3GPP TSG-RAN WG3 Meeting #122 R3-237837

**Chicago, US, 13-17 Nov, 2023**

Agenda Item: 13.2

Source: Huawei

Title: (TP for NR\_mobile\_IAB BL CR for TS 38.401) Support of mobility for mobile IAB

Document for: Discussion

# 1 Introduction

This paper is to produce TP for BL CR for TS 38.401 for the following CB:

**CB: # IAB-node\_mobility**

* **Discuss remaining proposals, if any**
* **Agree TPs**

Summary of offline disc R3-237857

(Moderator – Qualcomm)

The changes related agreements during this meeting are listed as following:

* **Capture the mIAB-MT RLF Recovery procedure via RRC Reestablishment in 38.401 section 8.YY.**
* **Update the following in all BL CRs, as needed:**

**The Rel-17 term “non-F1-terminating donor” is not applicable to mobile IAB.**

**The term “RRC-terminating donor” should be used instead.**

**The definition for “F1-terminating donor” should not only refer to the Rel-17 boundary node but also to the mIAB-DU’s CU.**

* **The sequence of procedures for UE HO and IAB TMM of DU migration is up to implementation. Remove corresponding Editor’s Note in 38.401.**
* **Capture in BL CR to 38.401, section 8.YY.3 for DU migration that the source DU’s CU should requests release of traffic offloaded to the MT’s CU via TMM, while it is up to MT´s CU implementation whether to keep backhaul resources.**
* **Capture in BL CR to 38.401, section 8.9.x1 that, after receiving the ‘not authorized’ indication, the F1-terminating CU first sends the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message to the RRC-terminating CU to confirm the reception of the mIAB-node authorization status indication, and then performs the orderly F1 release.**
* **Capture in BL CR to 38.401, section 8.9.X1, the following sequence: After the orderly release of F1, the DU’s CU initiates the IAB TRANSPORT MIGRATION MANAGEMENT Procedure toward the MT’s CU to indicate the release of all traffic. After traffic release, the MT’s CU removes the backhaul support.**
* **Capture in BL CR to 38.401, section 8.9.X1, the following behavior:**

**In case the authorization status is changed back from “non-authorized” to “authorized”, mIAB-DU integration follows phase 2 and phase 3 of the mIAB node integration procedure, as defined in section 8.12.X for network integration.**

* **For consecutive partial migration, the F1-terminating donor-CU retains the UE XnAP IDs that it allocated to the mobile IAB-MT as long as the corresponding mobile IAB-DU connects to this CU, and retains the UE XnAP ID allocated for the mIAB-MT by the RRC-terminating CU until it is notified that the mIAB-MT has been handed over to another CU.**

**For consecutive partial migration, the source donor CU of IAB-MT should retain the UE XnAP IDs allocated for the mobile IAB-MT as long as the mobile IAB-MT is connected.**

**Capture above two agreements in R3-237837, taking R3-237355 as baseline.**

# Annex 1: TP to Mobile IAB BL CR of TS 38.401

*Start of Change*

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply.
A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**Associated QoS Flow:** as defined in TS 23.247 [27].

**Associated QoS flow information:** Information encompassing: QoS flow QoS parameters for associated QoS flows and mapping information between mapped (unicast) QoS flows and associated QoS flows. The respective information is included in a way that non-supporting RAN nodes would not establish respective RAN resources irrespective the multicast session state.

**Boundary IAB-node:** anIAB-node with one RRC interface terminating at a different IAB-donor-CU than the F1 interface. This definition applies to partial migration, inter-donor redundancy and inter-donor RLF recovery.

**Conditional Handover:** as defined in TS 38.300 [2].

**Conditional PSCell Addition:** as defined in TS 37.340 [12].

**Conditional PSCell Change:** as defined in TS 37.340 [12].

**DAPS Handover:** as defined in TS 38.300 [2].

**eNB-CP**: as defined in TS 36.401 [28].

**eNB-UP**: as defined in TS 36.401 [28].

**en-gNB**: as defined in TS 37.340 [12].

**Early Data Forwarding**: as defined in TS 38.300 [2].

**F1-terminating IAB-donor**: Refers to the IAB-donor that terminates F1 for the boundary IAB-node or a mobile IAB-node.

**gNB:** as defined in TS 38.300 [2].

**gNB Central Unit (gNB-CU):** a logical node hosting RRC, SDAP and PDCP protocols of the gNB or RRC and PDCP protocols of the en-gNB that controls the operation of one or more gNB-DUs. The gNB-CU terminates the F1 interface connected with the gNB-DU.

