1 terminating donor-CU 503, 707, 1007 performs transport migration for migrating traffic related to or associated with the IAB-node for routing over at least one path between the target F1 terminating donor-CU 503, 707, 1007 and the IAB-node through the IAB topology managed by the non-F1 terminating donor-CU 502, 709, 1009.

Figure 12a is a schematic and simplified diagram 1200 illustrating an example message flow of a procedure to perform the activation of a logical DU according to an example.

This figure shows:

- a RAN node DU 1201, that may be DU of an IAB-node like IAB-DU 572 of IAB-node 570 of figure 5 (and IAB-DU1 805 of IAB-node 801 of figure 8),

- a RAN node CU 1202, that may be an IAB-donor-CU like IAB-donor-CU 501 of figure 5 (and source F1 donor-CU 803 of figure 8).

The message CONFIGURATION REQUEST 1203 is sent by the RAN node CU 1202 to the RAN node DU 1201 either to request the activation of new cell(s) controlled by the RAN node DU 1201, or to request the activation of a logical DU, or to request the deactivation of cell(s) in the RAN node DU 1201. In case of a logical DU activation, the message 1203 may include the TNL address (i.e. IP address) of a RAN node CU (e.g. the target F1 donor-CU 807 of figure 8) that will connect to the logical DU once activated. For example, CONFIGURATION REQUEST 1203 may be sent by the source IAB-donor-CU to the IAB-node (e.g. the first logical DU entity 805 having a F1 connection with the source IAB-donor-CU) for requesting establishment of a F1 connection between a target IAB-donor-CU and the IAB-node. The message 1203 may also include an information element (IE) requesting the RAN node DU 1201 to transmit to the RAN node CU (e.g. the target F1 donor-CU 807 of figure 8) that will connect to the logical DU once activated, the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the RAN node CU (e.g. the non-F1 IAB-donor-CU or

RRC IAB-donor-CU) terminating the RRC connection of the RAN node embedding the RAN node DU 1201 (e.g. the address and/or identifier of the IAB-donor-CU serving the MT of the IAB-node). This IE may be limited to one bit: one value (i.e. “0” or “1”) of this one-bit IE means no specific action is requested and another value (i.e. “1” or “0”) means sending the address/identifier of the non-F1 donor-CU. This IE may be extended to include the address/identifier of the RAN node CU terminating the RRC connection. The message 1203 may include the identifier of the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1201, as known by the RAN node CU terminating the RRC connection with the information element *non-F1-Terminating IAB-donor UE XnAP ID*, defined in TS 38.423 section 9.2.3.16 or *RRC-Terminating IAB-donor UE XnAP ID*.

The RAN Node DU 1201 may acknowledge the request with the message CONFIGURATION RESPONSE 1204 sent to the RAN Node CU 1202.

According to one example, the flow in figure 12a corresponds to the procedure gNB-CU Configuration Update procedure described in TS 38.473 V17.0.0 section 8.2.5, and the message 1203 corresponds to the message GNB-CU CONFIGURATION UPDATE described in TS 38.473 V17.2.0 section 9.2.1.10, while the message 1204 corresponds to the message GNB-CU CONFIGURATION UPDATE ACKNOWLEDGE described in TS 38.473 V17.2.0 section 9.2.1.11.

The message GNB-CU CONFIGURATION UPDATE includes the Information Element (IE) *Cells to be Activated List* to indicate the list of new cell(s) to be activated at the RAN Node DU 1201. For example and with reference to figure 8, the GNB-CU CONFIGURATION UPDATE includes information to activate the new cell(s) indicated in the IE *Cells to be Activated List*, which new cell(s) may be served by the first logical DU entity 805 at the IAB-node 801. The cell(s) to be activated refer to cell(s) controlled by the RAN Node DU 1201 receiving the request. The associated PCI and NCGI value(s) to be used by the RAN Node DU 1201 may also be provided.

The message GNB-CU CONFIGURATION UPDATE may also include the Information Element (IE) *Cells to be Deactivated List* to indicate the list cell(s) to be deactivated. The cell(s) to be deactivated refer to cell(s) controlled by the RAN node DU 1201 receiving the request. For example and with reference to figure 8, the GNB-CU CONFIGURATION UPDATE may include information to deactivate the cell(s) indicated in the IE *Cells to be Deactivated List* which cell(s) are currently served by the first logical DU entity 805 at the IAB-node 801.

According to one example, a new IE *Second DU Activation* may be added in the message 1203 in the form of a Boolean (e.g. a one-bit IE) to request the activation of a second logical DU. One value (i.e. “0” or “1”) of the one-bit IE means no specific action related to the second logical DU is requested and another value (i.e. “1” or “0”) means activation of a second logical DU is requested. This IE may be completed by a new IE indicating a number of cells to be activated in the second logical DU. In the absence of this IE, the number of cells to be activated corresponds to the number of cells currently activated in the RAN Node DU 1201. The presence of this IE may indicate that the BAP address that identifies the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1201 shall be inserted in the request for F1 connection.

Besides, a new IE may be added (e.g. *Target TNL address* IE) to identify the target RAN Node CU with which a F1 connection shall be setup.

