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Abstract

The present disclosure provides a method performed by a first radio network node for handling communication in a wireless communications network. The first radio network node transmits a message related to handover or cell reselection of a migration node to a second radio network node, wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node.

METHODS, RADIO NETWORK NODES FOR HANDLING COMMUNICATION

TECHNICAL FIELD

Embodiments herein relate to a first radio network node, a second radio network
5 node, and methods performed therein regarding wireless communication. Furthermore, a
computer program product and a computer-readable storage medium are also provided
herein. In particular, embodiments herein relate to handling communication, such as
controlling/managing handover or cell reselection of network nodes such as relay nodes,
in a wireless communications network.

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BACKGROUND

In a typical wireless communications network, user equipment (UE), also known
as wireless communication devices, mobile stations, stations (STA) and/or wireless
devices, communicate via a Radio Access Network (RAN) with one or more core
15 networks (CN). The RAN covers a geographical area which is divided into service areas
or cell areas, with each service area or cell area being served by radio network node such
as an access node e.g. a Wi-Fi access point or a radio base station (RBS), which in some
networks may also be called, for example, a NodeB, a gNodeB, or an eNodeB. The
service area or cell area is a geographical area where radio coverage is provided by the
20 radio network node. The radio network node operates on radio frequencies to
communicate over an air interface with the UEs within range of the radio network node.
The radio network node communicates over a downlink (DL) to the UE and the UE
communicates over an uplink (UL) to the radio network node.

A Universal Mobile Telecommunications System (UMTS) is a third generation
25 telecommunication network, which evolved from the second generation (2G) Global
System for Mobile Communications (GSM). The UMTS terrestrial radio access network
(UTRAN) is essentially a RAN using wideband code division multiple access (WCDMA)
and/or High-Speed Packet Access (HSPA) for communication with user equipment. In a
forum known as the Third Generation Partnership Project (3GPP), telecommunications
30 suppliers propose and agree upon standards for present and future generation networks
and UTRAN specifically, and investigate enhanced data rate and radio capacity. In some
RANs, e.g. as in UMTS, several radio network nodes may be connected, e.g., by
landlines or microwave, to a controller node, such as a radio network controller (RNC) or

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a base station controller (BSC), which supervises and coordinates various activities of the plural radio network nodes connected thereto. The RNCs are typically connected to one or more core networks.

Specifications for the Evolved Packet System (EPS) have been completed within
5 the 3GPP and this work continues in the coming 3GPP releases, such as for 5G networks such as New Radio (NR) and upcoming generations. The EPS comprises the Evolved Universal Terrestrial Radio Access Network (E-UTRAN), also known as the Long-Term Evolution (LTE) radio access network, and the Evolved Packet Core (EPC), also known as System Architecture Evolution (SAE) core network. E-UTRAN/LTE is a 3GPP radio
10 access technology wherein the radio network nodes are directly connected to the EPC core network. As such, the Radio Access Network (RAN) of an EPS has an essentially “flat” architecture comprising radio network nodes connected directly to one or more core networks.

With the emerging 5G technologies such as new radio (NR), the use of very many
15 transmit- and receive-antenna elements is of great interest as it makes it possible to utilize beamforming, such as transmit-side and receive-side beamforming. Transmit-side beamforming means that the transmitter can amplify the transmitted signals in a selected direction or directions, while suppressing the transmitted signals in other directions. Similarly, on the receive-side, a receiver can amplify signals from a selected direction or
20 directions, while suppressing unwanted signals from other directions.

Next generation systems are expected to support a wide range of use cases with varying requirements ranging from fully mobile devices to stationary internet of things (IoT) or fixed wireless broadband devices. The traffic pattern associated with many use cases may be expected to consist of short or long bursts of data traffic with varying length
25 of waiting period in between, here called inactive state. In NR, both license-assisted access and standalone unlicensed operation are to be supported. Hence the procedure of Physical Random Access Channel (PRACH) transmission and/or Scheduling Request (SR) transmission in unlicensed spectrum may be investigated in 3GPP.

3GPP is studying potential solutions for efficient operation of integrated access
30 and wireless access backhaul (IAB) in NR, or just integrated access backhaul for short. In the context of IAB there are two kinds of nodes that are identified as components of a RAN:

IAB-node: a RAN node that supports wireless access to UEs and wirelessly backhauls the access traffic.

IAB-donor: an IAB node i.e. RAN node which provides UE's interface to core network and wireless backhauling functionality to IAB nodes.

3GPP is currently standardizing integrated access and wireless access backhaul
5 in NR (IAB) in Rel-16 (RP-193251).

The usage of short range mmWave spectrum in NR creates a need for densified deployment with multi-hop backhauling. However, optical fiber to every base station will be too costly and sometimes not even possible, e.g. due to historical sites. The main IAB principle is the use of wireless links for the backhaul, instead of fiber, to enable flexible
10 and very dense deployment of cells without the need for densifying the transport network. Use case scenarios for IAB may include coverage extension, deployment of massive number of small cells and fixed wireless access (FWA), e.g. to residential/office buildings. The larger bandwidth available for NR in mmWave spectrum provides opportunity for self-backhauling, without limiting the spectrum to be used for the access links. On top of that,
15 the inherent multi-beam and multiple input multiple output (MIMO) support in NR reduce cross-link interference between backhaul and access links allowing higher densification.

During the study item phase of the IAB work, summary of the study item can be found in the technical report TR 38.874, it has been agreed to adopt a solution that leverages the Central Unit (CU)/Distributed Unit (DU) split architecture of NR, where the
20 IAB node will be hosting a DU part that is controlled by a central unit. The IAB nodes also have a Mobile Termination (MT) part, denoted as IAB-MT, that they use to communicate with their parent nodes.

The specifications for IAB strives to reuse existing functions and interfaces defined in NR. In particular, MT, gNB-DU, gNB-CU, user plane function (UPF), access and
25 mobility management functions (AMF) and session management function (SMF) as well as the corresponding interfaces NR Uu, between MT and gNB, F1, NG, X2 and N4 are used as baseline for the IAB architectures. Modifications or enhancements to these functions and interfaces for the support of IAB will be explained in the context of the architecture discussion. Additional functionality such as multi-hop forwarding is included in
30 the architecture discussion as it is necessary for the understanding of IAB operation and since certain aspects may require standardization.

The MT function has been defined as a component of the IAB node. In the context of this study, MT is referred to as a function residing on an IAB-node that terminates the radio interface layers of the backhaul Uu interface toward the IAB-donor or other IAB-
35 nodes.

Fig. 1 shows a high-level architectural view of an IAB network. **Fig. 1** shows a reference diagram for IAB in standalone mode, which contains one IAB-donor and multiple IAB-nodes. The IAB-donor may be treated as a single logical node that comprises a set of functions such as gNB-DU, gNB-CU-control plane (CP), gNB-CU-user plane (UP) and potentially other functions. In a deployment, the IAB-donor may be split according to these functions, which may all be either collocated or non-collocated as allowed by 3GPP NG-RAN architecture. IAB-related aspects may arise when such split is exercised. Also, some of the functions presently associated with the IAB-donor may eventually be moved outside of the IAB-donor in case it becomes evident that they do not perform IAB-specific tasks. Thus, Fig. 1 shows a reference diagram for IAB-architectures (TR 38.874 v0.7.0).

The baseline user plane and control plane protocol stacks for IAB are shown in the Figs 2-3.

Fig. 2 shows a Baseline User Plane Protocol stack for IAB in rel-16.

Fig. 3 shows a Baseline control plane Protocol stack for IAB in rel-16.

As shown, the chosen protocol stacks reuse the current CU-DU split specification in rel-15, where the full user plane F1-U (GTP-U/UDP/IP) is terminated at the IAB node, like a normal DU and the full control plane F1-C (F1-AP/SCTP/IP) is also terminated at the IAB node, like a normal DU. In the above cases, Network Domain Security (NDS) has been employed to protect both UP and CP traffic, IPsec in the case of UP, and datagram transport layer security (DTLS) in the case of CP. IPsec could also be used for the CP protection instead of DTLS, in this case no DTLS layer would be used.

A new protocol layer called Backhaul Adaptation Protocol (BAP) has been introduced in the IAB nodes and the IAB donor, which is used for routing of packets to the appropriate downstream/upstream node and also mapping the UE bearer data to the proper backhaul radio link control (RLC) channel, and also between ingress and egress backhaul RLC channels in intermediate IAB nodes, to satisfy the end-to-end quality of service (QoS) requirements of bearers.

BAP entities

On the IAB-node, the BAP sublayer contains one BAP entity at the MT function and a separate collocated BAP entity at the DU function. On the IAB-donor-DU, the BAP sublayer contains only one BAP entity. Each BAP entity has a transmitting part and a receiving part. The transmitting part of the BAP entity has a corresponding receiving part of a BAP entity at the IAB-node or IAB-donor-DU across the backhaul link.

Fig. 4 shows one example of the functional view of the BAP sublayer. This functional view should not restrict implementation. The Fig. 4 is based on the radio interface protocol architecture defined in TS 38.300 v16.1.0. In the example of Fig. 4, the receiving part on the BAP entity delivers BAP Protocol data units (PDU) to the transmitting part on the 5 collocated BAP entity. Alternatively, the receiving part may deliver BAP service data units (SDU) to the collocated transmitting part. When passing BAP SDUs, the receiving part removes the BAP header and the transmitting part adds the BAP header with the same BAP routing ID as carried on the BAP PDU header prior to removal. Passing BAP SDUs in this manner is therefore functionally equivalent to passing BAP PDUs, in 10 implementation.

Services provided to upper layers.

The following services are provided by the BAP sublayer to upper layers:

- data transfer;

Services expected from lower layers.

15 A BAP sublayer expects the following services from lower layers per RLC entity, for a detailed description see TS 38.322 v.16.1.0:

- acknowledged data transfer service;
- unacknowledged data transfer service.

Functions.

20 The BAP sublayer supports the following functions:

- Data transfer;
- Determination of BAP destination and path for packets from upper layers;
- Determination of egress backhaul (BH) RLC channels for packets routed to next hop;
- 25 - Routing of packets to next hop;
- Differentiating traffic to be delivered to upper layers from traffic to be delivered to egress link;
- Flow control feedback and polling signalling;

30 Topology Adaptation Scenarios for Baseline Architecture.

Fig. 5 shows an example of some possible IAB-node migration cases listed in the order of complexity and more details as follow:

Intra-CU Case (A): In this case the IAB-node (e) along with it serving UEs is moved to a new parent node (IAB-node (b)) under the same donor-DU (1). The successful 35 intra-donor DU migration requires establishing UE context setup for the IAB-node (e) MT

in the DU of the new parent node (IAB-node (b)), updating routing tables of IAB nodes along the path to IAB-node (e) and allocating resources on the new path. The IP address for IAB-node (e) will not change, while the F1-U tunnel/connection between donor-CU (1) and IAB-node (e) DU will be redirected through IAB-node (b).

5 **Intra-CU Case (B):** The procedural requirements/complexity of this case is the same as that of Case (A). Also, since the new IAB-donor DU, i.e. DU2, is connected to the same L2 network, the IAB-node (e) can use the same IP address under the new donor DU. However, the new donor DU, i.e. DU2, will need to inform the network using IAB-node (e) L2 address in order to get/keep the same IP address for IAB-node (e) by
10 employing some mechanism such as Address Resolution Protocol (ARP).

Intra-CU Case (C): This case is more complex than Case (A) as it also needs allocation of new IP address for IAB-node (e). In case, IPsec is used for securing the F1-U tunnel/connection between the Donor-CU (1) and IAB-node (e) DU, then it might be possible to use existing IP address along the path segment between the Donor-CU (1)
15 and security gateway (SeGW), and new IP address for the IPsec tunnel between SeGW and IAB-node (e) DU.

Inter-CU Case (D): This is the most complicated case in terms of procedural requirements and may need new specification procedures that are beyond the scope of 3GPP Rel-16.

20 Note that 3GPP Rel-16 has standardized procedure only for intra-CU migration, which is described below.

 Thus, Fig. 5 shows examples of different possible scenarios for IAB-node migration.

25 Intra-CU topology adaptation procedure.

 During the intra-CU topology adaptation, both the source and the target parent node are served by the same IAB-donor-CU. The target parent node may use a different IAB-donor-DU than the source parent node. The source path may further have common nodes with the target path. **Fig. 6** shows an example of an IAB intra-CU topology
30 adaptation procedure, where the target parent node uses a different IAB-donor-DU than the source parent node.

 Action 1. The migrating IAB- MT sends a *Measurement Report* message to the source parent node gNB-DU. This report is based on a *Measurement Configuration* the migrating IAB-MT received from the IAB-donor-CU before.

Action 2. The source parent node gNB-DU sends an UL RRC MESSAGE TRANSFER message to the IAB-donor-CU to convey the received *Measurement Report*.

Action 3. The IAB-donor-CU sends a UE CONTEXT SETUP REQUEST message to the target parent node gNB-DU to create the UE context for the migrating IAB-MT and setup one or more bearers. These bearers are used by the migrating IAB-MT for its own data and signalling traffic.

Action 4. The target parent node gNB-DU responds to the IAB-donor-CU with a UE CONTEXT SETUP RESPONSE message.

Action 5. The IAB-donor-CU sends a UE CONTEXT MODIFICATION REQUEST message to the source parent node gNB-DU, which includes a generated *RRCReconfiguration* message. The *Transmission Action Indicator* in the UE CONTEXT MODIFICATION REQUEST message indicates to stop the data transmission to the migrating IAB-node.

Action 6. The source parent node gNB-DU forwards the received *RRCReconfiguration* message to the migrating IAB-MT.

Action 7. The source parent node gNB-DU responds to the IAB-donor-CU with the UE CONTEXT MODIFICATION RESPONSE message.

Action 8. A Random Access procedure is performed at the target parent node gNB-DU.

Action 9. The migrating IAB-MT responds to the target parent node gNB-DU with an *RRCReconfigurationComplete* message.

Action 10. The target parent node gNB-DU sends an UL RRC MESSAGE TRANSFER message to the IAB-donor-CU to convey the received *RRCReconfigurationComplete* message. Also, uplink packets can be sent from the migrating IAB-MT, which are forwarded to the IAB-donor-CU through the target parent node gNB-DU. These DL and UL packets belong to the MT's own signalling and data traffic.

Action 11. The IAB-donor-CU configures BH RLC channels and BAP-layer route entries on the target path between migrating IAB-node and target IAB-donor-DU. This step also includes allocation of transport network layer (TNL) address(es) that is (are) routable via the target IAB-donor-DU. These configurations may be performed at an earlier stage, e.g. right after action 3. The new TNL address(es) is (are) included in the *RRCReconfiguration* message at action 5.

Action 12. All F1-U tunnels and F1-C are switched to use the migrating IAB-node's new TNL address(es).

Action 13. The IAB-donor-CU sends a UE CONTEXT RELEASE COMMAND message to the source parent node gNB-DU.

Action 14. The source parent node gNB-DU releases the migrating IAB-MT's context and responds the IAB-donor-CU with a UE CONTEXT RELEASE COMPLETE
5 message.

Action 15. The IAB-donor-CU releases BH RLC channels and BAP routing entries on the source path. The migrating IAB-node may further release the TNL address(es) it used on the source path.

NOTE: In case that the source route and target route have common nodes, the
10 BH RLC channels and BAP routing entries of those nodes may not need to be released in Action 15.

NOTE: Actions 11, 12 and 15 also have to be performed for the migrating IAB-node's descendant nodes, as follows:

- The descendant nodes must also switch to new TNL addresses that are anchored
15 in the target IAB-donor-DU. The IAB-donor-CU may send these addresses to the descendant nodes and release the old addresses via corresponding radio resource control (RRC) signalling.
- If needed, the IAB-donor-CU configures BH RLC channels, BAP-layer route entries on the target path for the descendant nodes and the BH RLC Channel
20 mappings on the descendant nodes in the same manner as described for the migrating IAB-node in action 11.
- The descendant nodes switch their F1-U and F1-C tunnels to new TNL addresses that are anchored at the new IAB-donor-DU, in the same manner as described for the migrating IAB-node in action 12.
- 25 - Based on implementation, these actions can be performed after or in parallel with the handover of the migrating IAB-node. In Rel-16, in-flight packets in UL direction that were dropped during the migration procedure may not be recoverable.

NOTE: In upstream direction, in-flight packets between the source parent node and the IAB-donor-CU can be delivered even after the target path is established.

30 NOTE: On-going downlink data in the source path may be discarded up to implementation.

NOTE: IAB-donor-CU can determine the unsuccessfully transmitted downlink data over the backhaul link by implementation.

As mentioned above, 3GPP Rel-16 has standardized only the IAB intra-CU migration procedure. Considering that inter-CU migration will be an important feature of IAB Rel-17 work item (WI), certain enhancements to existing UE handover and IAB intra-CU migration procedure are required for reducing service interruption, due to IAB-node migration, and signalling load.

SUMMARY

In the legacy UE case, by accepting a handover for an individual UE, the target RAN node commits to providing the resources for serving the migrating UE's signalling connection and up to 16 data radio bearers (DRB). As opposed to a legacy DU which serves a number of UEs, an IAB node may serve not only UEs, but also up to 1024 directly connected child nodes, and up to 65536 BH RLC channels established to each child, and their connected UEs. Moreover, these child IAB nodes may have their own child IAB nodes that also serve UEs. However, current specifications enable only the handover of individual UEs.

An object herein is to provide a mechanism to enable communication, e.g. handle or manage signalling, in an efficient manner in a wireless communications network.

According to an aspect the object is achieved, according to embodiments herein, by providing a method performed by a first radio network node for handling or managing signalling or communication in a wireless communications network. The first radio network node transmits a message related to handover or cell reselection of a migrating node to a second radio network node, wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node. Thus, the first radio network node such as an IAB node transmits to the second radio network node, for example, a message for setting up communication of the migrating node e.g. an IAB node, wherein the message comprises data associated with the migrating node and data related to other nodes, such as IAB nodes and/or UEs, directly and indirectly served by the migrating node. The data may indicate resources required to serve the migrating node and/or the other nodes.