**gNB Distributed Unit (gNB-DU):** a logical node hosting RLC, MAC and PHY layers of the gNB or en-gNB, and its operation is partly controlled by gNB-CU. One gNB-DU supports one or multiple cells. One cell is supported by only one gNB-DU. The gNB-DU terminates the F1 interface connected with the gNB-CU. For DC operation, the MgNB-DU designates the gNB-DU of an en-gNB or a gNB acting as master node, and the SgNB-DU designates the gNB-DU of an en-gNB or a gNB acting as secondary node.

**gNB-CU-Control Plane (gNB-CU-CP):** a logical node hosting the RRC and the control plane part of the PDCP protocol of the gNB-CU for an en-gNB or a gNB. The gNB-CU-CP terminates the E1 interface connected with the gNB-CU-UP and the F1-C interface connected with the gNB-DU. For DC operation, the MgNB-CU-CP designates the gNB-CU-CP of the gNB-CU for an en-gNB or a gNB acting as master node, and the SgNB-CU-CP designates the gNB-CU-CP of the gNB-CU for an en-gNB or a gNB acting as secondary node.

**gNB-CU-User Plane (gNB-CU-UP):** a logical node hosting the user plane part of the PDCP protocol of the gNB-CU for an en-gNB, and the user plane part of the PDCP protocol and the SDAP protocol of the gNB-CU for a gNB. The gNB-CU-UP terminates the E1 interface connected with the gNB-CU-CP and the F1-U interface connected with the gNB-DU. For DC operation, the MgNB-CU-UP designates the gNB-CU-UP of the gNB-CU for an en-gNB or a gNB acting as master node, and the the SgNB-CU-UP designates the gNB-CU-UP of the gNB-CU for an en-gNB or a gNB acting as secondary node.

**IAB-node**: as defined in TS 38.300 [2].

**IAB-donor**:as defined in TS 38.300 [2].

**IAB-donor-CU**: the gNB-CU of an IAB-donor, terminating the F1 interface towards IAB-nodes and IAB-donor-DU.

**IAB-donor-DU**: the gNB-DU of an IAB-donor, hosting the IAB BAP sublayer (as defined in TS 38.340 [22]), providing wireless backhaul to IAB-nodes.

**IAB-DU**: as defined in TS 38.300 [2].

**IAB-MT**: as defined in TS 38.300 [2].

**IAB Topology**: as defined in TS 38.300 [2].

**Mapped QoS flows:** Unicast QoS flows requested to be established, i.e. included in the legacy QoS flow lists in a way, that non-support RAN nodes would attempt to establish unicast QoS flows and supporting RAN nodes can identify them as mapped QoS flows based on the associated QoS information.

**Master node:** as defined in TS 37.340 [12].

**Master gNB:** see TS 37.340 [12].

**MBS session resource**: This term is used for specification of NG, Xn, F1 and E1 interfaces. It denotes NG-RAN interface and radio resources provided to support an MBS Session.

**ng-eNB:** as defined in TS 38.300 [2].

**ng-eNB Central Unit (ng-eNB-CU):** as defined in TS 37.470 [21].

**ng-eNB Distributed Unit (ng-eNB-DU):** as defined in TS 37.470 [21].

**ng-eNB-CU-Control Plane (ng-eNB-CU-CP):** a logical node hosting the RRC and the control plane part of the PDCP protocol of the ng-eNB-CU for an ng-eNB. The ng-eNB-CU-CP terminates the E1 interface connected with the ng-eNB-CU-UP and the W1-C interface connected with the ng-eNB-DU.

**ng-eNB-CU-User Plane (ng-eNB-CU-UP):** a logical node hosting the user plane part of the PDCP protocol and the SDAP protocol of the ng-eNB-CU for an ng-eNB. The ng-eNB-CU-UP terminates the E1 interface connected with the ng-eNB-CU-CP and the W1-U interface connected with the ng-eNB-DU.

**NG-RAN node:** as defined in TS 38.300 [2].

**Non-F1-terminating IAB-donor of boundary IAB-node**: Refers to the IAB-donor that has an RRC connection with the boundary node but does not terminate F1 with this boundary node.

**PDU Session Resource**: This term is used for specification of NG, Xn, and E1 interfaces. It denotes NG-RAN interface and radio resources provided to support a PDU Session.

**Public Network Integrated NPN:** as defined in TS 23.501 [3].

**RRC-terminating IAB-donor:** Refers to the IAB-donor that terminates the RRC connection of the mobile IAB-node. The RRC-terminating IAB-donor may be an F1-terminating or a non-F1-terminating IAB-donor.

**Secondary gNB:** see TS 37.340 [12].

**Stand-alone Non-Public Network:** as defined in TS 23.501 [3].

**U2N Relay UE:** as defined in TS 38.300 [2].

**U2N Remote UE:** as defined in TS 38.300 [2].

*Next Change*

### 8.9.X1 Mobile IAB node authorization

During mobile IAB-node integration procedure, the RRC-terminating IAB-donor-CU receives the authorization status of the mobile IAB-node from the 5GC. If the authorization status is “not authorized”, the RRC-terminating IAB-donor-CU will not establish any backhaul resources (including BAP address, TNL address and default BAP configuration) for this mobile IAB-node. If the authorization status for the mobile IAB-node changes, the 5GC sends an updated authorization status to the RRC-terminating IAB-donor.