Another IE may be added to request to send the address and/or identifier of the RAN node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1201 (e.g. the address and/or identifier of the IAB-donor-CU serving the MT of the IAB-node). This IE may be the address (e.g. *non-F1 TNL address* IE or *RRC TNL address* IE) or the identifier of (e.g. *non-F1 Global NG-RAN Node ID* or *RRC Global NG-RAN Node ID*), and its presence indicates that it shall be included in the request for F1 connection.

Another IE may be added to identify the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1201 (e.g. *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC-Terminating IAB-donor UE XnAP ID*), and its presence indicates that it shall be included in the request for F1 connection. The presence of this IE may indicate that the BAP address that identifies the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1201 shall be inserted in the request for F1 connection.

The message GNB-CU CONFIGURATION UPDATE ACKNOWLEDGE may include an Information Element (IE) (e.g. *second DU gNB-DU ID*), to identify the activated logical DU.

To complete the setup of the new logical DU at the IAB-node, the procedure described with reference to figure 12b may be used.

Figure 12b is a schematic and simplified diagram 1210 illustrating an example message flow of a procedure to setup a logical DU, so as to establish a F1 connection with the target IAB-donor-CU, according to an example.

This figure shows:

- a RAN node DU 1211, that may be a DU of an IAB-node DU like IAB-DU 572 of IAB-node 570 of figure 5 (and IAB-DU2 806 of IAB-node 801 of figure 8),

- a RAN node CU 1212, that may be an IAB-donor-CU like IAB-donor-CU 503 of figure 5 (and target F1 donor-CU 807 of figure 8).

The message SETUP REQUEST 1213 is sent by the RAN node DU 1211 to the RAN node CU 1212 to request the F1 setup for the logical DU. For example, SETUP REQUEST 1213 may be sent by the IAB-node (e.g. by the second logical DU entity 806 which has been activated at the IAB-node 801) to the target IAB-donor-CU 807 for requesting set up of a F1 connection between a target IAB-donor-CU and the IAB-node (e.g. with the second logical DU entity 806 of the IAB-node 801)). The SETUP REQUEST message 1213 may be sent after an activation request as described with reference to figure 12a. This SETUP REQUEST message 1213 may include the number of cells to be activated along with activation of the logical DU. This SETUP REQUEST message 1213 may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the RAN node CU terminating the F1 connection of the RAN node DU 1211 (e.g. the source IAB-donor-CU 803). This message may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the RAN node CU terminating the non-F1 (i.e. RRC) connection of the RAN node DU 1211 in the case where the MT (e.g. mMT 571 of IAB-node 570 or corresponding IAB-MT of 804 of IAB-node 801) has been migrated to the RAN node CU (which is now the non-F1 donor-CU).

The message 1213 may also include at least one of:

- the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the source RAN node CU that has requested the F1 setup,
- TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID*) of the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1211 (e.g. the address and/or identifier of the IAB-donor-CU serving the MT of the IAB-node),
- the identifier for the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1211 (e.g. *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC-Terminating IAB-donor UE XnAP ID*), known by the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1211,

- the BAP address of the MT of the RAN node embedding the RAN node DU 1211, assigned by the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1211,
- the identifier *gNB-DU ID* of the RAN node DU 1211.

The RAN node CU 1212 answers with the message SETUP RESPONSE 1214 sent to the RAN node DU 1211. It may include a list of cell(s) to activate with the logical DU, along with the associated PCI and NCGI value(s) to be used.

According to one example, the flow in figure 12b corresponds to the procedure F1 setup described in TS 38.473 V17.2.0 section 8.2.3, and the message 1213 corresponds to the message F1 SETUP REQUEST described in TS 38.473 V17.2.0 section 9.2.1.4, while the message 1214 corresponds to the message F1 SETUP RESPONSE described in TS 38.473 V17.2.0 section 9.2.1.5. The message F1 SETUP RESPONSE includes the Information Element (IE) *Cells to be Activated List* to indicate the list of new cell(s) to be activated. The cell(s) to be activated refer to cell(s) controlled by the RAN node DU 1211 receiving the response.

Figure 12c is a schematic and simplified diagram 1220 illustrating an example message flow of a procedure to remove a logical DU.

This figure shows:

- a RAN node DU 1221, that may be a DU of an IAB-node DU like IAB-DU 572 of IAB-node 570 of figure 5 (and IAB-DU1 805 of IAB-node 801 of figure 8),

- a RAN node CU 1222, that may be an IAB-donor-CU like IAB-donor-CU 501 of figure 5 (and source F1 donor-CU 803 of figure 8).

The message REMOVAL REQUEST 1223 is sent by the RAN node CU 1222 to the RAN node DU 1221 to request the removal (which is equivalent to deactivation) of the logical DU.

The RAN node DU 1221 answers with the message REMOVAL RESPONSE 1214 sent to the RAN node CU 1222.

According to one example, the flow in Figure 12c corresponds to the procedure F1 removal described in TS 38.473 V17.2.0 section 8.2.8, and the message 1223 corresponds to the message F1 REMOVAL REQUEST described in TS 38.473 V17.2.0 section 9.2.1.16, while the message 1224 corresponds to the message F1 REMOVAL RESPONSE described in TS 38.473 V17.2.0 section 9.2.1.7.

Figure 12d is a schematic and simplified diagram 1230 illustrating an example message flow of a procedure used by a logical DU to inform an IAB-donor-CU about a change of configuration, according to an example.