According to another aspect the object is achieved, according to embodiments herein, by providing a method performed by a second radio network node, such as an IAB node, for handling or managing communication and/or control signalling in a wireless communications network. The second radio network node receives from a first radio network node, a message related to handover or cell reselection of a migrating node, wherein the message comprises data associated with the migrating node and data related

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to one or more other nodes directly and indirectly served by the migrating node. Thus, the second radio network node receives the message related to handover or cell reselection of a node such as a handover request from the first radio network node. The message comprises data (indication) associated with the migrating node e.g. IAB node and data
5 related to the other nodes, such as IAB nodes and/or UEs, directly and/or indirectly served by the migrating node. The data may indicate one or more resources required to serve the migrating node and/or the other nodes. The second radio network node may then determine or decide whether to allow the handover of the migrating node and the one or more other nodes taking the received data into account e.g. performing admission
10 control for the UEs and IAB nodes included in the received data.

According to yet another aspect of embodiments herein, the object is achieved by providing a first radio network node for handling or managing signalling or communication in a wireless communications network. The first radio network node is configured to transmit a message related to handover or cell reselection of a migrating node to a
15 second radio network node, wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly or indirectly served by the migrating node.

According to still another aspect the object is achieved, according to embodiments herein, by providing a second radio network node, such as an IAB node, for handling or
20 managing communication and/or control signalling in a wireless communications network. The second radio network node is configured to receive from a first radio network node, a message related to handover or cell reselection of a migrating node, wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node. The message
25 comprises data, or an indication, associated with the migrating node e.g. IAB node and data related to other nodes, such as IAB nodes and/or UEs, directly and/or indirectly served by the migrating node. The data may indicate one or more resources required to serve the node and/or other nodes. The second radio network node may further be configured to determine or decide whether to allow the handover of the node taking the
30 received data into account, e.g., performing admission control for the UEs and IAB nodes included in the received data.

It is furthermore provided herein a computer program product comprising instructions, which, when executed on at least one processor, cause the at least one processor to carry out the method above, as performed by the first radio network node or
35 the second radio network node, respectively. It is additionally provided herein a computer-

readable storage medium, having stored thereon a computer program product comprising instructions which, when executed on at least one processor, cause the at least one processor to carry out the method according to the method above, as performed by the first radio network node or the second radio network node, respectively.

5 Embodiments herein enable the exchange of data such as handover-related information for a migrating IAB node and its directly and indirectly served IAB nodes and UEs and may also convey, to the second radio network node, information about the parent-child relations therein. In, for example, the case the migration/handover of a stationary IAB node is done due to load balancing, it is likely that the UEs or children IAB
10 nodes connected to the migrating IAB node prior to the migration will still be best served by the same IAB node after the migration. Even in the case of mobile IAB (e.g. an IAB node attached to a bus/train), there could be several UEs attached to that IAB node and they will continue to be served by the same IAB node/cell after the migration. Thus, it makes sense to optimize this transition and avoid unnecessary service interruption. In
15 other words, it seems optimal to keep the same topology (of UEs and children IAB nodes) under the migrating IAB node after the handover/migration of the IAB node. By informing the second radio network node such as a target gNB/gNB-CU about the resources required to serve the migrating IAB node and all the UEs/IAB nodes that are directly or indirectly being served by the IAB node, proper admission control may be performed by
20 the second radio network node, considering the resources available at the parent target node for the migrating IAB node and any intermediate nodes between the target donor CU and the parent target node in case of multiple hops between the parent node and the target gNB-CU. Also, the contexts of the migrating IAB node and all IAB nodes/UEs that are being served by the IAB node, directly or indirectly, may be relocated to the second
25 radio network node jointly.

Thus, embodiments herein enable communication, e.g. handle or manage signalling, in an efficient manner in a wireless communications network.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Embodiments will now be described in more detail in relation to the enclosed drawings, in which:

Fig. 1 is a reference diagram depicting IAB-architectures;

Fig. 2 shows a baseline User Plane (UP) Protocol stack for IAB in rel-16 according to prior art;

- Fig. 3 shows a baseline control plane (CP) Protocol stack for IAB in rel-16 according to prior art;
- Fig. 4 shows an example of functional view of BAP sublayer according to prior art;
- 5 Fig. 5 shows examples of different possible scenarios for IAB-node migration according to prior art;
- Fig. 6 is a IAB intra-CU topology adaptation procedure according to prior art;
- Fig. 7 is a schematic overview depicting a wireless communications network according to embodiments herein;
- 10 Fig. 8 is a schematic overview depicting a wireless communications network according to embodiments herein;
- Fig. 9 is a is a combined signalling scheme and flowchart according to some embodiments herein;
- Fig. 10 is a schematic flowchart depicting a method performed by a first radio
15 network node according to embodiments herein;
- Fig. 11 is a schematic flowchart depicting a method performed by a second radio network node according to embodiments herein;
- Fig. 12 is a block diagram depicting first radio network nodes according to embodiments herein;
- 20 Fig. 13 is a block diagram depicting second radio network nodes according to embodiments herein;
- Fig. 14 is a telecommunication network connected via an intermediate network to a host computer in accordance with some embodiments;
- Fig. 15 is a host computer communicating via a base station with a user equipment over a
25 partially wireless connection in accordance with some embodiments;
- Fig. 16 is methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments;
- Fig. 17 is methods implemented in a communication system including a host
30 computer, a base station and a user equipment in accordance with some embodiments;
- Fig. 18 is methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments; and

Fig. 19 is methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments.

5 DETAILED DESCRIPTION

Embodiments herein relate to wireless communications networks in general. **Fig. 7** is a schematic overview depicting a **wireless communications network 1**. The wireless communications network 1 comprises one or more RANs and one or more CNs. The wireless communications network 1 may use one or a number of different technologies.

10 Embodiments herein relate to recent technology trends that are of particular interest in a New Radio (NR) context, however, embodiments are also applicable in further development of existing wireless communications systems such as e.g. LTE or Wideband Code Division Multiple Access (WCDMA).

In the wireless communications network 1, a user equipment (**UE**) **10** such as a 15 mobile station, a wireless device, a non-access point (non-AP) STA, a STA, and/or a wireless terminal, is comprised communicating via e.g. one or more Access Networks (AN), e.g. RAN, to one or more core networks (CN). It should be understood by the skilled in the art that "UE" is a non-limiting term which means any terminal, wireless communications terminal, user equipment, NB-IoT device, Machine Type Communication 20 (MTC) device, Device to Device (D2D) terminal, or node e.g. smart phone, laptop, mobile phone, sensor, relay, mobile tablets or even a small base station capable of communicating using radio communication with a radio network node within an area served by the radio network node.

The wireless communications network 1 comprises a **first radio network node 12** 25 such as a IAB-donor node such as an access node, an access controller, a base station, e.g. a radio base station such as a gNodeB (gNB), an evolved Node B (eNB, eNode B), a NodeB, a base transceiver station, a radio remote unit, an Access Point Base Station, a base station router, a Wireless Local Area Network (WLAN) access point or an Access Point Station (AP STA), a mobility management entity (MME), an AMF, a stand-alone 30 access point or any other network unit or node capable of communicating with a wireless device within a service area served by the radio network node depending e.g. on a first radio access technology and terminology used. The first radio network node 12 may also be referred to as serving or source node or RAN node. It should be noted that a service area may be denoted as cell, beam, beam group or similar to define an area of radio 35 coverage.

The wireless communication network 1 further comprises a **first intermediate radio network node 13** connected in-between the first radio network node 12 and the UE 10. The first intermediate radio network node 13 may be an IAB node such as an access node, antenna unit, radio unit, a radio base station such as a gNodeB (gNB), an evolved Node B (eNB, eNode B), a NodeB, a base transceiver station, a radio remote unit, an Access Point Base Station, a base station router, a Wireless Local Area Network (WLAN) access point or an Access Point Station (AP STA), a transmission arrangement of a radio base station, a stand-alone access point or any other network unit or node capable of communicating with a wireless device within a service area served by the radio network node depending e.g. on a first radio access technology and terminology used.

The wireless communication network further comprises a **second intermediate radio network node 14** connected in-between the first radio network node 12 and the UE 10. The second intermediate radio network node 14 may be connected to the UE 10 directly and may be an egress point. The second intermediate radio network node 14 may be an IAB node such as an access node, antenna unit, radio unit, a radio base station such as a gNodeB (gNB), an evolved Node B (eNB, eNode B), a NodeB, a base transceiver station, a radio remote unit, an Access Point Base Station, a base station router, a Wireless Local Area Network (WLAN) access point or an Access Point Station (AP STA), a transmission arrangement of a radio base station, a stand-alone access point or any other network unit or node capable of communicating with a wireless device within a service area served by the radio network node depending e.g. on a radio access technology and terminology used.

Furthermore, the wireless communications network 1 comprises a **second radio network node 15** such as a IAB-donor node e.g. an access node, an access controller, a base station, e.g. a radio base station such as a gNodeB (gNB), an evolved Node B (eNB, eNode B), a NodeB, a base transceiver station, a radio remote unit, an Access Point Base Station, a base station router, a Wireless Local Area Network (WLAN) access point or an Access Point Station (AP STA), an MME, an AMF, a stand-alone access point or any other network unit or node capable of communicating with a wireless device within a service area served by the radio network node depending e.g. on a radio access technology and terminology used. The second radio network node 15 may be referred to as a target node or RAN node.

The wireless communication network 1 may further comprise a **third intermediate radio network node 16** connected in-between the second radio network node 15 and served UEs. The third intermediate radio network node 16 may be an IAB node e.g. an

access node, antenna unit, radio unit, a radio base station such as a gNodeB (gNB), an evolved Node B (eNB, eNode B), a NodeB, a base transceiver station, a radio remote unit, an Access Point Base Station, a base station router, a Wireless Local Area Network (WLAN) access point or an Access Point Station (AP STA), a transmission arrangement
 5 of a radio base station, a stand-alone access point or any other network unit or node capable of communicating with a wireless device within a service area served by the radio network node depending e.g. on a radio access technology and terminology used. It should be noted that a service area may be denoted as cell, beam, beam group or similar to define an area of radio coverage.

10 Embodiments herein disclose signalling over RAN interfaces during the handover of an migrating node, for example, an IAB node such as the first intermediate radio network node 13, to inform a target RAN node such as the second radio network node 15, e.g. gNB, gNB-CU, gNB-CU-CP, implicitly and/or explicitly, about data such as the amount of resources required for serving the migrating node and all the children IAB
 15 nodes and UEs being served, either directly or indirectly, by the concerned migrating node.

Fig. 8 shows an example of an IAB network handover scenario. The IAB node 3, being an example of the migrating node, is to be handover to the IAB node 2, being an
 20 example of the second radio network node 15. The IAB node 3 is serving one or more other nodes such as UEa, UEb, UEc, IAB node 4, and UEe. Fig. 8 is showing an inter-CU migration of the IAB node 3 with its children IAB node and connected UEs.

- The inter-CU IAB node migration may be caused by e.g. radio link failure (RLF), load balancing, IAB node mobility. These are non-limiting examples.
- 25 • The terms “gNB-CU” and “Donor-CU”, “donor”, “CU-CP” and “CU” are used interchangeably.
- All considerations for a split donor (i.e. donor CU) are equally applicable for a non-split donor (i.e. donor gNB).
- The terms “backhaul RLC channel” and “BH RLC channel” and “BH bearer” are
 30 used interchangeably.
- The term “gNB” applies to all variants therein, e.g. “gNB”, “en-gNB” etc.
- The example topology shown in Fig. 8 is used for the embodiments herein, where IAB-Donor CU1 has an F1 interface with IAB-node 3 DU, while the MT functionality of the IAB-node 3, i.e. IAB-MT-3, is connected/served by IAB-node 1.

- The term “a UE/IAB node *directly served by the migrating IAB node*” refers to a UE/IAB node that is directly connected to the migrating IAB node.
- The term “a UE/IAB node is *indirectly served by the migrating IAB node*” means that the migrating IAB node is an ancestor node to an IAB node that is currently serving the UE or IAB node.
- The term *concerned UE/IAB node* refers to a UE/IAB node that is directly/indirectly being served by the migrating IAB node.
- The term *source parent node* refers to the radio network node that was serving the migrating IAB node before the handover, i.e. a source donor DU in case the migrating IAB node was just one hop away from the source CU, or a parent IAB node, in case the migrating IAB node was multiple hops away from the source CU.
- The term *target parent node* refers to the radio network node that will serve the migrating IAB node after the handover, i.e. a target donor DU in case the migrating IAB node will be connected just one hop away from the target CU, or a parent IAB node, in case the migrating IAB node will be multiple hops away from the target CU.
- All the cells of the DUs controlled by the same donor CU, i.e. the donor DU and the IAB-DUs of all IAB nodes that are under the same donor CU, are also referred to as being served by the donor CU.
- Embodiments herein are presented on a non-limiting example of Xn handover, but it is applicable to the NG, S1 and X2 handovers as well.

Fig. 9 is a combined signalling scheme and flowchart depicting some embodiments herein wherein the first radio network node 12 is exemplified as an IAB-donor CU and the second radio network node 15 is exemplified as a second IAB-donor CU.

Action 901. The first radio network node 12 may decide to handover a node i.e. a migrating node such as an IAB node to the second radio network node 15 and/or a plurality of other nodes such as radio network nodes and/or UEs. This may be decided based on measurements, load conditions of the different radio network nodes, mobility or configured. The cause may be e.g. RLF, load balancing, and/or IAB node mobility.

Action 902. The first radio network node 12 transmits, for example, a handover request to the second radio network node 15, wherein the handover request comprises data, or an indication, associated with the migrating node, e.g. IAB node, and data related to the one or more other nodes, such as IAB nodes and/or UEs, directly and indirectly

served by the migrating node. The data may indicate one or more resources required to serve the migrating node and/or the one or more other nodes.

Action 903. The second radio network node 15 may then decide or determine whether to accept the handover (cell reselection) or not.

5 **Action 904.** The second radio network node 15 may then transmit an indication back to the first radio network node 12 reflecting the decision. The second radio network node 15 may for example transmit a value indicating acceptance and/or data indicating accepted PDU sessions, DRBs, and/or QoS flows.

10 **Action 905.** The first radio network node 12 may then handle the handover of the migrating node based on the received indication. E.g. transmit handover command to the second radio network node 15 or transmit a handover rejection to the second radio network node 15.

The method actions performed by the first radio network node 12 for handling
15 communication in the wireless communications network 1 according to embodiments herein will now be described with reference to a flowchart depicted in **Fig. 10**. The wireless communications network 1 may comprise the first radio network node 12 and the second radio network node 15 and one or more nodes relaying data packets between the radio network nodes and the UE 10. The one or more nodes may be an intermediate radio
20 network node between the first radio network node 12 and UEs.

Action 1001. The first radio network node 12 may determine to handover the migrating node to the second radio network node. E.g. based on measurements, load conditions or be configured. For example, the first radio network node 12 may decide to handover an IAB node to a target cell that belongs to the second radio network node 15
25 (target Donor-CU). The decision to handover the IAB node could be, for example, due to one or more of the following reasons:

- based on load conditions at the source, for example:
 - UP/CP resources at the source donor-CU, UP/CP resources at the source donor-DU, radio resources at the donor-DU, radio resources
30 at the parent node of the IAB node such as the source donor DU or another IAB node, radio resources at any intermediate node between the IAB node and the source donor DU ; and/or
- based on measurements received from the IAB node

- E.g. mobile IAB node, stationary IAB node experiencing a blockage on the link between the parent node and the IAB node degrading the performance of the backhaul link of the IAB node, etc.

- based on operation, administration and maintenance (OAM) network re-configuration decision.

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Action 1002. The first radio network node 12 may prepare a handover request for the second radio network node 15. Thus, the first radio network node 12 may prepare a HANDOVER REQUEST message (a modified version of the Xn HANDOVER REQUEST message or a newly defined message for the purpose of embodiments herein) to the

10 second radio network node 15, and may include in this handover request message one or more of the following:

- The context of the MT of the migrating IAB node
 - This includes a context similar to a UE context as well as particular information relevant only to IAB nodes such as BAP configuration, e.g. BAP address, and configuration of mapping of UL traffic.

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- The context of the DU of the migrating IAB node, migrating IAB-DU,
 - This includes information such as the information about the F1-C and F1-U connection of the migrating IAB-DU, including F1-AP context configuration information related to F1-C or F1-U enabling the transfer of the F1-AP connection, information about the cells served by the IAB-DU, as well as IAB-specific information, such as mapping configuration of UL/DL traffic, IAB-specific Physical layer configuration of the cells served by the IAB-DU, e.g. multiplexing capabilities between the IAB-DU and the collocated IAB-MT, etc.

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- The contexts of UEs being served directly by the migrating IAB node
- The contexts of the MTs of the IAB nodes being served directly by the migrating IAB node
 - Similar information elements contained as in the migrating IAB node's MT, as described above.

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- The contexts of the DUs of the IAB nodes being served directly by the migrating IAB node
 - Similar information elements contained as in the migrating IAB node's DU, as described above.

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- The contexts of UEs being served indirectly by the migrating IAB node

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- The contexts of the MTs of the IAB nodes being served indirectly by the migrating IAB node
 - The context additionally including an indication of the identity of the parent node the IAB node, i.e. the parent node's BAP address(es).
- 5 ○ The context of the DUs of the IAB nodes being served indirectly by the migrating IAB node

Note: The information listed in the above bullets may be referred to as the group handover information (GHI).

Action 1003. The first radio network node 12 transmits the message related to
 10 handover or cell reselection such as a handover request of the migrating node to the second radio network node 15, wherein the message comprises data (indication) associated with the migrating node, e.g. IAB node, and data related to the one or more other nodes, such as IAB nodes and/or UEs, directly and indirectly served by the migrating node. The data may indicate one or more resources required to serve the
 15 migrating node and/or the one or more other nodes. The data may comprise contexts of the migrating node and/or the one or more other nodes.

Action 1004. The first radio network node 12 may further receive from the second radio network node 15, an indication indicating whether handover is confirmed or not. The indication may indicate whether the handover or cell reselection of the migrating node
 20 and/or the one or more other nodes has been accepted or not, respectively. The received indication may be comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the transmitted message may comprise a HANDOVER REQUEST message. Thus, the first radio network node 12 may receive a handover response message from the second radio network node 15.