In case the mobile IAB-MT and its co-located mIAB-DU connect to different IAB-donor-CUs, i.e. the RRC-terminating IAB-donor is different from the F1-terminating IAB-donor, the RRC-terminating IAB-donor will inform the F1-terminating IAB-donor about the authorization status of the mobile IAB-node via XnAP signalling once the authorization status has been updated.

NOTE: In absence of Xn between RRC-terminating IAB-donor-CU and F1-terminating IAB-donor-CU, the passing of the authorization status is left up to implementation.

If the updated authorization status for the mobile IAB node is “not authorized”, the F1-terminating donor, sends the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message to the RRC-terminating CU to confirm the reception of the mIAB-node authorization status. Then, it may hand over the UEs served by the mobile IAB-node, and should releases the F1 interface towards the mobile IAB-DU. After that, the F1-terminating IAB-donor sends the IAB TRANSPORT MIGRATION MANAGEMENT message to request from the RRC-terminating donor the release of all the offloaded traffics, and then the RRC-terminating donor releases all backhaul resources (including BAP address, TNL address and default BAP reconfiguration) for this mobile IAB node.

If the authorization status is changed back from “not authorized” to “authorized”, the mIAB-DU perfroms integration procedure following the phase 2 and phase 3 of the mobile IAB node integration, as defined in 8.12.X.

*Next Change*

## 8.YY Mobile IAB migration procedures

### 8.YY.1 Migration of mobile IAB-MT via Xn handover

The mIAB-MT of a mobile IAB-node can be migrated from a source RRC-terminating IAB-donor-CU to a target RRC-terminating IAB-donor-CU using the Xn handover procedure. During this migration, the mIAB-DU co-located with the mIAB-MT is connected to an F1-terminating IAB-donor-CU, which may be the same as the source RRC-terminating IAB-donor-CU or the target RRC-terminating IAB-donor-CU, or it can be different from both the source and the target RRC-terminating IAB-donor-CU.

Figure 8.YY.1.1-1 shows an example of mIAB-MT migration via Xn handover. In this example, the mIAB-MT is connected to the source RRC-terminating IAB-donor-CU via a source path of an IAB topology before the migration, and it is connected to the target RRC-terminating IAB-donor-CU via a target path of a different IAB topology after the migration.



Figure 8.YY.1.1-1: Procedure for Xn-based migration of mobile IAB-MT

1. Steps 1-14 of the topology adaptation procedure of Section 8.17.3.1 are performed to conduct Xn handover of the mIAB-MT from the source parent IAB-node connected to the source RRC-terminating IAB-donor-CU to the target parent IAB-node connected to the target RRC-terminating IAB-donor-CU. In these steps, the mIAB-node corresponds to the migrating IAB-node of Section 8.17.3.1, and the mIAB-MT’s source and target RRC-terminating IAB-donor-CUs correspond to the respective source and target IAB-donor-CUs of Section 8.17.3.1. The source RRC-terminating IAB-donor-CU should retain the UE XnAP IDs allocated for the mobile IAB-MT as long as the mIAB-MT is connected.

2. Same as step 15 of the topology adaptation procedure of Section 8.17.3.1, where the F1-C connection between the co-located mIAB-DU and its F1-terminating IAB-donor-CU is switched to the target path using the new TNL address information of the IAB-MT. In this step, the mIAB-node corresponds to the migrating IAB-node, and the F1-terminating IAB-donor-CU corresponds to the source IAB-donor-CU.

3. The mIAB-DU passes the gNB ID of the target RRC-terminating IAB-donor-CU and the mIAB-node’s BAP address allocated by the target RRC-terminating IAB-donor-CU to the F1-terminating IAB-donor-CU via F1AP. The F1-terminating IAB-donor-CU retains the UE XnAP IDs that it allocated to the mobile IAB-MT as long as the corresponding mIAB-DU connects to this CU, and retains the UE XnAP ID allocated for the mIAB-MT by the source RRC-terminating IAB-donor-CU until this step 3.

4. Steps 16-20 of the topology adaptation procedure of Section 8.17.3.1, where the F1-terminating IAB-donor-CU initiates the IAB Transport Migration Management procedure towards the target RRC-terminating IAB-donor-CU to provide the context of the traffic offloaded. The target RRC-terminating IAB-donor-CU reconfigures the BAP sublayer and/or BH RLC channels on the target path accordingly, and provides the UL BH information for UL BH reconfigurations to be conducted by the F1-terminating IAB-donor-CU on the mIAB-node. Then, the F1-U connections of the mIAB-node are migrated to the target path.