This figure shows:

- a RAN node DU 1231, that may be a DU of an IAB-node DU like IAB-DU 572 of IAB-node 570 of figure 5 (and IAB-DU2 806 of IAB-node 801 of figure 8),

- a RAN node CU 1232, that may be an IAB-donor-CU like IAB-donor-CU 503 of figure 5 (and target F1 donor-CU 807 of figure 8).

The message CONFIGURATION UPDATE 1233 is sent by the RAN node DU 1231 to the RAN node CU 1232 to indicate a configuration change for the RAN node embedding the RAN node DU 1231. CONFIGURATION UPDATE message 1233 may be sent by the RAN node DU 1231 for indicating to the RAN node CU 1232 the identifier of the RAN node CU serving the MT of the RAN node embedding the RAN node DU 1231. For instance the message 1233 is sent by the second logical DU entity 806 that has been activated at the IAB-node 801 to the target IAB-donor-CU 807 to indicate the IAB-donor-CU serving the MT 804 of the IAB-node 801. This CONFIGURATION UPDATE message 1233 may include the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of the RAN node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1211 (e.g. the address and/or identifier of the IAB-donor-CU serving the MT of the IAB-node). It may also include at least one of:

- the identifier for the Mobile Termination (MT) of the RAN node embedding the RAN node DU 1231 (e.g. *non-F1-Terminating IAB-donor UE XnAP ID* or *RRC-Terminating IAB-donor UE XnAP ID*), known by the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1231,
- the BAP address of the MT of the RAN node embedding the RAN node DU 1231, assigned by the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1231,
- the identifier *gNB-DU ID* of the RAN node DU 1231.

The RAN node CU 1232 answers or responds with the message CONFIGURTION ACKNOWLEDGE 1234 sent to the RAN node DU 1231.

The identifier for the Mobile Termination (MT) of the RAN node may be provided by the RAN Node CU terminating the RRC connection of the RAN node embedding the RAN node DU 1231.

According to one example, the flow in figure 12d corresponds to the procedure gNB-DU configuration update described in TS 38.473 V17.2.0 section 8.2.4, amended to include the information elements described above. The message 1233 corresponds to the message GNB-DU CONFIGURATION UPDATE described in TS 38.473 V17.2.0 section 9.2.1.7, while the message 1234 corresponds to the message GNB-DU CONFIGURATION UPDATE ACKNOWLEDGE described in TS 38.473 V17.2.0 section 9.2.1.8.

Figure 13a is a schematic and simplified diagram 1300 illustrating an example message flow of a procedure used by a RAN Node CU to report configuration information to another RAN Node CU according to an example.

This figure shows two RAN nodes, RAN node CUa 1301 and RAN node CUb 1302, that may be two IAB-donor-CUs, like two of IAB-donor-CUs 501, 502, and 503 of figure 5. With respect to the example shown in figure 8, RAN node CUa 1301 may be the target F1 donor-CU 807 and RAN node CUb 1302 may be the source F1 donor-CU 803 depending on the purpose of the messages.

The message CONFIGURATION UPDATE 1303 is sent by the RAN node CUa 1301 to the RAN node CUb 1302 to inform the RAN node CUb 1302 about the activation of new cell(s) in a logical DU of a RAN node DU like the IAB-DU2 806 of the IAB-node 801.

For example, the source F1 donor-CU 803 receives the CONFIGURATION UPDATE message 1303 from the target F1 donor-CU 807 and the CONFIGURATION UPDATE message 1303 includes identification information (e.g. PCI, NRGI) identifying one or more new cells that have been activated at a second logical DU entity (IAB-DU2 806) of the DU of the IAB-node 801.

The message CONFIGURATION UPDATE 1303 can also be used by the RAN node CUa 1301 to the RAN node CUb 1302 to inform the RAN node CUb 1302 about the TNL address (i.e. the IP address) and/or the identifier (i.e. *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3) of a RAN node CU terminating the RRC connection of a RAN node embedding a RAN node DU (e.g. the address and/or identifier of the IAB-donor-CU serving the MT of the IAB-node) that is to be migrated toward the RAN node CUb 1302. In this case, RAN node CUa 1301 is the source F1 donor-CU 803 and RAN node CUb 1302 is the target F1 donor-CU 807.

The messages 1303 may also include at least one of:

- the identifier of the migrated RAN node as known by the RAN node CUa 1301, with the information element *F1-Terminating IAB-donor UE XnAP ID* identifying the Mobile Termination (MT) of the migrated RAN node, and/or with the information element *gNB-DU ID* identifying the logical DU of the migrated RAN node having F1 connection with the RAN node CUa 1301,
- the identifier of the MT of the migrated RAN node as known by the RAN node CU terminating the RRC connection with the migrated RAN node, through the information element *non-F1-Terminating IAB-donor UE XnAP ID*, or *RRC-Terminating IAB-donor UE XnAP ID*
- the identifier of the migrated RAN node as known by the RAN node CUb 1302, with the information element *target F1-Terminating IAB-donor UE XnAP ID* identifying the Mobile Termination (MT) of the migrated RAN node, and/or the identifier *gNB-DU ID* of a logical DU of the migrated RAN node having a F1 connection with the RAN node CUb 1302,
- the BAP address of the MT of the migrated RAN node assigned by the RAN Node CU terminating the RRC connection of the migrated RAN node.

The RAN node CUb 1302 answers with the message CONFIGURATION ACKNOWLEDGE 1304 sent to the RAN node CUa 1301 to acknowledge the reception of the message 1303.