25 **Action 1005.** The first radio network node 12 may then handle a handover process of the migrating node and/or the one or more other nodes based on the received indication, for example, handle handover of the migrating node based on the received indication. The first radio network node 12 may, for example, on determining the response message is a HANDOVER REQUEST ACKNOWLEDGE message (a modified version of
 30 the Xn HANDOVER REQUEST ACKNOWLEDGE message or a newly defined message for that purpose): Determine the *admission level* of the response message.

- The admission level may be a measure used/computed by the source node such as the first radio network node 12, and one or more of the following are considered while computing it:

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- the PDU sessions of the directly and/or indirectly served UEs
- the DRBs of the directly and/or indirectly served UEs (and optionally IAB-MTs)
- the QoS flows of the directly/indirectly served UEs
- the PDU sessions, if any, of the MTs of the directly/indirectly served IAB nodes, including the migrating IAB-MT
- The number and properties of BH RLC channels on all concerned hops/links, i.e. between the migrating IAB node and all its served IAB nodes, i.e. their configured priority, QoS, the number of 1:1- and N:1- mapped
 - The number of UE and IAB-MT contexts being migrated
 - The admission level may be based on the number of accepted PDU sessions, DRBs, QoS flows, etc
 - The admission level could be based on an aggregated measure, e.g. the aggregate data rate of the QoS flows that were admitted
 - If the admission level is acceptable:
 - Sending a handover command to the MT of the migrating IAB node
 - If the admission level is not acceptable:
 - Sending a HANDOVER CANCEL message to the target network node such as the second radio network node 15.

The first radio network node 12 may for example on determining the response message is a HANDOVER PREPARATION FAILURE message or that the response message was a HANDOVER REQUEST ACKNOWLEDGE but the admission level was found to be unacceptable, the first radio network node 12 may:

- Refrain from sending the handover command to the MT of the migrating IAB node.

The first radio network node 12 may be a source IAB donor central unit and the second radio network node 15 may be a target IAB donor central unit.

Thus, it is herein disclosed a method for the first radio network node 12, operating as a source donor central unit, e.g. Donor-CU, in an Integrated access backhaul (IAB) network, serving as a donor node for an IAB node, migrating IAB node, and providing connectivity for a UE.

The method actions performed by the second radio network node 15, such as an IAB node, for handling communication in the wireless communications network 1 according to embodiments herein will now be described with reference to a flowchart depicted in Fig. 11. The wireless communications network 1 may comprise the first radio network node 12 and the second radio network node 15 and one or more nodes relaying data packets between a central network node such as the first radio network node 12 and the UE 10.

Action 1101. The second radio network node 15 receives from the first radio network node 12, the message related to handover or cell reselection of the migrating node, wherein the message comprises data associated with the migrating node and data related to the one or more other nodes directly and indirectly served by the migrating node. Thus, the second radio network node 15 may receive the message related to handover or cell reselection of a node such as a handover request from the first radio network node 12, wherein the message comprises data (indication) associated with the (migrating) node e.g. IAB node and data related to other nodes, such as IAB nodes and/or UEs, directly and/or indirectly served by the node. The data may indicate one or more resources required to serve the migrating node and/or the one or more other nodes. The data may comprise contexts of the migrating node and/or the one or more other nodes. For example, the second radio network node 15 may receive a HANDOVER REQUEST message, for example, a modified version of the Xn Handover Request message or a newly defined message for that purpose, from the first radio network node 12, requesting to handover the migrating node such as an indicated migrating IAB node to a cell that belongs to the second radio network node 15, e.g. a cell being served by a donor DU or an IAB node under the second radio network node 15, wherein the message includes data comprising one or more of the following:

- The context of the one or more MTs of the migrating IAB node
 - This includes a context similar to a UE context as well as particular information relevant only to IAB nodes such as BAP configuration, e.g. BAP address, and configuration of mapping of UL traffic.
- The context of the DU of the migrating IAB node (migrating IAB-DU)
 - This includes information such as the information about the F1-C and F1-U connection of the migrating IAB-DU, information about the cells served by the migrating IAB-DU, as well as IAB-specific information, such as mapping configuration of UL/DL traffic, IAB-specific Physical layer configuration of the cells served by the IAB-

DU, e.g. multiplexing capabilities between the IAB-DU and the collocated IAB-MT, etc.

- The contexts of UEs being served directly by the migrating IAB node
- The contexts of the MTs of the IAB nodes being served directly by the migrating IAB node
 - Similar information elements contained as in the migrating IAB node's MT.
- The contexts of the DUs of the IAB nodes being served directly by the migrating IAB node
 - Similar information elements contained as in the migrating IAB node's DU.
- The contexts of UEs being served indirectly by the migrating IAB node
- The contexts of the MTs of the IAB nodes being served indirectly by the migrating IAB node
 - The context additionally including an indication of the identity of the parent node the IAB node (i.e. the parent node's BAP address(es))
- The context of the DUs of the IAB nodes being served indirectly by the migrating IAB node

Action 1102. The second radio network node 15 may perform admission control to determine whether to accept or not the handover or cell reselection of the migrating node and/or the one or more other nodes. For example, the second radio network node 15 may determine or decide whether to allow the handover of the node e.g. performing admission control for the UEs and IAB nodes included in the received data. For example, the second radio network node 15 may perform admission control for the UEs and IAB nodes included in the handover request, and may consider one or more of the following:

- The CP resources required to admit/handle the indicated one or more other nodes such as UEs and IABs and their CP connections at the target network node such as the second radio network node 15
- The UP resources required to serve the migrating IAB-nodes and UEs (DRBs, QoS flows, PDU sessions, backhaul (BH) RLC channels)
- The number of UE and IAB-MT contexts being migrated
- The lower layer resources, e.g. radio resources such as symbols and frequencies, required to admit/handle the indicated migrating node and the one or more other nodes such as UEs and IAB contexts at the target donor DU, i.e. on the first backhaul link between the target donor DU and the first

backhaul (IAB) network, serving as a candidate donor node for an IAB node (migrating IAB node) and providing connectivity for a user equipment (UE).

Preparing Example of a signalling implementation is herein disclosed.

5 XnAP handover signalling.

Note: As mentioned earlier, for the sake of simplicity, the handover information pertaining to the migrating node such as the IAB node and all the IAB nodes and UEs directly and indirectly served by the migrating IAB node may be referred to as the group handover information (GHI).

10 In case of standalone IAB network and Xn-based handover, the source donor CU, i.e. Donor CU1 in Fig. 8 being an example of the first radio network node 12, may send the GHI to the target donor CU, i.e. Donor CU2 in Fig. 8 being an example of the second radio network node 15, in e.g.:

- The existing XnAP HANDOVER REQUEST message, which needs to be modified
- 15 to include the GHI, or
- A newly defined XnAP message for IAB node handover request carrying the GHI. This message may be non-UE-associated.

The second radio network node 15 may reply by using, for example the HANDOVER REQUEST ACKNOWLEDGE message, such as the modification of the

20 existing message or a newly defined message for that purpose.

A non-limiting example of implementation is given below, using a newly defined XnAP IAB HANDOVER REQUEST message. Some of the information elements (IE) are taken from the existing messages for UE handover and modified, while the novel IAB-specific parts are highlighted as underlined.

25 In the example, the 'migrating node' is the IAB node that directly or indirectly serves a multitude of the one or more other nodes such as IAB nodes and UEs.

9.1.1.x IAB HANDOVER REQUEST

This message is sent by the source NG-RAN node to the target NG-RAN node to request

30 the preparation of resources for a handover of an IAB node and directly and indirectly served child IAB nodes and UEs.

Direction: source NG-RAN node → target NG-RAN node.

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IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3.1		YES	reject
Source NG-RAN node UE XnAP ID reference	M		NG-RAN node UE XnAP ID 9.2.3.16	Allocated at the source NG-RAN node	YES	reject
Cause	M		9.2.3.2		YES	reject
Target Cell Global ID	M		9.2.3.25	Includes either an E-UTRA CGI or an NR CGI	YES	reject
GUAMI	M		9.2.3.24		YES	reject
<u>Migrating IAB-MT Context Information</u>		<u>1</u>			<u>YES</u>	<u>reject</u>
>NG-C IAB-MT associated Signalling reference	M		AMF UE NGAP ID 9.2.3.26	Allocated at the AMF on the source NG-C connection.	-	
>Signalling TNL association address at source NG-C side	M		CP Transport Layer Information 9.2.3.31	This IE indicates the AMF's IP address of the SCTP association used at the source NG-C interface instance. Note: If no UE TNLA binding exists at the source NG-RAN node, the source NG-RAN node indicates the TNL association address it would have selected if it would have had to create a UE TNLA binding.	-	
>UE Security Capabilities	M		9.2.3.49		-	
>AS Security Information	M		9.2.3.50		-	
>Index to RAT/Frequency Selection Priority	O		9.2.3.23		-	
>UE Aggregate Maximum Bit Rate	O		9.2.3.17		-	
>PDU Session Resources To Be Setup List		0..1	9.2.1.1	Similar to NG-C signalling, containing UL tunnel information per PDU Session Resource; and in addition, the source side QoS flow □ DRB mapping	-	

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>RRC Context	M		OCTET STRING	Either includes the <i>HandoverPreparationInformation</i> message as defined in subclause 10.2.2. of TS 36.331 [14], if the target NG-RAN node is an ng-eNB, or the <i>HandoverPreparationInformation</i> message as defined in subclause 11.2.2 of TS 38.331 [10], if the target NG-RAN node is a gNB.	–	
>Location Reporting Information	O		9.2.3.47	Includes the necessary parameters for location reporting.	–	
>Mobility Restriction List	O		9.2.3.53		–	
>5GC Mobility Restriction List Container	O		9.2.3.100		YES	ignore
> <u>Migrating IAB-MT backhaul connectivity info</u>				<u>The RRC configuration of BH RLC connectivity between the migrating IAB node and its parent node (which does not migrate).</u>	<u>YES</u>	<u>ignore</u>
Trace Activation	O		9.2.3.55		YES	ignore
Masked IMEISV	O		9.2.3.32		YES	ignore
UE History Information	M		9.2.3.64		YES	ignore
UE Context Reference at the S-NG-RAN node	O				YES	ignore
>Global NG-RAN Node ID	M		9.2.2.3		–	
>S-NG-RAN node UE XnAP ID	M		NG-RAN node UE XnAP ID 9.2.3.16		–	
<u>Migrating IAB-DU Information</u>				<u>The “top of tree” IAB-DU, collocated with the migrating IAB-MT.</u>		
> <u>Migrating IAB-DU context</u>	<u>M</u>			<u>The information about the F1-C/F1-U connection of the migrating IAB-DU, information about the served cells, as well as other IAB-specific info e.g. <u>multiplexing capabilities between the IAB-DU and the collocated IAB-MT.</u></u>		

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>Migrating IAB node backhaul connectivity info	<u>M</u>			The configuration of the backhaul connectivity between the migrating IAB node and its parent node. UL backhaul traffic mapping info and ingress-egress BH bearer mapping info.		
>Directly served UE context info List	<u>O</u>			Contains the context information of the UEs directly connected to the IAB-DU of the migrating IAB node. Includes the UE context kept at source donor CU and at migrating IAB-DU.		
>>Directly served UE context info List Item		1..<max number of served UEs>				
>>>UE context information	<u>M</u>			Same as for a legacy UE.		
Served IAB-MT info List		0..1		The list of descendant nodes of the migrating IAB node (served directly or indirectly), and their relevant information – for the MT related information		
>Descendant IAB node info Item		1..<max number of child nodes>				
>>IAB-MT BAP address	<u>M</u>			The BAP address of the IAB-MT		
>>Parent IAB node info List	<u>M</u>			The BAP address of parent IAB node(s) of the IAB-MT. Helps the target node understand the topology under the migrating IAB node. The secondary node BAP address is included only in the case this IAB-MT is operating in Dual Connectivity.		

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>>>Master node BAP address	M			The BAP address of parent IAB node of the IAB-MT (or the Master parent IAB node in case of dual connectivity).		
>>>Secondary node BAP Parent IAB node BAP address	O			The BAP address of secondary parent IAB node of the IAB-MT in case of dual connectivity.		
>>IAB-MT context information	M			The context information of the descendant IAB-MT. The IE has the same structure as the IAB-MT Context Information IE defined above.		
>>IAB-MT backhaul connectivity information	M			The RRC configuration of BH RLC connectivity between the migrating IAB node and its parent node (indicated in the Parent IAB node BAP address IE)		
Served IAB-DU info List		0..1		The list of descendant nodes of the migrating IAB node (served directly or indirectly), and their relevant information – for the DU related information		
>Served IAB-DU info List Item		1..<max number of DUs in IAB network>				
>>Collocated IAB-MT BAP address	M			The BAP address of the collocated IAB-MT.		
>Migrating IAB-DU context	M			The information about the F1-C/F1-U connection of the migrating IAB-DU, information about the served cells, as well as other IAB-specific info e.g. multiplexing capabilities between the IAB-DU and the collocated IAB-MT.		

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>Migrating IAB node backhaul connectivity info	M			The configuration of the backhaul connectivity between the migrating IAB node and its parent node. UL backhaul traffic mapping info and ingress-egress BH bearer mapping info.		
Indirectly served UE context info List		0..1		Contains the context information of the UEs directly connected by the IAB DU of the migrating IAB node. Includes the UE context kept at source donor CU and migrating IAB-DU.		
>Indirectly served UE context info List Item						
>>Serving IAB node BAP address	M			The ID of IAB node serving the UE. Helps the target node understand the topology under the migrating IAB node.		
>>UE context information	M			Same as for a legacy UE.		

The above message is exemplified as the message sent from the source donor, i.e. the first radio network node 12, to the target donor, i.e. the second radio network node 15.

The response message from the target donor is structured similar to the request message 5 above. For example:

- The handover response from the second radio network node 15 may comprise information pertaining to the migrating IAB-MT, including the list of admitted and the list of not admitted BH RLC channels and PDU sessions established towards the migrating IAB-MT's parent node.
- 10 • The handover response from the second radio network node 15 may comprise information pertaining to the migrating IAB-DU, including the list of admitted and the list of not admitted BH RLC channels and PDU sessions established towards the directly served child IAB-MTs and UEs.
- 15 • The handover response from the second radio network node 15 may comprise information pertaining to the IAB-MTs directly and indirectly served by the migrating IAB-DU, including the list of admitted and the list of not admitted BH RLC channels and PDU sessions established between these IAB-MTs and their serving IAB-DUs.

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- 5 • The handover response from the second radio network node 15 may comprise information pertaining to the IAB-DUs of IAB nodes directly and indirectly served by the migrating IAB-DU, including the list of admitted and the list of not admitted BH RLC channels and PDU sessions established between these IAB-DUs and their served IAB-MTs and UEs.
- The handover response from the second radio network node 15 may comprise information pertaining to the UEs directly served by the migrating IAB-DU, including the list of admitted and the list of not admitted PDU sessions established towards these UEs
- 10 • The handover response from the second radio network node 15 may comprise information pertaining to the UEs directly served descendants of the migrating IAB node, including the list of admitted and the list of not admitted PDU sessions established towards these UEs.

The handover response message may be an enhanced HANDOVER REQUEST
15 ACKNOWLEDGE MESSAGE or a newly defined XnAP message.

If any of the parameters of the migrating node and its directly and indirectly served one or more other nodes need to be changed, these new parameters, obtained e.g. from the OAM, as discussed above, may be provided in the handover response message as well, e.g. BAP configurations, backhaul channel configurations, cell configurations of the
20 migrating IAB-MTs, the cells served by the migrating IAB-DUs etc.

NG-signalling aspects.

In case of standalone IAB network and NG-based handover, i.e. no Xn interface between the source and target CU, the source donor CU, i.e. Donor CU1 in Fig 8 being an
25 example of the first radio network node 12, may send the GHI to the AMF serving the migrating IAB-MT/IAB node in e.g.:

- The existing NGAP HANDOVER REQUIRED message (which needs to be enhanced in order to include the GHI), or
- A newly-defined NGAP message carrying the GHI. This message may be non-UE-associated
30

The AMF forwards the handover information towards the target donor CU, i.e. Donor CU2 in Fig. 8 being an example of the second radio network node15. Thus, the first radio network node 12 transmits the message directly or indirectly to the second radio network node 15.

- In a newly defined NGAP message for IAB node handover to the AMF serving the migrating IAB-MT/IAB node, by using e.g.:
 - The existing NGAP HANDOVER REQUEST message (which needs to be enhanced to include the GHI),
 - The AMF includes the GHI in a newly defined NGAP message towards the target donor CU. The newly defined NGAP message carrying the GHI may be non-UE-associated.

In case of successful handover, the second radio network node 15 may reply by, for example, using the HANDOVER REQUEST ACKNOWLEDGE message, the enhancement of the existing message to include the GHI or a newly defined message for that purpose, to the AMF. The AMF may reply to the second radio network node 15 by using the HANDOVER COMMAND message, the enhancement of the existing message to include the GAI or a newly defined message for that purpose. The message content is similar to the one described for Xn handover above.

Fig. 12 is a block diagram depicting the first radio network node 12 for handling communication in the wireless communications network 1 according to embodiments herein.

The first radio network node 12 may comprise **processing circuitry 1201**, e.g. one or more processors, configured to perform the methods herein.

The first radio network node 12 may comprise **a transmitting unit 1202**, e.g. a transmitter or a transceiver. The first radio network node 12, the processing circuitry 1201, and/or the transmitting unit 1202 is configured to transmit the message related to handover or cell reselection of the migrating node to the second radio network node 15, wherein the message comprises data associated with the migrating node and data related to the one or more other nodes directly or indirectly served by the migrating node. The first radio network node 12, the processing circuitry 1201, and/or the transmitting unit 1202 may be configured to transmit to the second radio network node the message for setting up communication, e.g., indicating handover or cell selection, of the node, e.g., second intermediate radio network node 14, comprising data. The data is associated with the migrating node, e.g. IAB node, and related to other nodes, such as IAB nodes and/or UEs, directly and indirectly served by the migrating node. The data may indicate one or more resources required to serve the one or more other nodes. The data may comprise contexts of the migrating node and/or the one or more other nodes.

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The first radio network node 12 may comprise a **determining unit 1203**. The first radio network node 12, the processing circuitry 1201, and/or the determining unit 1203 may be configured to determine to handover the migrating node to the second radio network node. E.g. based on measurements, load conditions or be configured.