*Next Change*

### 8.YY.3 Mobile IAB-DU migration procedure

The RAN may perform the mobile IAB-DU migration procedure. During this procedure, the mobile IAB-node concurrently supports two logical mobile IAB-DUs, which have F1AP associations with the source F1-terminating IAB-donor-CU and target F1-terminating IAB-donor-CU, respectively. The mobile IAB-MT’s IAB-donor-CU may be the same as either the source F1-termainting IAB-donor CU or the target F1-terminating IAB-donor-CU, or it may be different from both source and target F1-terminating IAB-donor-CUs.

UEs connected to the mobile IAB-node are handed over from the cell(s) of the source logical mobile IAB-DU associated with the source F1-terminating IAB-donor-CU to the cell(s) of the target logical mobile IAB-DU associated with the target F1-terminating IAB-donor-CU. After the UEs are handed over, the source logical mobile IAB-DU’s F1AP association with the source F1-terminating IAB-donor-CU may be released.

Figure 8.YY.3.1-1 shows an example of the mobile-IAB-DU migration procedure. In this example, the source and target F1-terminating IAB-donor-CUs are different from the RRC-terminating IAB-donor-CU.



Figure 8.YY.3.1-1: Mobile IAB-DU inter-CU migration procedure

1. The source F1-terminating IAB-donor-CU sends an MIAB F1 SETUP TRIGGERING to the source logical mIAB-DU to initialize the F1 Setup procedure towards the target F1-terminating IAB-donor-CU. The MIAB F1 SETUP TRIGGERING message includes the gNB ID of the target F1-terminating IAB-donor-CU and the information needed to establish the TNL connection with the target F1-terminating IAB-donor-CU for F1-C.

NOTE: The mIAB-DU migration can also be triggered by the OAM. In this case, OAM provides the mIAB-node with all information to initiate the F1 Setup procedure toward the target F1-terminating IAB-donor-CU, and step 1 is omitted.

1. The target logical mIAB-DU initiates TNL establishment and F1 setup (as defined in clause 8.5) with the target F1-terminating IAB-donor-CU. During the F1 Setup procedure, the target logical mobile IAB-DU includes the gNB ID of the RRC-terminating IAB-donor-CU, and the BAP address of the mIAB-node in the F1 SETUP REQUEST message.
2. The target F1-terminating IAB-donor-CU responds to the target logical mIAB-DU with an F1 SETUP RESPONSE message. After F1 setup with the target F1-terminating IAB-donor-CU, the target logical mobile IAB-DU can serve UEs via the target mobile IAB-DU’s activated cell(s).
3. By sending the MIAB F1 SETUP OUTCOME NOTIFICATION, the source logical mIAB-DU informs the source F1-terminating IAB-donor-CU about the outcome of the F1 interface setup between the co-located target logical mIAB-DU and the target F1-terminating IAB-donor-CU. The source logical mIAB-DU may provide the source F1-terminating IAB-donor-CU a mapping between activated cells of the source logical mIAB-DU and those of the target logical mIAB-DU.
4. The source F1-terminating IAB-donor-CU hands over the UE from a source cell served by the source logical mobile IAB-DU to a target cell served by the target logical mobile IAB-DU. The target F1-termianting IAB-donor-CU initiates IAB Transport Migration Management procedure towards the RRC-terminating IAB-donor-CU during this step. After UE handover, the source F1-terminating IAB-donor-CU requests release of traffic offloaded to the RRC-terminating IAB-donor-CU by initiating IAB Transport Migration Management procedure.

NOTE 1: In step 5, the sequence of procedures for UE Handover and the IAB Transport Migration Management procedure initiated by the target F1-terminating IAB-donor-CU is up to implementation.

NOTE 2: When receiving traffic release request from the source F1-terminating IAB-donor-CU, it is up to RRC terminating IAB-donor-CU’s implementation to keep or release the backhaul resources.

NOTE 3: How to exchange the IAB Transport Migration Management/Modification messages between the target F1-terminating IAB-donor-CU and the RRC-terminating IAB-donor-CU without Xn interface is up to implementation.

1. After all the UEs are handed over, the source F1-terminating IAB-donor-CU may initiate the removal of the F1 interface towards the source logical mIAB-DU.

### 8.YY.4 Mobile IAB-node RLF recovery

When the mobile IAB-MT detects backhaul RLF, the mIAB-node can perfrom inter-CU backhaul RLF recovery procedure to another parent node underneath a different IAB-donor-CU. The procedure is same as step 1-18 of IAB inter-CU backhaul RLF recovery procedure in section 8.17.4 with the following correspondence: the mobile IAB-node corresponds to the Recovery IAB-node of Section 8.17.4.