According to one example, the Figure 13a corresponds to the procedure NG-RAN node configuration update described in TS 38.423 V17.2.0 section 8.4.2, and the message 1303 corresponds to the message NG-RAN NODE CONFIGURATION UPDATE described in TS 38.423 V17.2.0 section 9.1.3.4, amended with IEs listed above, while the message 1304 corresponds to the message NG-RAN NODE CONFIGURATION UPDATE ACKNOWLEDGE described in TS 38.423 V17.2.0 section 9.1.3.5.

Figure 13b is a schematic and simplified diagram 1310 illustrating an example message flow of a procedure used by a RAN node CU to manage the transport migration (e.g. setup, modification, or release of F1 traffic such as user/control traffic) in coordination with another RAN Node CU according to an example.

This figure shows two RAN nodes, RAN node CUa 1311 and RAN node CUb 1312, that may be two IAB-donor-CUs, like two of IAB-donor-CUs 501, 502, and 503 of figure 5.

The message MIGRATION REQUEST 1313 is sent by the RAN node CUa 1311 to the RAN node CUb 1312 to request the traffic migration setup, or modification, or release in the IAB topology controlled by the RAN node CUb 1312. For example, with reference to figure 8, in the case where the DU has been migrated to the target F1 donor-CU 807 and the MT 804 of the IAB-node 801 had been migrated to a non-F1/RRC donor-CU (not shown in figure 8), the source F1 donor-CU 803 may send a MIGRATION REQUEST 1313 to the non-F1 donor-CU to request release of the traffic (e.g. F1 traffic) migrated to the non-F1 donor-CU's topology (i.e as the F1 traffic is now to be routed from the target F1 donor-CU 807 through the IAB topology managed by the non-F1 donor-CU). Alternatively, in the case where the DU has been migrated to the target F1 donor-CU 807 and the MT 804 of the IAB-node 801 had been migrated to a non-F1 donor-CU, the target F1 donor-CU 807 may send a MIGRATION REQUEST 1313 to the non-F1 donor-CU to request traffic (e.g. F1 traffic) migration to the non-F1 donor-CU's topology (i.e as the F1 traffic is now to be routed from the target F1 donor-CU 807 through the IAB topology managed by the non-F1 donor-CU).

In another example, the message MIGRATION REQUEST 1313 is sent by the RAN node CUa 1311 to the RAN node CUb 1312 to notify the DU migration of an IAB-node. When the RAN node CUb 1312 acknowledges with the message MIGRATION RESPONSE 1314, the RAN node CUb 1312 may include an identifier the RAN node CUb 1312 has assigned for the migrated IAB-node, for instance the information element *target F1-Terminating IAB-donor UE XnAP ID* identifying the Mobile Termination (MT) of the migrated IAB-node.

The message 1313 may include at least one of:

- the indication that the traffic migration release is due to the DU migration of the IAB-node 801 toward the target F1 donor-CU 807,

- the identifiers of the migrated IAB-node known by the source F1 donor-CU 803 and the non-F1 donor-CU, with the information elements *F1-Terminating IAB-donor UE XnAP ID* and *non-F1-Terminating IAB-donor UE XnAP ID* (or *RRC-Terminating IAB-donor UE XnAP ID*), and/or the BAP address assigned by the non-F1 donor-CU for the migrated IAB-node,

- the identifier of the target F1 donor-CU 807 (i.e. TNL/IP address and/or *Global NG-RAN Node ID* as specified in TS 38.423 V17.2.0 section 9.2.2.3),

- the identifier *gNB-DU ID* (as specified in TS 38.473 section 9.3.1.19) of the logical DU of the IAB-node 801 served by the target F1 donor-CU 807.

The RAN node CUb 1312 answers with the message MIGRATION RESPONSE 1314 sent to the RAN node CUa 1311 to accept or reject the request.

Depending on the situation, the figure 13b may correspond to the IAB transport migration management procedure specified in TS 38.423 V17.2.0 section 8.5.2. The message 1313 corresponds to the IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message specified in TS 38.423 V17.2.0 section 9.1.4.2, and the message 1314 corresponds to the IAB TRANSPORT MIGRATION MANAGEMENT RESPONSE message specified in TS 38.423 V17.2.0 section 9.1.4.3. If the TRANSPORT MIGRATION MANAGEMENT procedure is the one specified in TS 38.423 V17.2.0 section 8.5.2 (which can be referred to as the legacy procedure), then the target F1 donor-CU 807 should know the UE XnAP ID assigned by the non-F1 donor-CU. If the F1 setup request message from the migrated IAB-node only provides the BAP address, then both BAP address and UE XnAP ID shall be provided to the target F1 donor-CU (through the procedure described at the figure 13a), so that the target F1 donor-CU can associate the UE XnAP ID with the BAP address. If the TRANSPORT MIGRATION MANAGEMENT procedure is amended to allow not providing a UE XnAP ID but the BAP address instead, then only the BAP address may be provided to the target F1 donor-CU (through the procedure described with reference to the figure 13a).

The figure 13b may also correspond to the IAB transport migration modification procedure specified in TS 38.423 V17.2.0 section 8.5.3. The message 1313 corresponds to the IAB TRANSPORT MIGRATION MODIFICATION REQUEST message specified in TS 38.423 V17.2.0 section 9.1.4.4, and the message 1314 corresponds to the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message specified in TS 38.423 V17.2.0 section 9.1.4.5.