5 The first radio network node 12 may comprise a **receiving unit 1204**, e.g. a receiver or a transceiver. The first radio network node 12, the processing circuitry 1201, and/or the receiving unit 1204 may be configured to receive from the second radio network node 15, the indication indicating whether handover is confirmed or not. For example, the indication may indicate whether the handover or cell reselection of the
10 migrating node and/or the one or more other nodes has been accepted or not, respectively. The received indication may be comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the transmitted message may comprise a HANDOVER REQUEST message.

The first radio network node 12, the processing circuitry 1201, and/or the
15 transmitting unit 1202 may be configured to handle handover process of the node based on the received indication, e.g. the first radio network node 12, the processing circuitry 1201, and/or the transmitting unit 1202 may be configured to handle handover process of the migrating node and/or the one or more other nodes based on the received indication.

The first radio network node 12 may be a source IAB donor central unit and the
20 second radio network node may 15 be a target IAB donor central unit.

The first radio network node 12 further comprises a **memory 1205**. The memory 605 comprises one or more units to be used to store data on, such as indications, measurements, thresholds, data related to nodes, and applications to perform the methods disclosed herein when being executed, and similar. Furthermore, the first radio
25 network node 12 may comprise a **communication interface 1208** such as comprising a transmitter, a receiver and/or a transceiver.

The methods according to the embodiments described herein for the first radio network node 12 are respectively implemented by means of e.g. a **computer program product 1206** or a computer program, comprising instructions, i.e., software code
30 portions, which, when executed on at least one processor, cause the at least one processor to carry out the actions described herein, as performed by the first radio network node 12. The computer program product 1206 may be stored on a **computer-readable storage medium 1207**, e.g. a disc, a universal serial bus (USB) stick or similar. The computer-readable storage medium 1207, having stored thereon the computer
35 program product, may comprise the instructions which, when executed on at least one

processor, cause the at least one processor to carry out the actions described herein, as performed by the first radio network node 12. In some embodiments, the computer-readable storage medium may be a transitory or a non-transitory computer-readable storage medium. Thus, embodiments herein may disclose a first radio network node for
5 handling communication in a wireless communications network, wherein the first radio network node comprises processing circuitry and a memory, said memory comprising instructions executable by said processing circuitry whereby said first radio network node is operative to to perform any of the methods herein.

10 **Fig. 13** is a block diagram depicting the second radio network node 15 such as a relay node also denoted as an IAB node, for handling data packets or handling communication in the wireless communications network 1 according to embodiments herein. The wireless communications network 1 may comprise the first radio network node 12 and the second radio network node 15 and one or more nodes relaying data
15 packets between a central network node and the UE 10.

The second radio network node 15 may comprise **processing circuitry 1301**, e.g. one or more processors, configured to perform the methods herein.

The second radio network node 15 may comprise **a receiving unit 1302**, e.g. a receiver or a transceiver. The second radio network node 15, the processing circuitry
20 1301, and/or the receiving unit 1302 is configured to receive from the first radio network node 12, the message related to handover or cell reselection of the migrating node, wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node. For example, the second radio network node 15, the processing circuitry 1301, and/or the
25 receiving unit 1302 may be configured to receive from the first radio network node 12, the message related to handover or cell reselection of a node such as a handover request. The message comprises data, e.g. being an indication, associated with the migrating node e.g. IAB node and data related to other nodes, such as IAB nodes and/or UEs, directly and/or indirectly served by the migrating node. The data may indicate one or more
30 resources required to serve the migrating node and/or the one or more other nodes. The data may comprise contexts of the migrating node and/or the one or more other nodes.

The second radio network node 15 may comprise **a determining unit 1303**. The second radio network node 15, the processing circuitry 1301, and/or the determining unit 1303 may be configured to perform admission control to determine whether to accept or
35 not the handover or cell reselection of the migrating node and/or the one or more other

nodes. For example, configured to determine or decide whether to allow the handover of the node e.g. performing admission control for the UEs and IAB nodes included in the received data.

The second radio network node 15 may comprise a **transmitting unit 1304**, e.g. a transmitter or a transceiver. The second radio network node 15, the processing circuitry 1301, and/or the transmitting unit 1304 may be configured to transmit to the first radio network node 12, the indication indicating whether handover is confirmed or not. For example, configured to transmit the indication wherein the indication indicates acceptance or not. The indication may further indicate one or more nodes that has been accepted or not. The transmitted indication may indicate whether the handover or cell reselection of the migrating node and/or the one or more other nodes has been accepted or not, respectively. The transmitted indication may be comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the received message may be comprised in a HANDOVER REQUEST message.

The first radio network node 12 may be a source IAB donor central unit and the second radio network node 15 may be a target IAB donor central unit.

The second radio network node 15 further comprises a **memory 1305**. The memory 1305 comprises one or more units to be used to store data on, such as indications, data regarding nodes, capacity, allowed nodes, and applications to perform the methods disclosed herein when being executed, and similar. Furthermore, the second radio network node 15 may comprise a **communication interface 1308** such as comprising a transmitter, a receiver and/or a transceiver, with one or more antennas.

The methods according to the embodiments described herein for the second radio network node 15 are respectively implemented by means of e.g. a **computer program product 1306** or a computer program, comprising instructions, i.e., software code portions, which, when executed on at least one processor, cause the at least one processor to carry out the actions described herein, as performed by the second radio network node 15. The computer program product 1306 may be stored on a **computer-readable storage medium 1307**, e.g. a disc, a universal serial bus (USB) stick or similar. The computer-readable storage medium 1307, having stored thereon the computer program product, may comprise the instructions which, when executed on at least one processor, cause the at least one processor to carry out the actions described herein, as performed by the second radio network node 15. In some embodiments, the computer-readable storage medium may be a transitory or a non-transitory computer-readable storage medium. Thus, embodiments herein may disclose a second radio network node

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15 for handling communication in a wireless communications network, wherein the radio network node comprises processing circuitry and a memory, said memory comprising instructions executable by said processing circuitry whereby said second radio network node 15 is operative to to perform any of the methods herein.

5 In some embodiments a more general term “radio network node” is used and it can correspond to any type of radio-network node or any network node, which communicates with a wireless device and/or with another network node. Examples of network nodes are NodeB, MeNB, SeNB, a network node belonging to Master cell group (MCG) or Secondary cell group (SCG), base station (BS), multi-standard radio (MSR)
10 radio node such as MSR BS, eNodeB, network controller, radio-network controller (RNC), base station controller (BSC), relay, donor node controlling relay, base transceiver station (BTS), access point (AP), transmission points, transmission nodes, Remote radio Unit (RRU), Remote Radio Head (RRH), nodes in distributed antenna system (DAS), etc.

In some embodiments the non-limiting term wireless device or user equipment
15 (UE) is used and it refers to any type of wireless device communicating with a network node and/or with another wireless device in a cellular or mobile communication system. Examples of UE are IoT capable device, target device, device to device (D2D) UE, proximity capable UE (aka ProSe UE), machine type UE or UE capable of machine to machine (M2M) communication, Tablet, mobile terminals, smart phone, laptop embedded
20 equipped (LEE), laptop mounted equipment (LME), USB dongles etc.

Embodiments are applicable to any RAT or multi-RAT systems, where the wireless device receives and/or transmit signals (e.g. data) e.g. New Radio (NR), Wi-Fi, Long Term Evolution (LTE), LTE-Advanced, Wideband Code Division Multiple Access (WCDMA), Global System for Mobile communications/enhanced Data rate for GSM Evolution
25 (GSM/EDGE), Worldwide Interoperability for Microwave Access (WiMax), or Ultra Mobile Broadband (UMB), just to mention a few possible implementations.

As will be readily understood by those familiar with communications design, that functions means or circuits may be implemented using digital logic and/or one or more microcontrollers, microprocessors, or other digital hardware. In some embodiments,
30 several or all of the various functions may be implemented together, such as in a single application-specific integrated circuit (ASIC), or in two or more separate devices with appropriate hardware and/or software interfaces between them. Several of the functions may be implemented on a processor shared with other functional components of a wireless device or network node, for example.

Alternatively, several of the functional elements of the processing means discussed may be provided through the use of dedicated hardware, while others are provided with hardware for executing software, in association with the appropriate software or firmware. Thus, the term “processor” or “controller” as used herein does not exclusively refer to hardware capable of executing software and may implicitly include, without limitation, digital signal processor (DSP) hardware and/or program or application data. Other hardware, conventional and/or custom, may also be included. Designers of communications devices will appreciate the cost, performance, and maintenance trade-offs inherent in these design choices.

10

OTT

Fig. 14 shows a Telecommunication network connected via an intermediate network to a host computer in accordance with some embodiments. With reference to Fig. 14, in accordance with an embodiment, a communication system includes telecommunication network 3210, such as a 3GPP-type cellular network, which comprises access network 3211, such as a radio access network, and core network 3214. Access network 3211 comprises a plurality of base stations 3212a, 3212b, 3212c, such as NBs, eNBs, gNBs or other types of wireless access points being examples of the radio network node 12 above, each defining a corresponding coverage area 3213a, 3213b, 3213c. Each base station 3212a, 3212b, 3212c is connectable to core network 3214 over a wired or wireless connection 3215. A first UE 3291 located in coverage area 3213c is configured to wirelessly connect to, or be paged by, the corresponding base station 3212c. A second UE 3292 in coverage area 3213a is wirelessly connectable to the corresponding base station 3212a. While a plurality of UEs 3291, 3292 are illustrated in this example being examples of the wireless device 10 above, the disclosed embodiments are equally applicable to a situation where a sole UE is in the coverage area or where a sole UE is connecting to the corresponding base station 3212.

Telecommunication network 3210 is itself connected to host computer 3230, which may be embodied in the hardware and/or software of a standalone server, a cloud-implemented server, a distributed server or as processing resources in a server farm. Host computer 3230 may be under the ownership or control of a service provider, or may be operated by the service provider or on behalf of the service provider. Connections 3221 and 3222 between telecommunication network 3210 and host computer 3230 may extend directly from core network 3214 to host computer 3230 or may go via an optional intermediate network 3220. Intermediate network 3220 may be one of, or a combination

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of more than one of, a public, private or hosted network; intermediate network 3220, if any, may be a backbone network or the Internet; in particular, intermediate network 3220 may comprise two or more sub-networks (not shown).

The communication system of Fig. 14 as a whole enables connectivity between
5 the connected UEs 3291, 3292 and host computer 3230. The connectivity may be described as an over-the-top (OTT) connection 3250. Host computer 3230 and the connected UEs 3291, 3292 are configured to communicate data and/or signalling via OTT connection 3250, using access network 3211, core network 3214, any intermediate network 3220 and possible further infrastructure (not shown) as intermediaries. OTT
10 connection 3250 may be transparent in the sense that the participating communication devices through which OTT connection 3250 passes are unaware of routing of uplink and downlink communications. For example, base station 3212 may not or need not be informed about the past routing of an incoming downlink communication with data originating from host computer 3230 to be forwarded (e.g., handed over) to a connected
15 UE 3291. Similarly, base station 3212 need not be aware of the future routing of an outgoing uplink communication originating from the UE 3291 towards the host computer 3230.

Fig. 15 shows a host computer communicating via a base station and with a user equipment over a partially wireless connection in accordance with some embodiments
20 Example implementations, in accordance with an embodiment, of the UE, base station and host computer discussed in the preceding paragraphs will now be described with reference to Fig 15. In communication system 3300, host computer 3310 comprises hardware 3315 including communication interface 3316 configured to set up and maintain a wired or wireless connection with an interface of a different communication device of
25 communication system 3300. Host computer 3310 further comprises processing circuitry 3318, which may have storage and/or processing capabilities. In particular, processing circuitry 3318 may comprise one or more programmable processors, application-specific integrated circuits, field programmable gate arrays or combinations of these (not shown) adapted to execute instructions. Host computer 3310 further comprises software 3311,
30 which is stored in or accessible by host computer 3310 and executable by processing circuitry 3318. Software 3311 includes host application 3312. Host application 3312 may be operable to provide a service to a remote user, such as UE 3330 connecting via OTT connection 3350 terminating at UE 3330 and host computer 3310. In providing the service to the remote user, host application 3312 may provide user data which is transmitted
35 using OTT connection 3350.

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Communication system 3300 further includes base station 3320 provided in a telecommunication system and comprising hardware 3325 enabling it to communicate with host computer 3310 and with UE 3330. Hardware 3325 may include communication interface 3326 for setting up and maintaining a wired or wireless connection with an
5 interface of a different communication device of communication system 3300, as well as radio interface 3327 for setting up and maintaining at least wireless connection 3370 with UE 3330 located in a coverage area (not shown in Fig. 15) served by base station 3320. Communication interface 3326 may be configured to facilitate connection 3360 to host computer 3310. Connection 3360 may be direct or it may pass through a core network
10 (not shown in Fig 15) of the telecommunication system and/or through one or more intermediate networks outside the telecommunication system. In the embodiment shown, hardware 3325 of base station 3320 further includes processing circuitry 3328, which may comprise one or more programmable processors, application-specific integrated circuits, field programmable gate arrays or combinations of these (not shown) adapted to execute
15 instructions. Base station 3320 further has software 3321 stored internally or accessible via an external connection.

Communication system 3300 further includes UE 3330 already referred to. It's hardware 3333 may include radio interface 3337 configured to set up and maintain wireless connection 3370 with a base station serving a coverage area in which UE 3330 is
20 currently located. Hardware 3333 of UE 3330 further includes processing circuitry 3338, which may comprise one or more programmable processors, application-specific integrated circuits, field programmable gate arrays or combinations of these (not shown) adapted to execute instructions. UE 3330 further comprises software 3331, which is stored in or accessible by UE 3330 and executable by processing circuitry 3338.
25 Software 3331 includes client application 3332. Client application 3332 may be operable to provide a service to a human or non-human user via UE 3330, with the support of host computer 3310. In host computer 3310, an executing host application 3312 may communicate with the executing client application 3332 via OTT connection 3350 terminating at UE 3330 and host computer 3310. In providing the service to the user,
30 client application 3332 may receive request data from host application 3312 and provide user data in response to the request data. OTT connection 3350 may transfer both the request data and the user data. Client application 3332 may interact with the user to generate the user data that it provides.

It is noted that host computer 3310, base station 3320 and UE 3330 illustrated in
35 Fig. 15 may be similar or identical to host computer 3230, one of base stations 3212a,

3212b, 3212c and one of UEs 3291, 3292 of Fig. 14, respectively. This is to say, the inner workings of these entities may be as shown in Fig. 15 and independently, the surrounding network topology may be that of Fig. 14.

In Fig. 15, OTT connection 3350 has been drawn abstractly to illustrate the
5 communication between host computer 3310 and UE 3330 via base station 3320, without explicit reference to any intermediary devices and the precise routing of messages via these devices. Network infrastructure may determine the routing, which it may be configured to hide from UE 3330 or from the service provider operating host computer 3310, or both. While OTT connection 3350 is active, the network infrastructure may
10 further take decisions by which it dynamically changes the routing (e.g., on the basis of load balancing consideration or reconfiguration of the network).

Wireless connection 3370 between UE 3330 and base station 3320 is in accordance with the teachings of the embodiments described throughout this disclosure. One or more of the various embodiments improve the performance of OTT services
15 provided to UE 3330 using OTT connection 3350, in which wireless connection 3370 forms the last segment. More precisely, the teachings of these embodiments make it possible to enable handover of e.g. IAB nodes. Thereby the data communication, e.g. the handling or managing setup of communication may be performed in an efficient manner resulting in improved responsiveness and better battery time.

20 A measurement procedure may be provided for the purpose of monitoring data rate, latency and other factors on which the one or more embodiments improve. There may further be an optional network functionality for reconfiguring OTT connection 3350 between host computer 3310 and UE 3330, in response to variations in the measurement results. The measurement procedure and/or the network functionality for reconfiguring
25 OTT connection 3350 may be implemented in software 3311 and hardware 3315 of host computer 3310 or in software 3331 and hardware 3333 of UE 3330, or both. In embodiments, sensors (not shown) may be deployed in or in association with communication devices through which OTT connection 3350 passes; the sensors may participate in the measurement procedure by supplying values of the monitored quantities
30 exemplified above, or supplying values of other physical quantities from which software 3311, 3331 may compute or estimate the monitored quantities. The reconfiguring of OTT connection 3350 may include message format, retransmission settings, preferred routing etc.; the reconfiguring need not affect base station 3320, and it may be unknown or imperceptible to base station 3320. Such procedures and functionalities may be known
35 and practiced in the art. In certain embodiments, measurements may involve proprietary

UE signalling facilitating host computer 3310's measurements of throughput, propagation times, latency and the like. The measurements may be implemented in that software 3311 and 3331 causes messages to be transmitted, in particular empty or 'dummy' messages, using OTT connection 3350 while it monitors propagation times, errors etc.

5 **Fig. 16** shows methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments.

Fig. 16 is a flowchart illustrating a method implemented in a communication system, in accordance with one embodiment. The communication system includes a host computer, a base station and a UE which may be those described with reference to Fig. 10 14 and Fig. 15. For simplicity of the present disclosure, only drawing references to Fig. 16 will be included in this section. In step 3410, the host computer provides user data. In substep 3411 (which may be optional) of step 3410, the host computer provides the user data by executing a host application. In step 3420, the host computer initiates a transmission carrying the user data to the UE. In step 3430 (which may be optional), the 15 base station transmits to the UE the user data which was carried in the transmission that the host computer initiated, in accordance with the teachings of the embodiments described throughout this disclosure. In step 3440 (which may also be optional), the UE executes a client application associated with the host application executed by the host computer.

20 **Fig. 17** shows methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments.

Fig. 17 is a flowchart illustrating a method implemented in a communication system, in accordance with one embodiment. The communication system includes a host computer, a base station and a UE which may be those described with reference to Fig. 25 14 and Fig. 15. For simplicity of the present disclosure, only drawing references to Fig. 17 will be included in this section. In step 3510 of the method, the host computer provides user data. In an optional substep (not shown) the host computer provides the user data by executing a host application. In step 3520, the host computer initiates a transmission carrying the user data to the UE. The transmission may pass via the base station, in 30 accordance with the teachings of the embodiments described throughout this disclosure. In step 3530 (which may be optional), the UE receives the user data carried in the transmission.

Fig. 18 shows methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments.

Fig. 18 is a flowchart illustrating a method implemented in a communication system, in accordance with one embodiment. The communication system includes a host computer, a base station and a UE which may be those described with reference to Fig. 14 and Fig. 15. For simplicity of the present disclosure, only drawing references to Fig. 18 will be included in this section. In step 3610 (which may be optional), the UE receives input data provided by the host computer. Additionally or alternatively, in step 3620, the UE provides user data. In substep 3621 (which may be optional) of step 3620, the UE provides the user data by executing a client application. In substep 3611 (which may be optional) of step 3610, the UE executes a client application which provides the user data in reaction to the received input data provided by the host computer. In providing the user data, the executed client application may further consider user input received from the user. Regardless of the specific manner in which the user data was provided, the UE initiates, in substep 3630 (which may be optional), transmission of the user data to the host computer. In step 3640 of the method, the host computer receives the user data transmitted from the UE, in accordance with the teachings of the embodiments described throughout this disclosure.

Fig. 19 show methods implemented in a communication system including a host computer, a base station and a user equipment in accordance with some embodiments.

Fig. 19 is a flowchart illustrating a method implemented in a communication system, in accordance with one embodiment. The communication system includes a host computer, a base station and a UE which may be those described with reference to Fig. 14 and Fig. 15. For simplicity of the present disclosure, only drawing references to Fig. 19 will be included in this section. In step 3710 (which may be optional), in accordance with the teachings of the embodiments described throughout this disclosure, the base station receives user data from the UE. In step 3720 (which may be optional), the base station initiates transmission of the received user data to the host computer. In step 3730 (which may be optional), the host computer receives the user data carried in the transmission initiated by the base station.

Any appropriate steps, methods, features, functions, or benefits disclosed herein may be performed through one or more functional units or modules of one or more virtual apparatuses. Each virtual apparatus may comprise a number of these functional units. These functional units may be implemented via processing circuitry, which may include one or more microprocessor or microcontrollers, as well as other digital hardware, which may include digital signal processors (DSPs), special-purpose digital logic, and the like. The processing circuitry may be configured to execute program code stored in memory,

which may include one or several types of memory such as read-only memory (ROM), random-access memory (RAM), cache memory, flash memory devices, optical storage devices, etc. Program code stored in memory includes program instructions for executing one or more telecommunications and/or data communications protocols as well as

5 instructions for carrying out one or more of the techniques described herein. In some implementations, the processing circuitry may be used to cause the respective functional unit to perform corresponding functions according one or more embodiments of the present disclosure.

It will be appreciated that the foregoing description and the accompanying

10 drawings represent non-limiting examples of the methods and apparatus taught herein. As such, the apparatus and techniques taught herein are not limited by the foregoing description and accompanying drawings. Instead, the embodiments herein are limited only by the following claims and their legal equivalents.

15	Abbreviation	Explanation
	ACK	(positive) Acknowledgment
	AUL	Autonomous uplink
	BLER	Block error rate
	BWP	Bandwidth Part
20	CAPC	Channel access priority class
	CBG	Code block group
	CCA	Clear channel assessment
	CO	Channel occupancy
	COT	Channel occupancy time
25	CWS	Contention window size
	DL	Downlink
	ED	Energy detection
	eNB	4G base station
	gNB	5G base station
30	HARQ	Hybrid automatic repeat request
	IS	In synch
	LAA	Licensed assisted access
	LBT	Listen before talk
	MAC	Medium access control
35	MCOT	Maximum channel occupancy time

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	NACK	Negative acknowledgment
	NDI	New data indicator
	NR	3GPP defined 5G radio access technology
	NR-U	NR unlicensed
5	OOS	out of synch
	PCell	Primary cell
	PCI	Physical cell identity
	PDCCH	A downlink control channel
	PDU	Protocol data unit
10	PHICH	Physical channel Hybrid ARQ Indicator Channel
	PLMN	Public land mobile network
	PSCell	Primary SCG cell
	PUCCH	Physical Uplink Control Channel
	PUSCH	Physical Uplink Shared Channel
15	QCI	QoS class identifier
	QoS	Quality of service
	RAT	Radio access technology
	RLF	Radio link failure
	RLM	Radio link monitoring
20	RLC	Radio link control
	RRC	Radio resource control
	RS	Reference signal
	SCG	Secondary cell group
	SDU	Service data unit
25	SMTTC	SSB—based measurement timing configuration
	SpCell	Special cell (PCell or PSCell)
	SPS	Semi persistent scheduling
	TTI	Transmission time interval
	UCI	Uplink Control Information
30	UE	User equipment
	UL	Uplink

CLAIMS

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1. A method performed by a first radio network node (12) for handling communication in a wireless communications network, the method comprising
 - *transmitting* (1003) a message related to handover or cell reselection of a migrating node (13,14) to a second radio network node (15), wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node.
 2. The method according to claim 1, wherein the data indicates one or more resources required to serve the migrating node and/or the one or more other nodes.
 3. The method according to any of the claims 1-2, wherein the data comprises contexts of the migrating node and/or the one or more other nodes.
 4. The method according to any of the claims 1-3, further comprising
 - *receiving* (1004) from the second radio network node (15), an indication indicating whether handover is confirmed or not.
 5. The method according to claim 4, wherein the indication indicates whether the handover or cell reselection of the migrating node and/or the one or more other nodes has been accepted or not, respectively.
 6. The method according to any of the claims 4-5, wherein the received indication is comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the transmitted message comprises a HANDOVER REQUEST message.
 7. The method according to any of the claims 4-6, further comprising
 - *handling* (1005) a handover process of the migrating node (13,14) and/or the one or more other nodes based on the received indication.
 8. The method according to any of the claims 1-7, wherein the first radio network node (12) is a source Integrated access backhaul, IAB, donor central unit and the second radio network node (15) is a target IAB donor central unit.

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- 5 9. A method performed by a second radio network node (15) for handling communication in a wireless communications network, the method comprising
- *receiving* (1101) from a first radio network node (12), a message related to handover or cell reselection of a migrating node (13,14), wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node (13,14).
- 10 10. The method according to claim 9, wherein the data indicates one or more resources required to serve the migrating node and/or the one or more other nodes.
- 15 11. The method according to any of the claims 9-10, wherein the data comprises contexts of the migrating node and/or the one or more other nodes.
- 20 12. The method according to any of the claims 9-11, further comprising
- *performing* (1102) admission control to determine whether to accept or not the handover or cell reselection of the migrating node and/or the one or more other nodes.
- 25 13. The method according to any of the claims 9-12, further comprising
- *transmitting* (1103) to the first radio network node (12), an indication indicating whether handover is confirmed or not.
- 30 14. The method according to claim 13, wherein the transmitted indication indicates whether the handover or cell reselection of the migrating node and/or the one or more other nodes has been accepted or not, respectively.
- 35 15. The method according to any of the claims 13-14, wherein the transmitted indication is comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the received message comprises a HANDOVER REQUEST message.
16. The method according to any of the claims 9-15, wherein the first radio network node (12) is a source Integrated access backhaul, IAB, donor central unit and the second radio network node (15) is a target IAB donor central unit.

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- 5 17. A computer program product comprising instructions, which, when executed on at least one processor, cause the at least one processor to carry out the method according to any of the claims 1-16, as performed by the first radio network node (12) or the second radio network node (15), respectively.
- 10 18. A computer-readable storage medium, having stored thereon a computer program product comprising instructions which, when executed on at least one processor, cause the at least one processor to carry out the method according to any of the claims 1-16, as performed by the first radio network node (12) or the second radio network node (15), respectively.
- 15 19. A first radio network node (12) for handling communication in a wireless communications network, wherein the first radio network node (12) is configured to
transmit a message related to handover or cell reselection of a migrating node (13,14) to a second radio network node (15), wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly or indirectly served by the migrating node (13,14).
- 20 20. The first radio network node (12) according to claim 19, wherein the data indicates one or more resources required to serve the migrating node and/or the one or more other nodes.
- 25 21. The first radio network node (12) according to any of the claims 19-20, wherein the data comprises contexts of the migrating node and/or the one or more other nodes.
- 30 22. The first radio network node (12) according to any of the claims 19-21, wherein the first radio network node (12) is configured to
receive from the second radio network node (15), an indication indicating whether handover is confirmed or not.
- 35 23. The first radio network node (12) according to claim 22, wherein the indication indicates whether the handover or cell reselection of the migrating node and/or the one or more other nodes has been accepted or not, respectively.

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- 5 24. The first radio network node (12) according to any of the claims 22-23, wherein the received indication is comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the transmitted message comprises a HANDOVER REQUEST message.
- 10 25. The first radio network node (12) according to any of the claims 22-24, wherein the first radio network node (12) is configured to handle handover process of the migrating node and/or the one or more other nodes based on the received indication.
- 15 26. The first radio network node (12) according to any of the claims 19-25, wherein the first radio network node (12) is a source Integrated access backhaul, IAB, donor central unit and the second radio network node (15) is a target IAB donor central unit.
- 20 27. A second radio network node (15) for handling communication in a wireless communications network (1), wherein the second radio network node (15) is configured to receive from a first radio network node (12), a message related to handover or cell reselection of a migrating node (13,14), wherein the message comprises data associated with the migrating node and data related to one or more other nodes directly and indirectly served by the migrating node (13,14).
- 25 28. The second radio network node (15) according to claim 27, wherein the data indicates one or more resources required to serve the migrating node and/or the one or more other nodes.
- 30 29. The second radio network node (15) according to any of the claims 27-28, wherein the data comprises contexts of the migrating node and/or the one or more other nodes.
30. The second radio network node (15) according to any of the claims 27-29, wherein the second radio network node (15) is configured to

perform admission control to determine whether to accept or not the handover or cell reselection of the migrating node and/or the one or more other nodes.

- 5 31. The second radio network node (15) according to any of the claims 27-30, wherein the second radio network node (15) is configured to transmit to the first radio network node (15), an indication indicating whether handover is confirmed or not.
- 10 32. The second radio network node (15) according to claim 31, wherein the transmitted indication indicates whether the handover or cell reselection of the migrating node and/or the one or more other nodes has been accepted or not, respectively.
- 15 33. The second radio network node (15) according to any of the claims 31-32, wherein the transmitted indication is comprised in a HANDOVER REQUEST ACKNOWLEDGE message and the received message comprises a HANDOVER REQUEST message.
- 20 34. The second radio network node (15) according to any of the claims 27-33, wherein the first radio network node (12) is a source Integrated access backhaul, IAB, donor central unit and the second radio network node (15) is a target IAB donor central unit.

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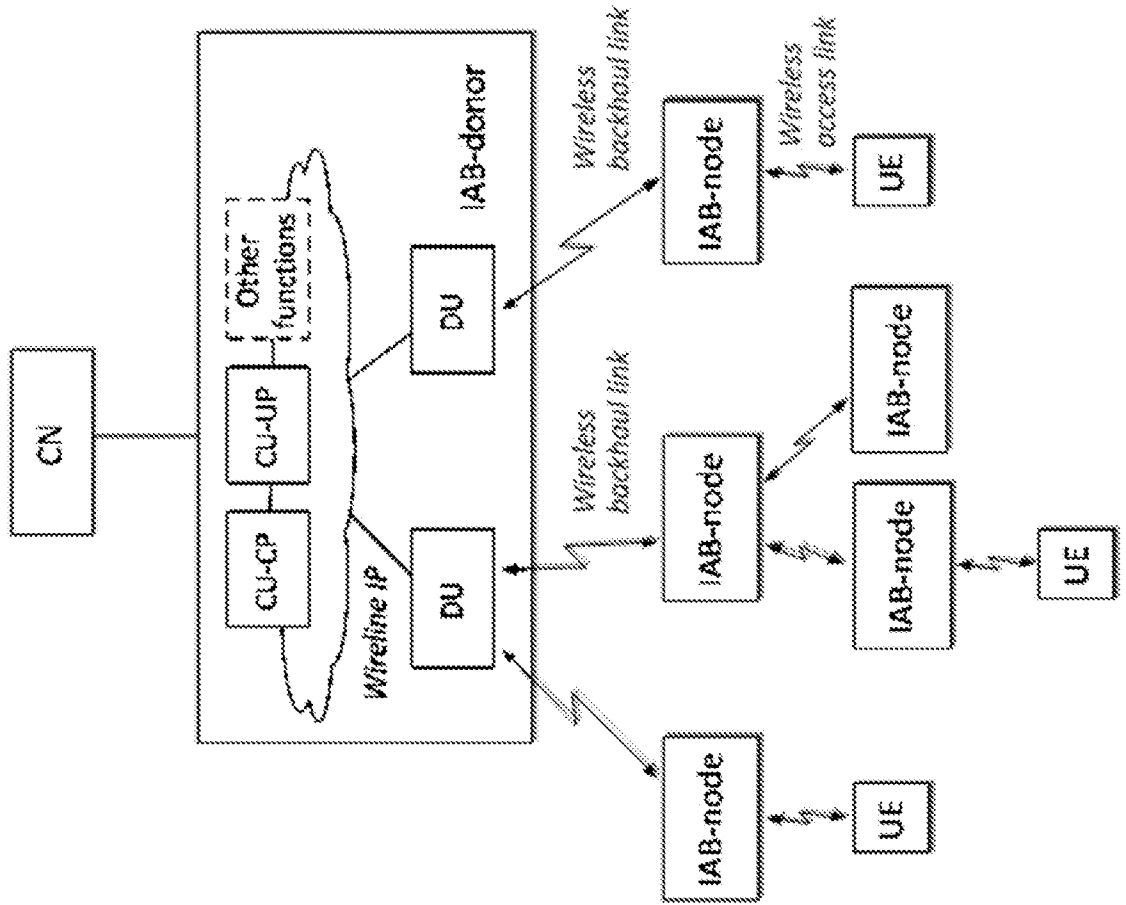