In other words and as a summary, it can be noted that a mobile IAB-node can be partially migrated as other IAB-nodes according to Release 17. Also, this mobile IAB-MT (mIAB-MT) handover is driven by the radio conditions, and it should not be delayed to maintain backhaul connection and to avoid service interruption at the served UEs.

Thus, it can be observed that a mIAB-MT handover should not be delayed to maintain backhaul connection and to avoid service interruption at the served UEs.

Based on this first observation, it may happen that a mIAB-MT handover is triggered and executed while a migration of the co-located mobile IAB-DU (mIAB-DU) is on-going. Thus, even if the target donor-CU for the mIAB-DU migration is restricted to the mIAB-MT's donor-CU, in some situations the F1 terminating donor-CU after the mIAB-DU

migration may finally be different from the non-F1 terminating donor-CU after handover of the co-located mIAB-MT.

Therefore, considering that a mIAB-MT handover should not be delayed may lead to situations where a mIAB-MT and its co-located mIAB-DU can be handed over/migrated to different donor-CUs.

Besides, the criteria for DU migration and MT handover differ: MT handover is driven by the radio conditions while DU migration decision may be based, for instance, on the available connectivity between donor-CUs and/or for load balancing purpose.

Then, it can be noted that the criteria to select a target donor-CU for a mobile IAB-node depend on the migration type, i.e., MT handover or DU migration.

Thus, according to the above observations, it should be supported, for flexible and smooth IAB network management purpose, that a mIAB-MT and its co-located mIAB-DU can be handed over/migrated to different donor-CUs.

Also, if the target F1 donor-CU is different from the non-F1 donor-CU, the target F1 donor-CU should be informed about the current non-F1 donor-CU serving the co-located mIAB-MT of the mobile IAB-node. This would allow the target F1 donor-CU to setup the IAB transport migration toward the non-F1 donor-CU's topology.

Then, it is proposed that the target F1 donor-CU for the migration of a mobile IAB-DU should be informed about the current non-F1 donor-CU serving the co-located mobile IAB-MT.

In case of concurrent MT handover and DU migration for a mobile IAB-node, it is the DU migration that may suffer from delay or failure due to the modification of the backhaul path to communicate with the mobile IAB-node.

To be more precise on a potential issue, it is considered the case where the mobile IAB-node has successfully performed the F1 setup procedure with a target F1 donor-CU for DU migration purpose, and that this target F1 donor-CU is different from the non-F1 donor-CU for the mobile IAB-node. If meanwhile, a MT migration of the mobile IAB-node has occurred toward a target non-F1 donor-CU (still different from the target F1 donor-CU), the target F1 donor-CU may not be aware of this new non-F1 donor-CU to perform the transport migration management (TMM) procedure.

It can be noted that in case the target logical mIAB-DU's CU is different from the mIAB-MT's CU, the target logical mIAB-DU's CU needs to be informed about the mIAB-

MT's CU ID and the mIAB-MT ID so that it can initiate the Xn TMM procedures towards mIAB-MT's CU,

However, this statement may not be accurate enough to prevent any deadlock situation in case of concurrent MT and DU migrations. Indeed, it does not say when the target F1 donor-CU (i.e. the target logical mIAB-DU's CU) is informed about the non-F1 donor-CU (i.e the mIAB-MT's CU ID). If the target F1 donor-CU was informed before the MT migration, then the target F1 donor-CU will trigger the TMM procedures toward a donor-CU that may no longer be the non-F1 donor-CU.

Therefore, the above statement could be completed by the following: if the mIAB-MT's CU is changed during a DU migration, the target logical mIAB-DU's CU needs to be informed about the target mIAB-MT's CU ID and the mIAB-MT ID, before it can initiate the TMM procedures towards the target mIAB-MT's CU.

From the above example, it appears that some adaptations of MT and DU migration procedures may be required to avoid deadlock situations and to limit the impact of concurrent MT and DU migrations to some delay to complete the procedures.

To go forward, there are 3 options:

- option 1: to consider independent procedures as a working assumption, to define the procedures accordingly, and then in a second step to refine (if necessary) the procedures to support concurrent DU and MT migrations,

- option 2: to consider concurrent DU and MT migrations as a working assumption, then to define the procedures accordingly,

- option 3: to not support concurrent DU and MT migrations, to define the procedures independently, and in a second step to add the necessary mechanisms to avoid this concurrence.

It can be observed that a mobile IAB-MT migration is driven by the radio conditions, and it should not be delayed to maintain backhaul connectivity and to avoid service interruption at the served UEs. It means that a mobile IAB-MT handover may be triggered and executed while a migration of the co-located mobile IAB-DU is on-going.

Besides, option 2 seems more efficient than option 1 when considering the support of concurrent DU and MT migrations.

Therefore, if concurrent DU and MT migrations have to be supported, then the procedures for MT and DU migrations are defined taking into account the possible concurrence of DU and MT migrations (option 2).

Providing identification information to a target F1 donor-CU, one question to address is which node informs the target F1 donor-CU for the DU migration of a mobile IAB-node about the identification information related to the non-F1 donor-CU (i.e. the mIAB-MT's CU ID and the mIAB-MT ID).