Fig. 1

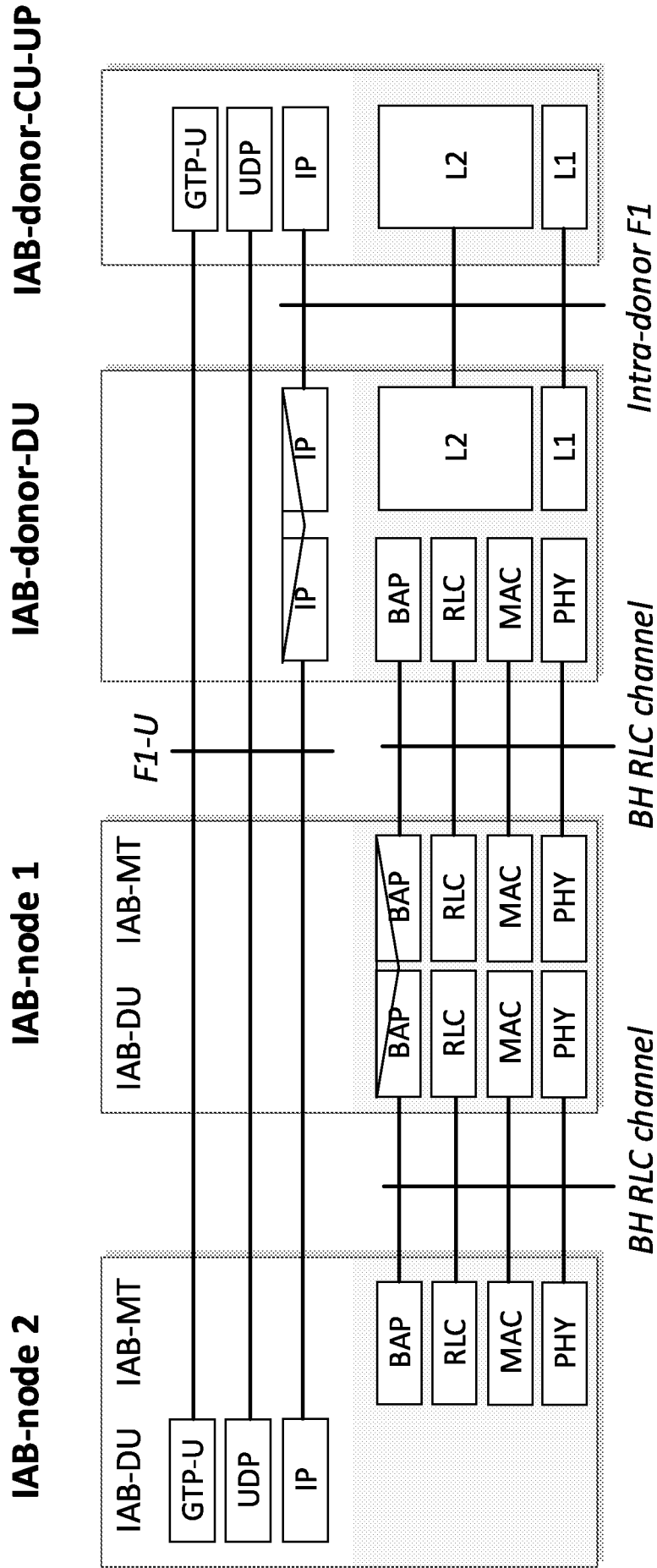


Fig. 2

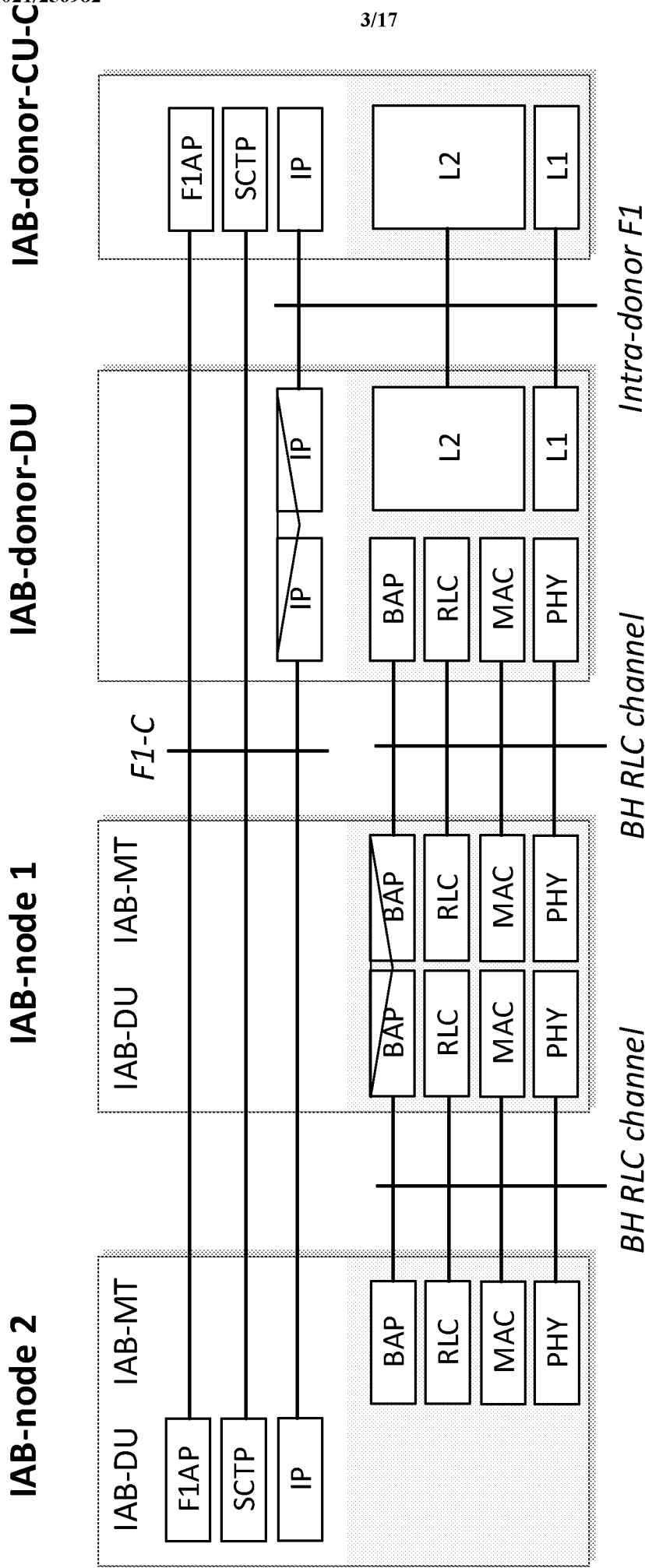


Fig. 3

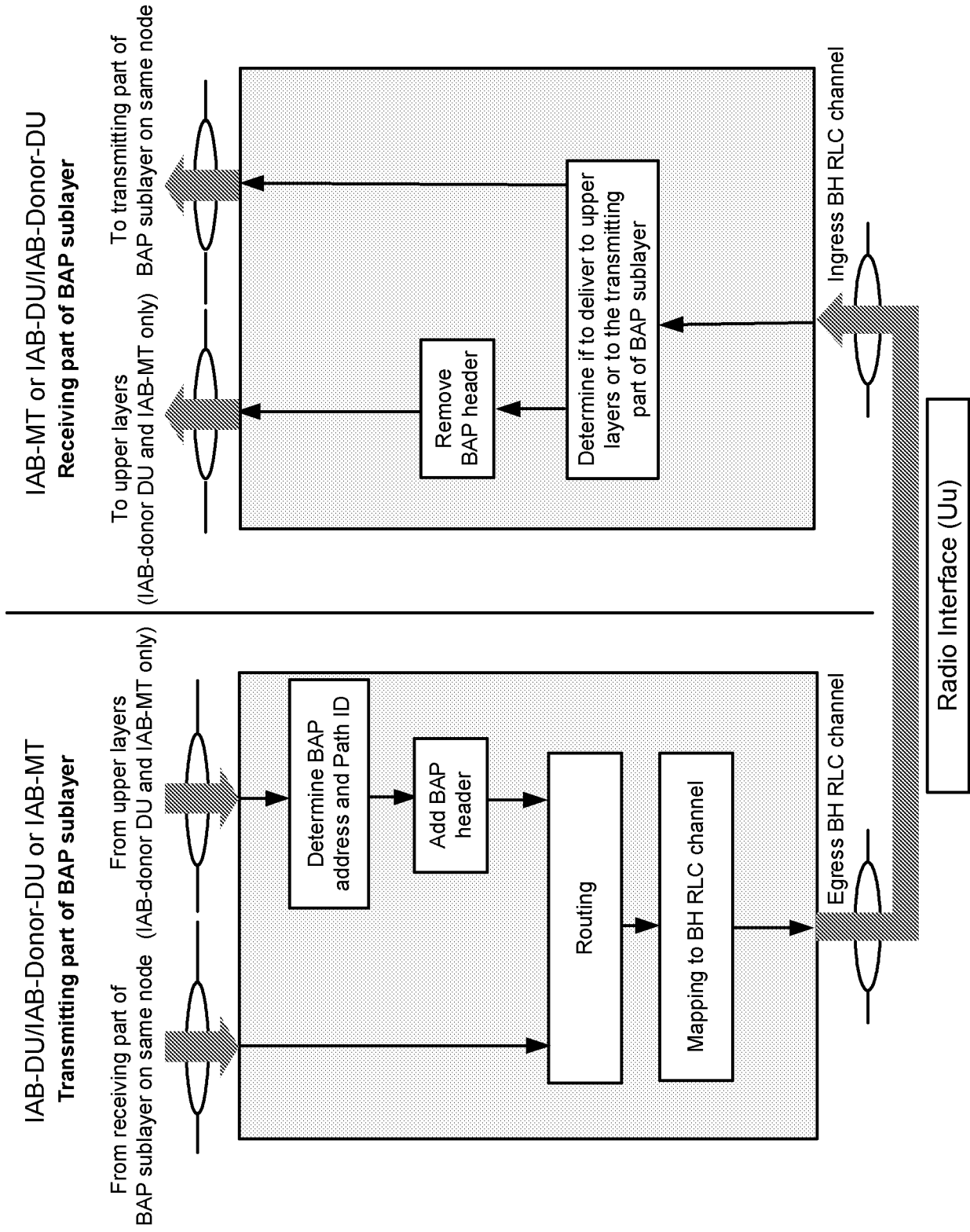


Fig. 4

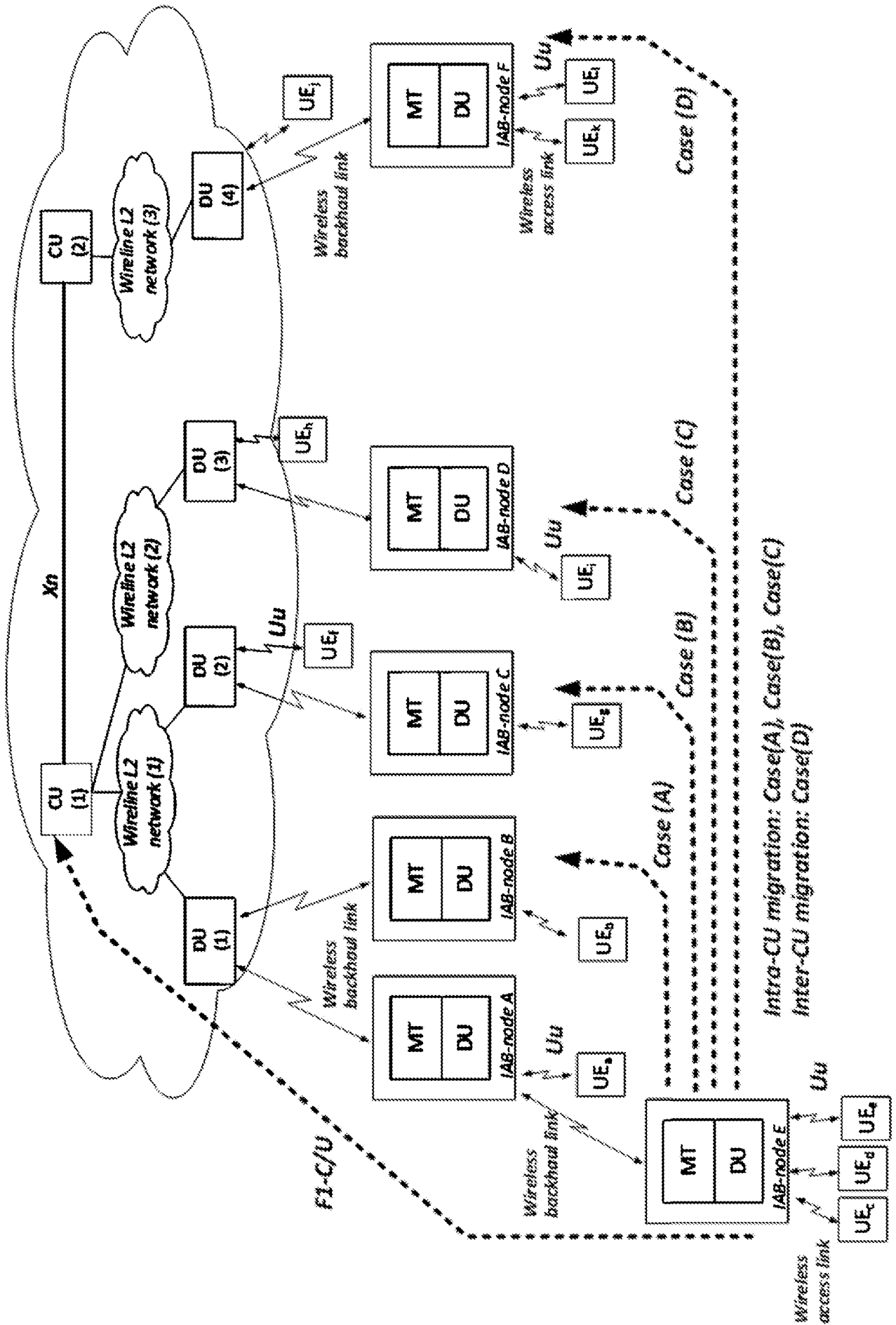


Fig. 5

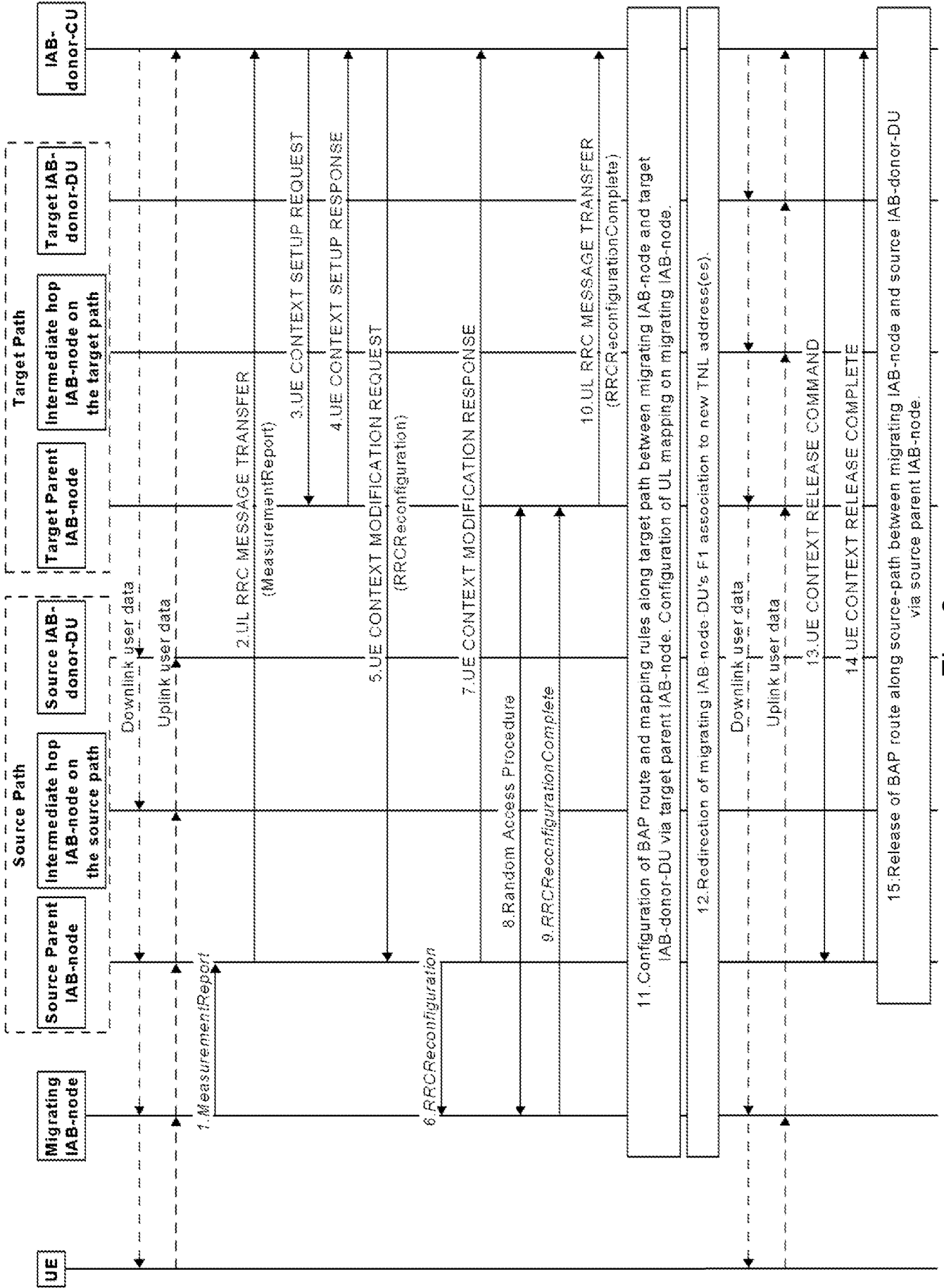


Fig. 6

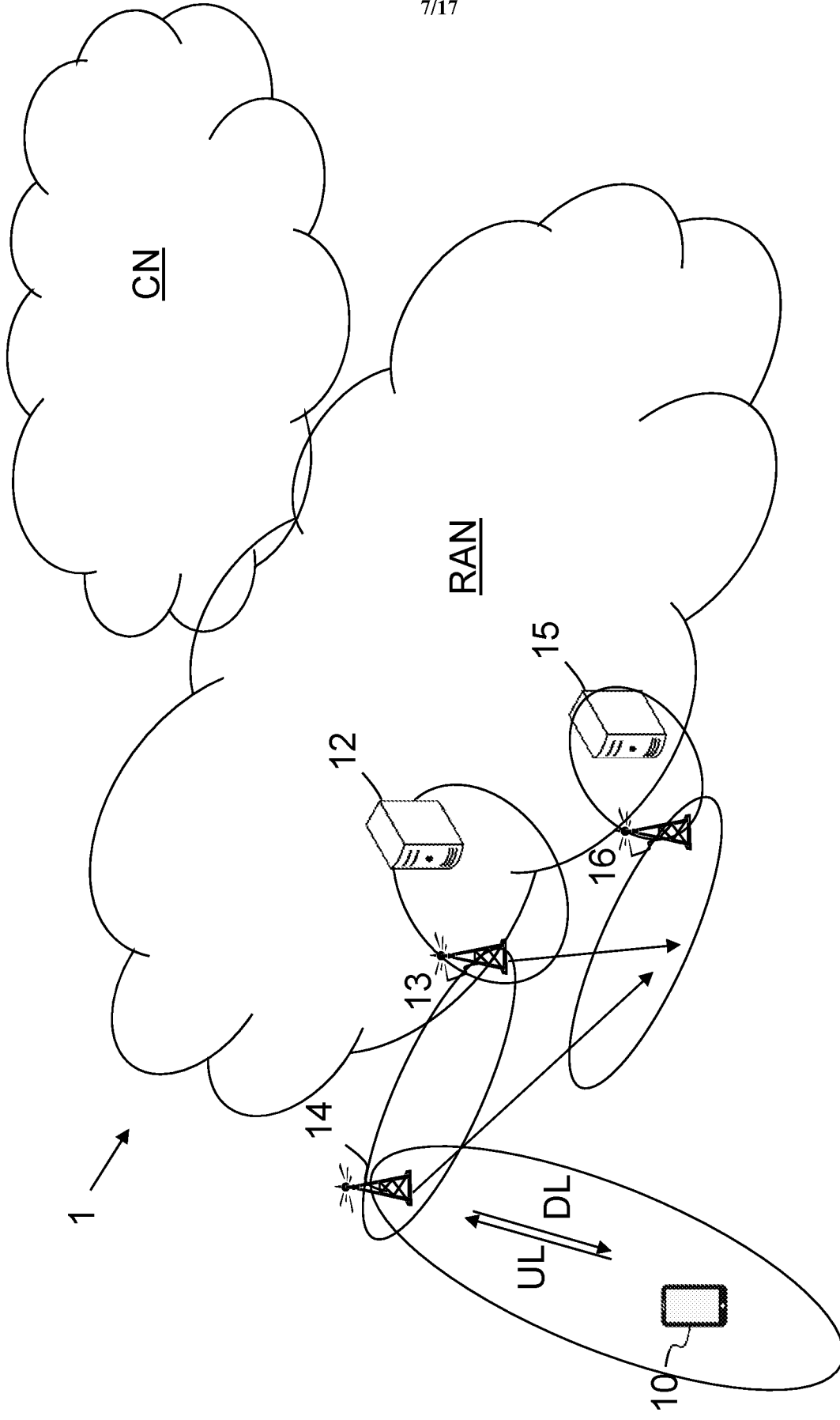


Fig. 7

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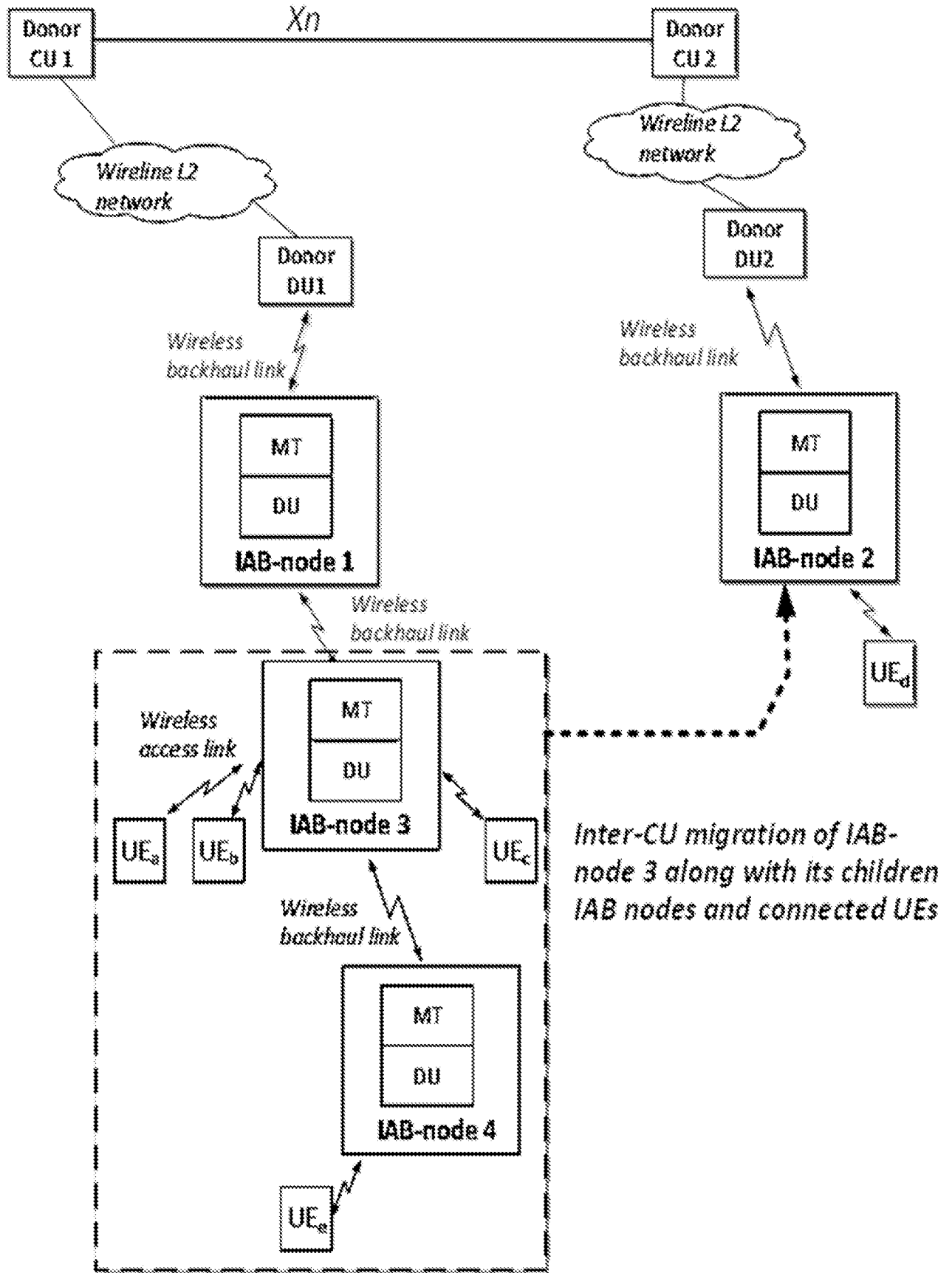


Fig. 8

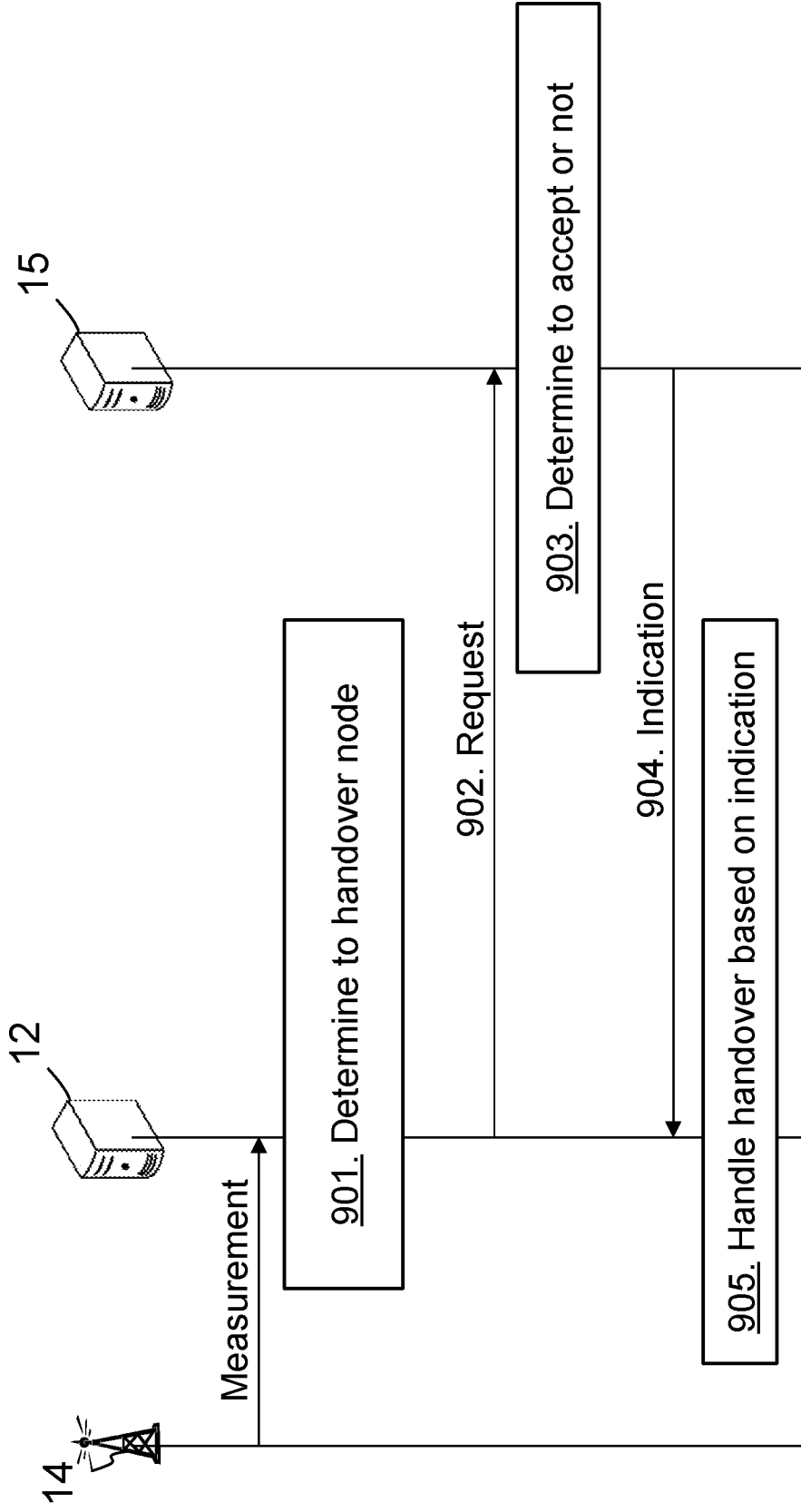


Fig. 9

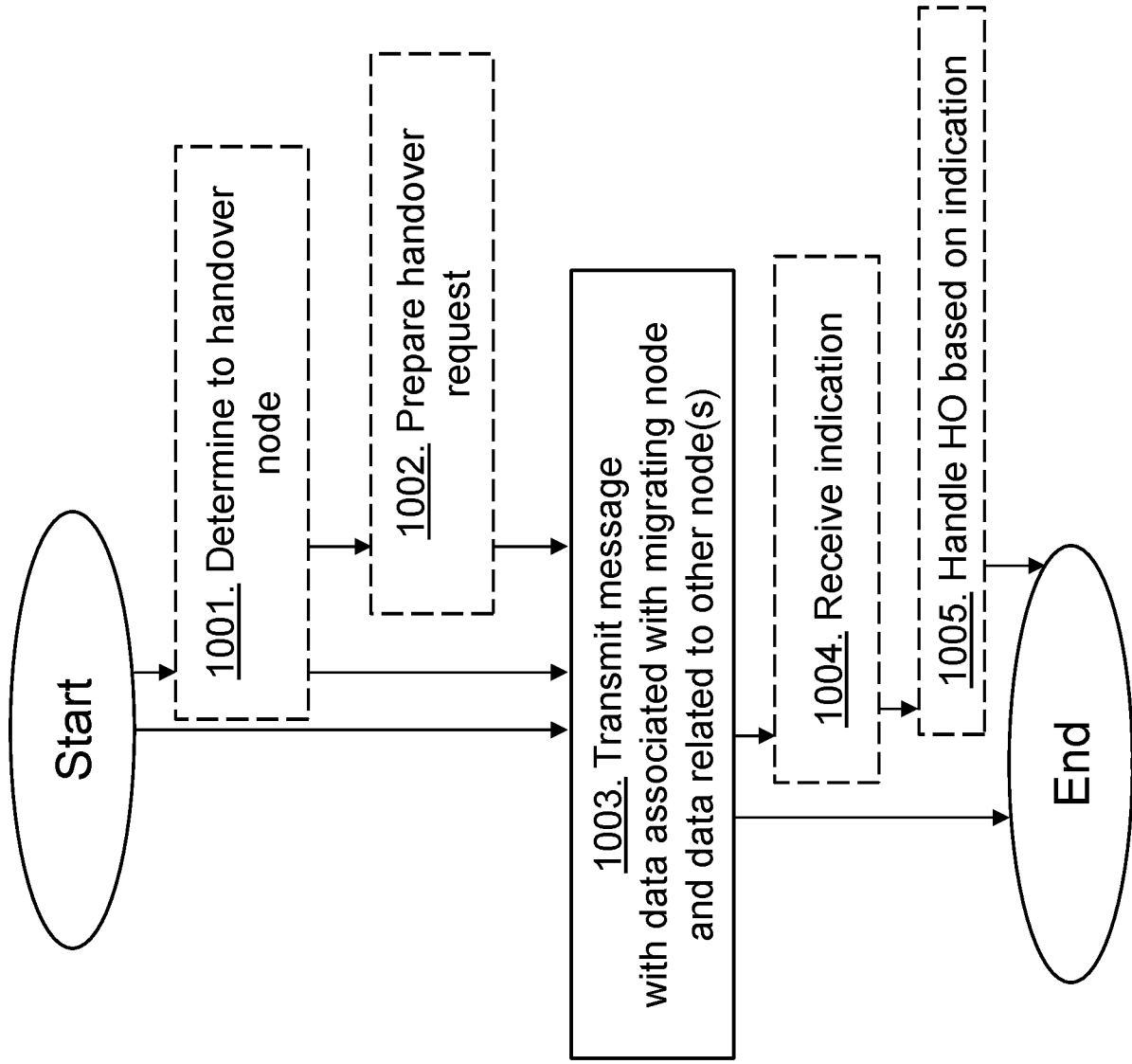


Fig. 10

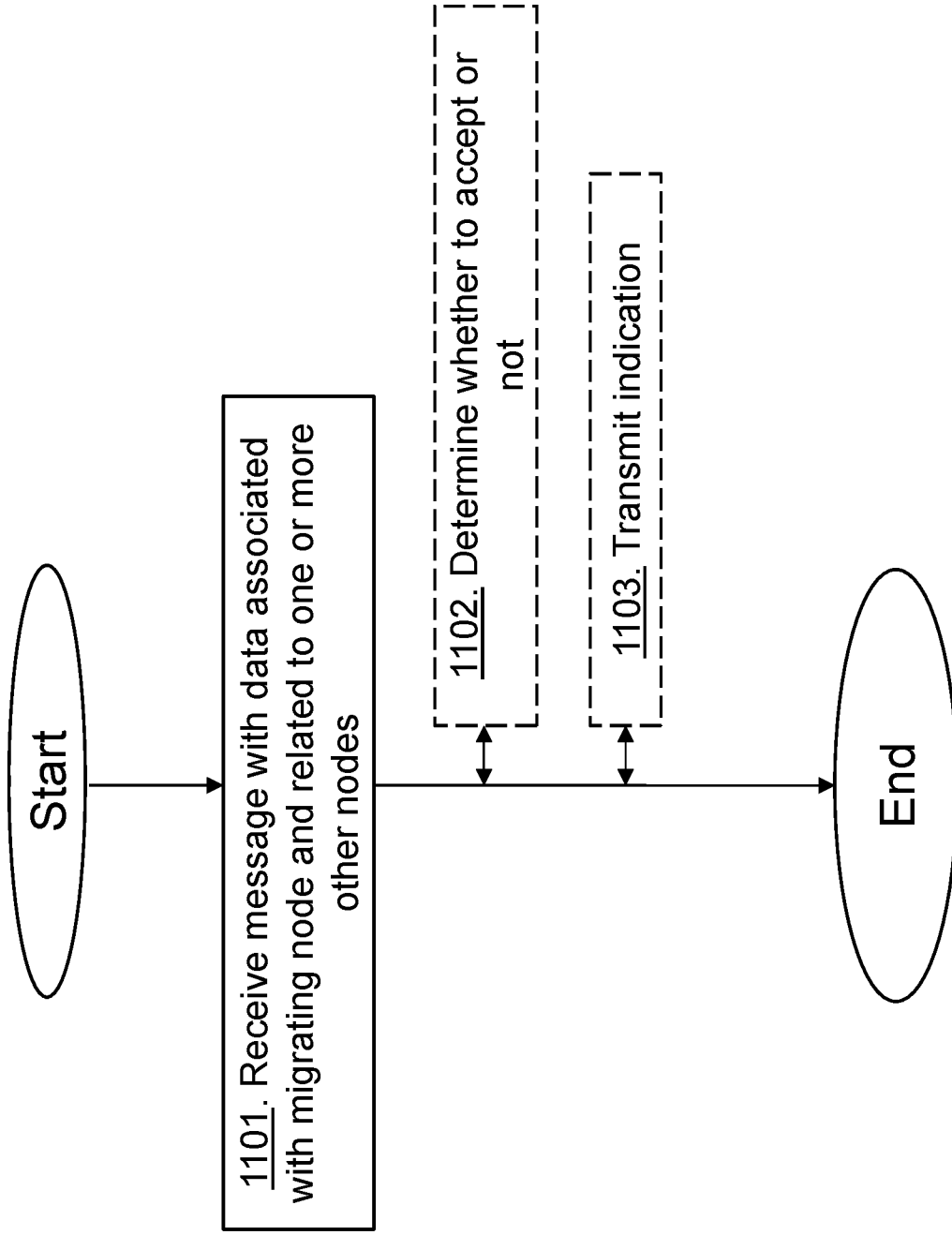
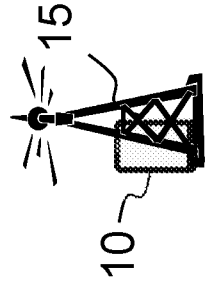
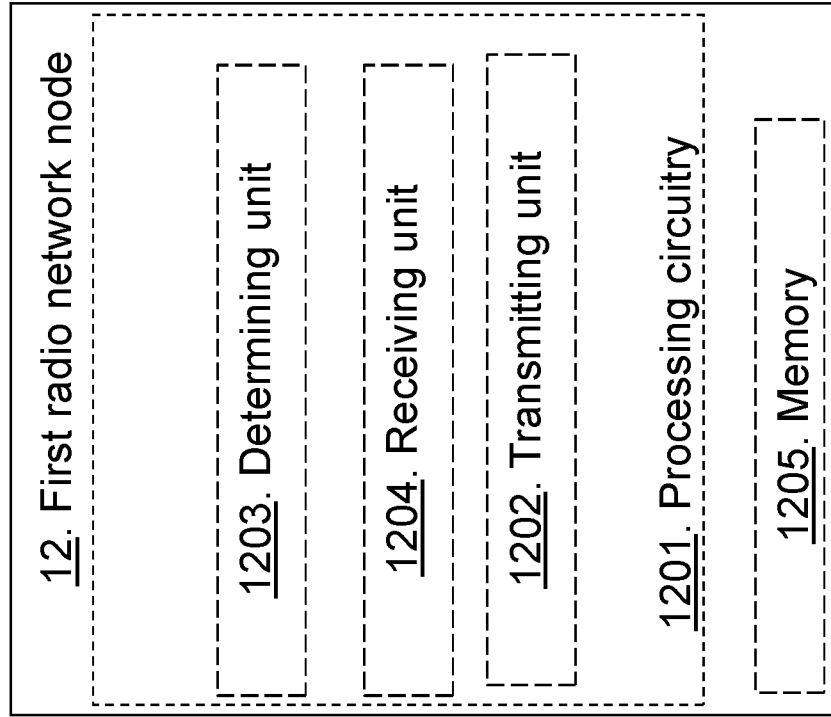


Fig. 11



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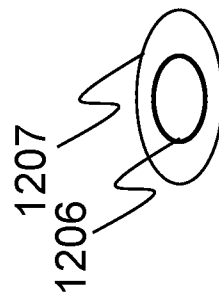
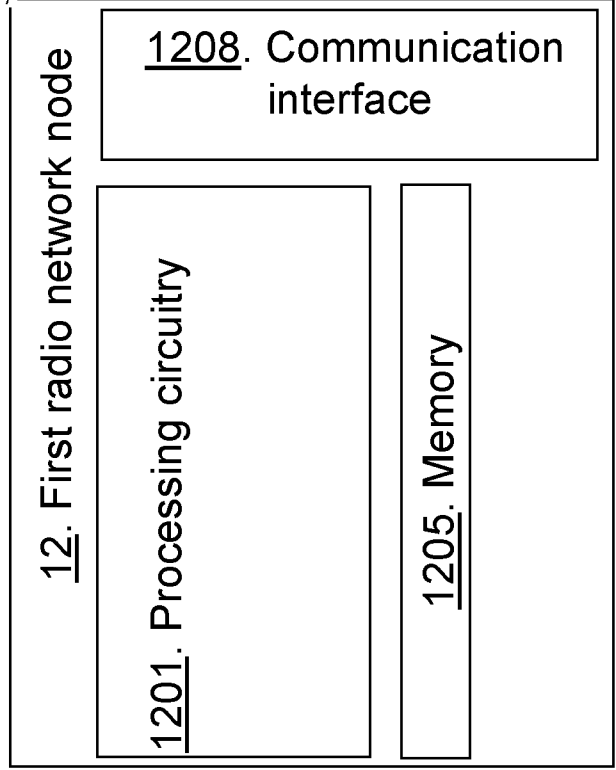