The 3 following options may be considered for the providing node:

- Option 1: the source F1 donor-CU. In this case, the source F1 donor-CU may relay to the target F1 donor-CU the identification information previously received from the source non-F1 donor-CU at the MT migration of the mobile IAB-node.

- Option 2: the non-F1 donor-CU. In this case the source F1 donor-CU should have provided to the non-F1 donor-CU the identification information related to the target F1 donor-CU.

- Option 3: the migrating IAB-node. In this case, the non-F1 donor-CU should have provided the identification information to the IAB-node.

Therefore, the 3 following options may be considered to provide the identification information related to the non-F1 donor-CU (i.e. the mIAB-MT's CU ID and the mIAB-MT ID) to the target F1 donor-CU for the DU migration of a mobile IAB-node:

- Option 1: the source F1 donor-CU,

- Option 2: the source non-F1 donor-CU,

- Option 3: the migrating IAB-node.

Option 2 may be a suitable option as it is in line with the following statement:

The source donor CU for the mIAB-MT HO provides to the donor CU serving the mIAB-DU at least the:

- gNB ID of the target donor CU for the mIAB-MT HO.
- ID(s) of the mIAB-MT.

As mentioned above, in case of concurrent MT handover and DU migration for a mobile IAB-node, it is the DU migration that may suffer from delay or failure due to the modification of the backhaul path to communicate with the mobile IAB-node.

To be more precise on a potential issue, it is considered the case where the mobile IAB-node has successfully performed the F1 setup procedure with a target F1 donor-CU for DU migration purpose, and that this target F1 donor-CU is different from the non-F1 donor-CU for the mobile IAB-node. If meanwhile, a MT migration of the mobile IAB-node has occurred toward a target non-F1 donor-CU (still different from the target F1 donor-CU), the target F1

donor-CU may not be aware of this new non-F1 donor-CU to perform the transport migration management (TMM) procedure.

It can be noted that in case the target logical mIAB-DU's CU is different from the mIAB-MT's CU, the target logical mIAB-DU's CU needs to be informed about the mIAB-MT's CU ID and the mIAB-MT ID so that it can initiate the Xn TMM procedures towards mIAB-MT's CU.

However, this statement may not be accurate enough to prevent any deadlock situation in case of concurrent MT and DU migrations. Indeed, it does not say when the target F1 donor-CU (i.e. the target logical mIAB-DU's CU) is informed about the non-F1 donor-CU (i.e the mIAB-MT's CU ID). If the target F1 donor-CU was informed before the MT migration, then the target F1 donor-CU will trigger the TMM procedures toward a donor-CU that may no longer be the non-F1 donor-CU.

Therefore, the above statement could be completed by the following: if the mIAB-MT's CU is changed during a DU migration, the target logical mIAB-DU's CU needs to be informed about the target mIAB-MT's CU ID and the mIAB-MT ID, before it can initiate the TMM procedures towards the target mIAB-MT's CU.

From the above example, it appears that some adaptations of MT and DU migration procedures may be required to avoid deadlock situations and to limit the impact of concurrent MT and DU migrations to some delay to complete the procedures.

Assuming that the mIAB-MT handover (or migration) and mIAB-DU migration are separate procedures, does not preclude that both migrations may overlap in time. To go forward, there are 3 options:

- option 1: to consider concurrent DU and MT migrations as a working assumption, to define the procedures without taking into account the potential concurrence in a first step, and then in a second step to refine (if necessary) the procedures to support concurrent DU and MT migrations,

- option 2: to consider concurrent DU and MT migrations as a working assumption, then to define the procedures accordingly,

- option 3: to not support concurrent DU and MT migrations, to define the procedures, and in a second step to add the necessary mechanisms to avoid this concurrence.

It can be observed that a mobile IAB-MT migration is driven by the radio conditions, and it should not be delayed to maintain backhaul connectivity and to avoid service interruption at

the served UEs. It means that a mobile IAB-MT handover may be triggered and executed while a migration of the co-located mobile IAB-DU is on-going.

Besides, option 2 seems more efficient than option 1 when considering the support of concurrent DU and MT migrations.

Therefore, if concurrent DU and MT migrations have to be supported, then the procedures for MT and DU migrations are defined taking into account the possible concurrence of DU and MT migrations (option 2).

Providing identification information to a target F1 donor-CU, one question to address is which node informs the target F1 donor-CU for the DU migration of a mobile IAB-node about the identification information related to the non-F1 donor-CU (i.e. the mIAB-MT's CU ID and the mIAB-MT ID).

There are the following two options for providing the gNB-ID of the mIAB-MT's CU and the XnAP UE ID of the mIAB-MT at this CU to mIAB-DU's target CU:

- Option A: XnAP signalling from the mIAB-DU's source CU.
- Option B: F1AP signalling from the target logical mIAB-DU.

It can be noted that both options can support concurrent MT and DU migrations according to the way it is performed.

With option A, the source F1 donor-CU may relay to the target F1 donor-CU the identification information previously received from the source non-F1 donor-CU at the MT migration of the mobile IAB-node. In this case the XnAP procedure NG-RAN node Configuration Update procedure may be appropriate.

With option B, providing the identification information through the F1 setup procedure may not be sufficient: in case the non-F1 donor CU changes after the completion of the F1 setup procedure, the target F1 donor-CU will not know the new non-F1 donor-CU to perform the TMM procedure. Thus, the F1AP procedure gNB-DU Configuration Update may be appropriate as it can be triggered at any time, for instance when the non-F1 donor-CU has changed.

For the down selection (i.e. for the selection of one option between option A and option B), option A seems more straight forward than option B as it does not involve the migrating IAB-node as intermediate node.

Thus, it can be proposed that XnAP signalling from the mIAB-DU's source CU is used for providing the gNB-ID of the mIAB-MT's CU and the XnAP UE ID of the mIAB-MT at this CU to the mIAB-DU's target CU.

Taking into account that the identifier of the MT of the mobile IAB-node (mIAB-MT) may be the BAP address assigned by the IAB-donor-CU controlling the mIAB-MT (and sent to the mIAB-MT via RRC protocol message when the mIAB-MT connects to this IAB-donor-CU), and that the IAB-donor-CU controlling the mIAB-MT may be referred to as the non-F1 terminating donor-CU or RRC terminating donor-CU, it can be further questioned which ID assigned by the MT's CU for the IAB MT should be used for the TMM procedure and how this ID can be mapped to a corresponding IAB node.

Actually, this ID assigned by the RRC terminating donor-CU (i.e. the mIAB-MT's CU) may be a BAP address or a UE XnAP ID.

The BAP address selected by the RRC terminating donor-CU can be provided by the target logical mobile IAB-DU to the target F1 terminating donor-CU (i.e. the mIAB-DU's CU) in the legacy Rel-16/17 F1 setup request message. In case only the BAP address is provided (and not the UE XnAP ID allocated at the RRC terminating donor-CU), the TMM request message shall be amended to allow the use of the BAP address IE instead of the non-F1 terminating IAB-donor UE XnAP ID IE. Moreover, the behavior of the RRC terminating donor-CU receiving this TMM request message shall be adapted accordingly. Indeed, according to the Release 17 specifications (TS 38.423), the presence of UE XnAP IDs allocated by the F1 terminating donor-CU and by the RRC terminating donor-CU is mandatory for the TMM procedure.

To avoid the modifications of the TMM procedure and of the IAB-donor-CUs' behavior, the UE XnAP ID allocated at the RRC terminating donor-CU should be provided to the target F1 terminating donor-CU. For this purpose, there are two options:

- F1AP signalling from the target logical mobile IAB-DU, e.g. with the F1 setup request message or the gNB-DU Configuration Update message. This option involves that the UE XnAP ID is provided to the mobile IAB-node beforehand, e.g. through RRC by the RRC terminating donor-CU. With this option, it is not needed to provide a BAP address in the F1 setup request message.

- XnAP signalling from the source F1 terminating donor-CU. This option may involve the introduction of a new XnAP procedure. Besides, to avoid any confusion in case of DU migration of several mobile IAB-nodes at the same time, an additional piece of information known by the target F1 terminating donor-CU shall be provided along with the UE XnAP ID. This additional information may be the BAP address selected by the RRC terminating donor-CU for the mobile IAB-node, assuming this BAP address was present in the F1 setup request

message from the target logical mobile IAB-DU to the target F1 terminating donor-CU, and assuming this BAP address is also available at the source F1 terminating donor-CU.

Based on the above considerations, we can conclude that there is less specifications impact when F1AP signalling from the target mobile IAB-DU is selected for transferring an ID of the mobile IAB MT to the target F1 terminating donor-CU, and that it is preferable to use the UE XnAP ID for the identification of the mobile IAB-MT.

Thus, it is proposed that for the case of DU migration of a mobile IAB-node, F1AP signalling from the target mobile IAB-DU is selected for transferring the UE XnAP ID of the mobile IAB MT (at the RRC terminating donor-CU) to the target F1 terminating donor-CU.

Considering the network integration case, there are two options to pass the identification information to the F1 terminating donor-CU (i.e. the mIAB-DU's CU):

- Option 1: through F1AP signalling, the mobile IAB-node provides the identification information based on information received from the RRC terminating donor-CU (i.e. the mIAB-MT's CU),

- Option 2: through XnAP signalling, the RRC terminating donor-CU provides the identification information once the RRC terminating donor-CU knows the identifier of the F1 terminating donor-CU from the mobile IAB-node.

With the option 2, the RRC terminating donor-CU shall provide an identifier of the mobile IAB-node known by the F1 terminating donor-CU. This identifier may be the BAP address of the mobile IAB-MT selected by the RRC terminating donor-CU, assuming this BAP address was present in the F1 setup request message from the mobile IAB-DU to the F1 terminating donor-CU.

With the option 1, the F1AP signalling can be the same as for the case of DU migration. Moreover, it seems there is less specifications impact with option 1 than with option 2.

Thus, it is proposed that for the case of network integration of a mobile IAB-node, F1AP signalling from the mobile IAB-DU is selected for transferring the gNB-ID of the RRC terminating donor-CU and the UE XnAP ID of the mobile IAB MT (at this RRC terminating donor-CU) to the F1 terminating donor-CU.

Assuming the same F1AP signalling is adopted to pass identification information at DU migration and at network integration of a mobile IAB-node, then, for the sake of consistency, the mobile IAB-node should also provide identification information related to the target RRC terminating donor-CU at MT migration.