FIG. 12

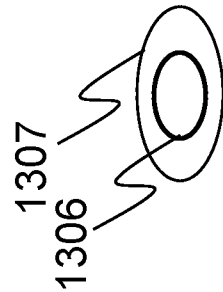
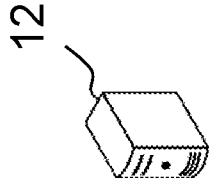
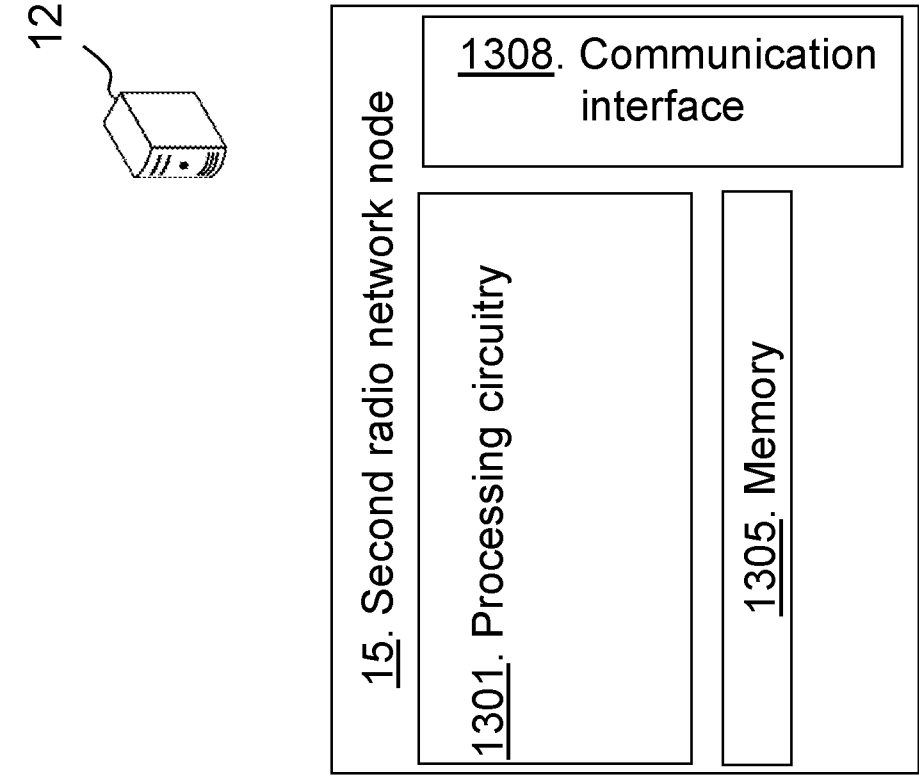


FIG. 13

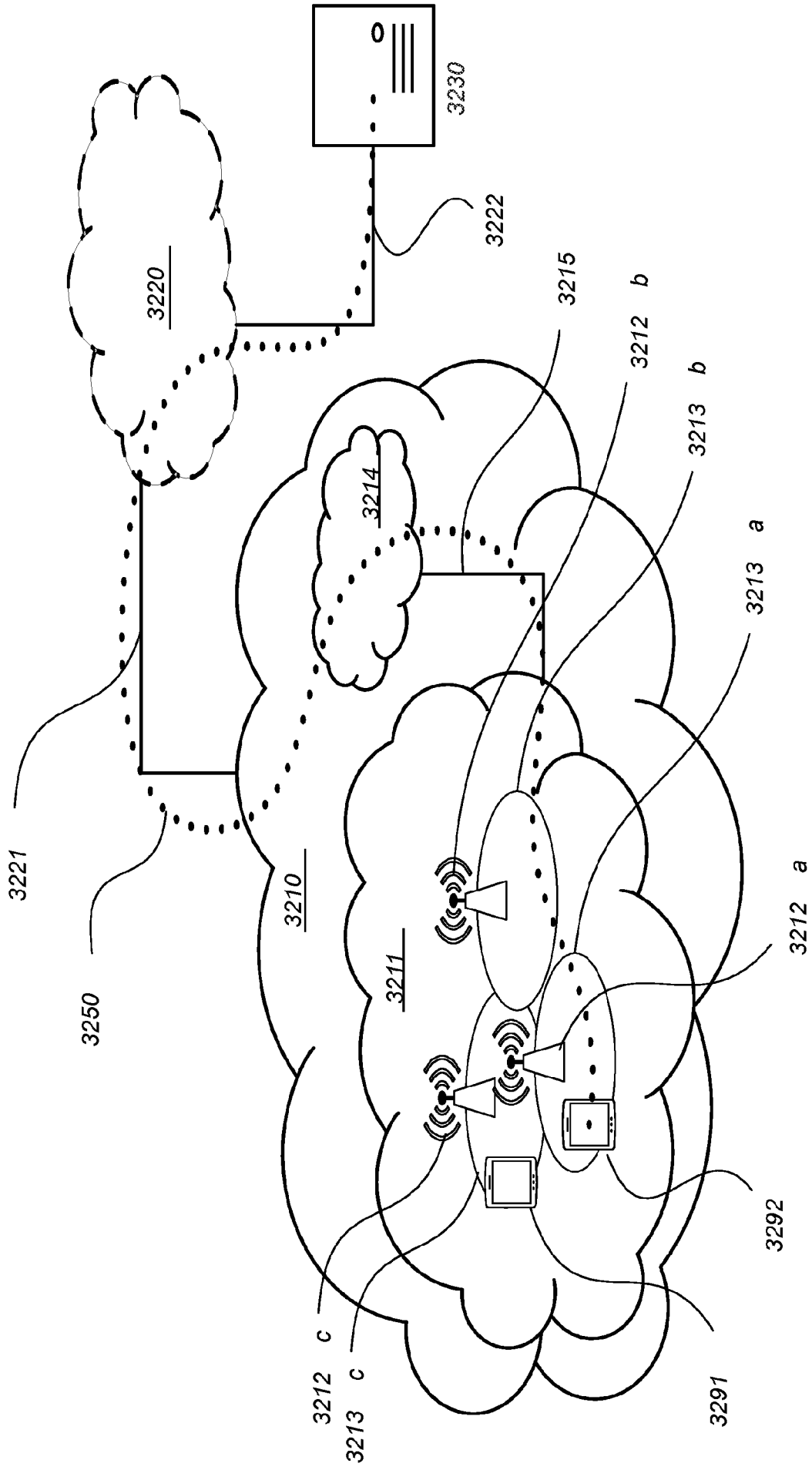


FIG. 14

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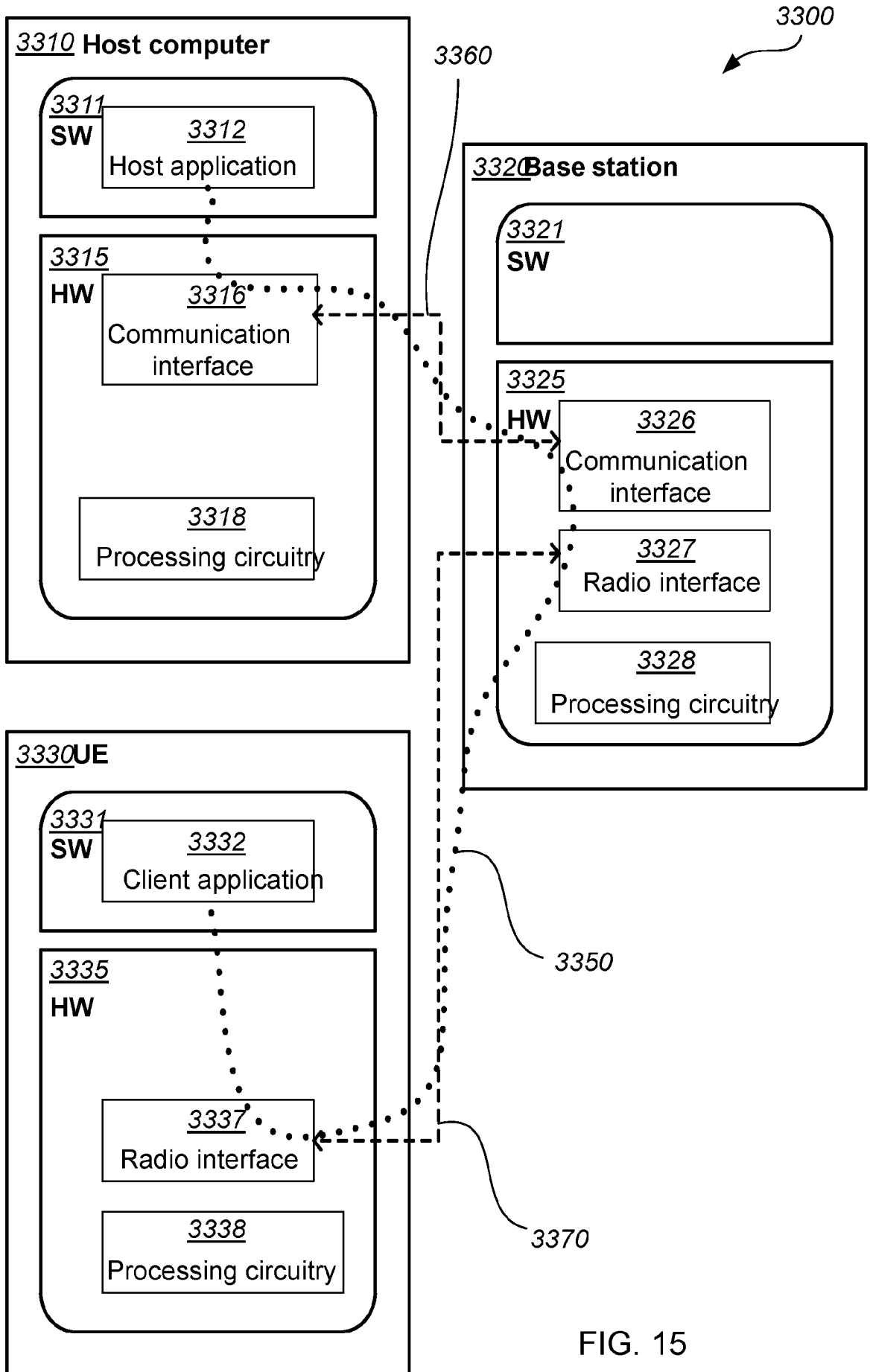


FIG. 15

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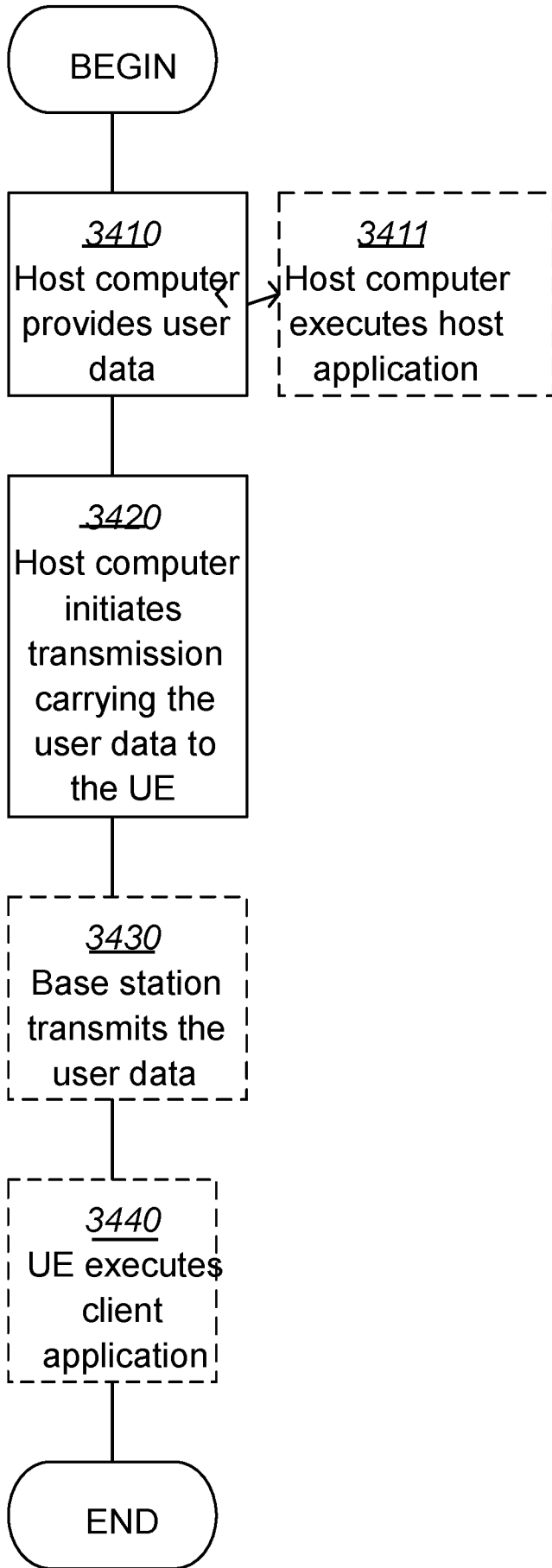


FIG. 16

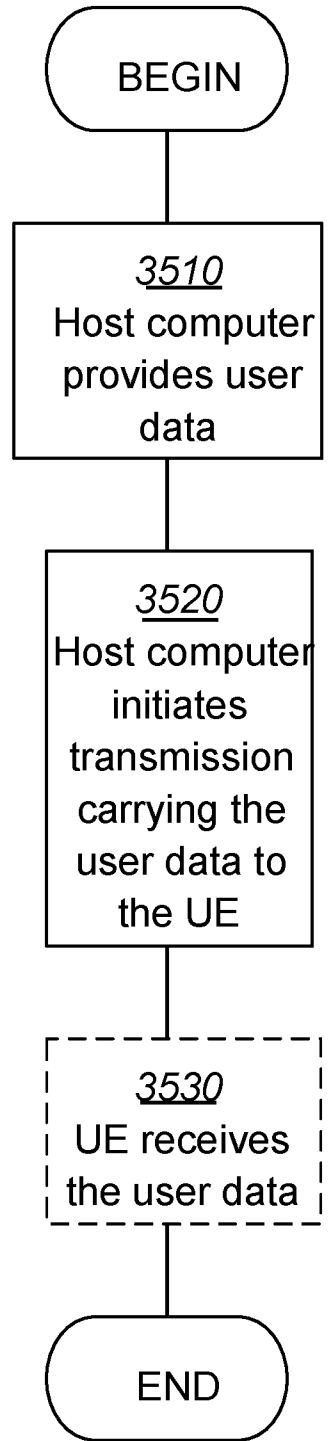


FIG. 17

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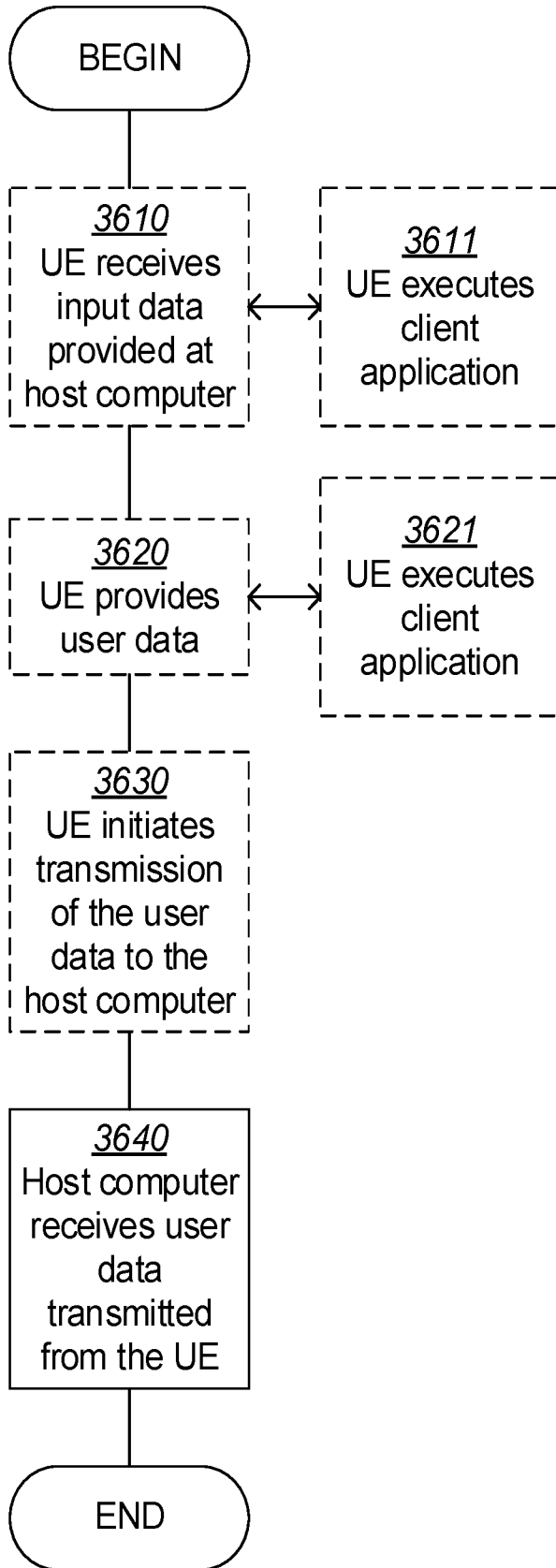


FIG. 18

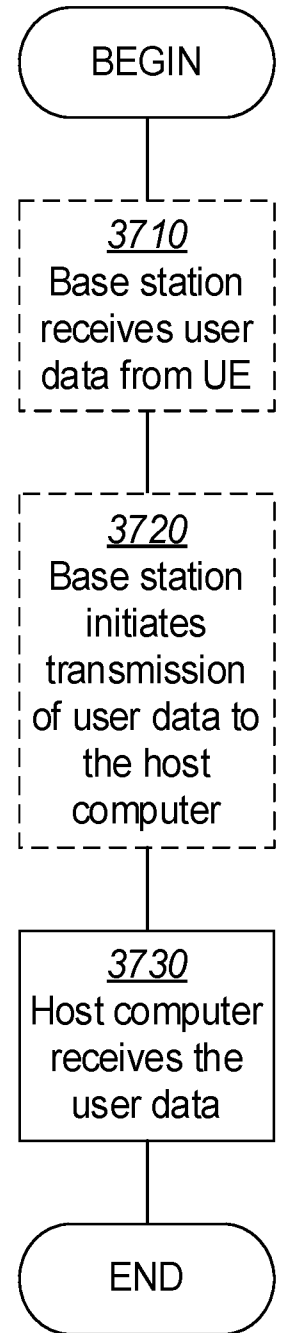


FIG. 19