Thus, it is proposed that for the case of MT integration of a mobile IAB-node, F1AP signalling from the mobile IAB-DU is selected for transferring the gNB-ID of the target RRC terminating donor-CU and the UE XnAP ID of the mobile IAB MT (at this RRC terminating donor-CU) to the F1 terminating donor-CU.

The F1AP procedure gNB-DU Configuration Update is appropriate to inform the F1 terminating donor-CU in the case of MT migration.

Then, the gNB-DU Configuration Update procedure can be used by a mobile IAB-node to inform the F1 terminating donor-CU about the gNB-ID of the RRC terminating donor-CU and the UE XnAP ID of the mobile IAB-MT at this CU.

It can be observed that the mIAB-MT's source donor CU can send the info on the mIAB-MT's target donor CU to the mIAB-DU's donor CU after the completion of IAB-MT HO (handover). Actually, the proposal is compatible with this statement as the source RRC terminating donor-CU (i.e. the mIAB-MT's source donor CU) would pass the information to the F1 terminating donor-CU (i.e. the mIAB-DU's donor CU), not directly, but through the mobile IAB-node.

While the present invention has been described with reference to examples and embodiments, it is to be understood that the invention is not limited to the disclosed examples and embodiments. It will be appreciated by those skilled in the art that various changes and modification might be made without departing from the scope of the invention, as defined in the appended claims. All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive. Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that different features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be advantageously used.

In the preceding embodiments, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may

be stored on or transmitted over, as one or more instructions or code, a computer-readable medium and executed by a hardware-based processing unit.

Computer-readable media may include computer-readable storage media, which corresponds to a tangible medium such as data storage media, or communication media including any medium that facilitates transfer of a computer program from one place to another, e.g., according to a communication protocol. In this manner, computer-readable media generally may correspond to (1) tangible computer-readable storage media which is non-transitory or (2) a communication medium such as a signal or carrier wave. Data storage media may be any available media that can be accessed by one or more computers or one or more processors to retrieve instructions, code and/or data structures for implementation of the techniques described in this disclosure. A computer program product may include a computer-readable medium.

By way of example, and not limitation, such computer-readable storage media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage, or other magnetic storage devices, flash memory, 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. Also, any connection is properly termed a computer-readable medium. For example, if instructions are transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave may be included in the definition of medium. It should be understood, however, that computer-readable storage media and data storage media do not include connections, carrier waves, signals, or other transient media, but are instead directed to non-transient, tangible storage media. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and Blu-ray disc, where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

Claims

1. A method for use in a migration process for migrating a Distributed Unit, DU, of an Integrated Access Backhaul, IAB, node from a source F1-terminating IAB-donor Central Unit, CU, to a target F1-terminating IAB-donor-CU, the method at the target F1-terminating IAB-donor-CU comprising:

receiving, from the IAB node, a message including identification information for identifying a RRC-terminating IAB-donor-CU terminating the RRC connection of the IAB-node, the RRC-terminating IAB-donor-CU being a different IAB-donor-CU to the target F1-terminating IAB-donor-CU;

based on the identification information, performing transport migration for migrating traffic related to the IAB-node through an IAB topology managed by the RRC-terminating IAB-donor-CU.

2. The method of claim 1, wherein the RRC-terminating IAB-donor-CU is the source IAB-donor-CU.

3. The method of claim 1, wherein the RRC-terminating IAB-donor-CU is a different IAB-donor-CU to the source and target F1-terminating IAB-donor-CU.

4. The method of claim 1, wherein the RRC-terminating IAB-donor-CU is a second IAB-donor-CU managing a second IAB topology, wherein performing transport migration includes performing transport migration for migrating traffic related to the IAB-node between the second topology and a target IAB topology managed by the target F1-terminating IAB-donor-CU.

5. The method of any one of the preceding claims, wherein the message is a F1 setup request message or a configuration update message.

6. The method of any one of the preceding claims, wherein the message further includes identification information for identifying a MT of the IAB-node.

7. The method of claim 6, wherein the identification information for identifying the MT of the IAB-node includes at least one of: *UE XnAP ID*; and a BAP address.

8. An apparatus for a first Integrated Access Backhaul, IAB, donor Central Unit, CU, node of an IAB communication system, the apparatus comprising:

one or more processing units configured to:

receive, from an IAB-node of the IAB communication system, a message including identification information for identifying a RRC-terminating IAB-donor-CU terminating the RRC connection of the IAB-node, the RRC-terminating IAB-donor-CU being a different IAB-donor-CU to the first IAB donor CU;

based on the identification information, perform transport migration for migrating traffic related to the IAB-node through an IAB topology managed by the RRC-terminating IAB-donor-CU.

9. The apparatus of claim 8, wherein the RRC-terminating IAB-donor-CU is a second IAB-donor-CU managing a second IAB topology, wherein performing transport migration includes performing transport migration for migrating traffic related to the IAB-node between the second topology and a first IAB topology managed by the first IAB-donor-CU.

10. The apparatus of claim 8 or claim 9, wherein the message is a F1 setup request message or a configuration update message.

11. The apparatus of any one of claims 8 to 10, wherein the message further includes identification information for identifying a MT of the IAB-node.

12. The apparatus of claim 11, wherein the identification information for identifying the MT of the IAB-node includes at least one of: *UE XnAP ID*; and a BAP address.

13. A computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method according to any one of claims 1 to 7.

14. A computer-readable medium carrying a computer program according to claim 13.