**3GPP TSG-RAN WG3 Meeting #122 R3-23xxxx**

**Chicago, IL, November 13 - 17, 2023**

**Agenda item:** 13.1

**Source:** Qualcomm Incorporated (WI Rapporteur)

**Title:** Offline discussion on mIAB

**Document for:** Discussion

# 1 Introduction

This document includes a summary of a Rapporteur-initiated offline discussion on mobile IAB.

# 2 Proposals

The following is proposed:

Issue 0: Missing Stage-2 procedure and terminology issue

**Proposal 0-1: Capture the mIAB-MT RLF Recovery procedure via RRC Reestablishment in 38.401 section 8.YY**.

**Proposal 0-2: 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.**

Issue 1: Sequence of procedures for UE HO and IAB TMM in stage 2 of DU migration

**Proposal 1-1: 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.**

**Proposal 1-2: Capture in BL CR to 38.401, section 8.YY.3 for DU migration that the source DU’s CU should request release of traffic offloaded to the MT’s CU via TMM.**

Issue 2: WA that BAP address is used to indicate mIAB-node

**Proposal 3: In BL CR to 38473, the 9.3.1.X3 IE with BAP address and gNB-ID of MT’s CU to be included in the F1 Setup Request and to replace the explicit gNB-ID for the MT’s CU. The procedure text to be updated accordingly. The semantics description of the IE to capture that the 9.3.1.X3 IE is used in case the MT’s CU is different from DU’s CU.**

Issue 3: BAP address in UL F1AP messages

**Proposal 3: In BL CR to 38473, the 9.3.1.X3 IE with BAP address and gNB-ID of MT’s CU to be included in the F1 Setup Request and to replace the explicit gNB-ID for the MT’s CU. The procedure text to be updated accordingly. The semantics description of the IE to capture that the 9.3.1.X3 IE is used in case the MT’s CU is different from DU’s CU.**

Issue 4: “Authorized” indication by MT’s CU to DU’s CU

**Proposal 4a: Agree** **TP to BL CR for TS 38.413 in R3-237200: Transfer of mobile IAB authorization state in NGAP DOWNLINK NAS TRANSPORT.**

**Proposal 4b: Add mIAB authorization status indicator in mIAB-MT’s Xn Context Retrieve Response message analogue to Xn HO Request message.**

**Proposal 4c: 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 TMM toward the MT’s CU to indicate the release of all traffic. After traffic release, the MT’s CU removes the backhaul support.**

**Proposal 4d: RAN3 to decide whether MT’s CU sends an NGAP indication to AMF to inform that BH has been removed and F1 properly released (potentially SoH).**

**Proposal 4e: Capture in BL CR to 38.401, section 8.9.X1, the following behavior for the scenario, where the AMF indicates to the MT’s CU that the mIAB-node is authorized again:**

* **In case the AMF’s re-authorization indication arrives at the MT’s CU before orderly F1 release has been completed, the MT’s CU sends the authorization status change to “authorized” to the DU’s CU via the TM Modification Request. In case the AMF’s re-authorization indication arrives after orderly F1 release, the mIAB-DU integration follows the DU integration procedure as defined in section 8.12.X for network integration.**

Issue 5: Support for dual connectivity

**Proposal 5: Dual-connectivity is not supported for the mobile IAB-MT.**

Issue 7: DU migration issues

**Proposal 7a: RAN3 to decide how to resolve reception of DU migration triggers from OAM and from the source DU’s CU with these triggers hold conflicting information about the target DU’s CU (potentially SoH):**

* **Option 1: Based on OAM configuration, the (source) mIAB-DU indicates in its F1 Setup Request message that OAM-triggered DU migration is preferred. The DU’s CU can overwrite this preference in the F1 Setup Response message with an indication that it itself will trigger DU migration.**
* **Option 2: Both, OAM and source mIAB-DU’s CU can trigger DU migration. In case the trigger is first received from the CU, the mIAB-node ignores OAM-based triggers until DU migration has completed. In case the trigger is first received from OAM, the mIAB-node ignores CU-based triggers until DU migration has completed, and it reports the gNB-ID of target DU’s CU to the source DU’s CU in the MIAB F1 Setup Outcome Notification.**

**Proposal 7b: Capture RAN3’s decision for P7a in BL CRs to 38.473 and 38.401, section on DU migration.**

**Proposal 7c: For DU migration, capture in BL CR to 38401 in section on DU migration, that the MT’s CU might receive traffic offload requests for a UE from the target CU, while it still holds traffic offload from the source CU for the same UE, and that the MT’s CU can identify by implementation that such traffic offload from two CUs is due to DU migration.**

Issue 8: MT migration

**Proposal 8a: The target gNB shall ignore the PDU Session Resource Setup List IE and not take action to setup the PDU session, when the IAB-MT does not have PDU session.**

**Proposal 8b: Capture P8a, if agreed, in BL CR for 38.413 following TP in R3-237430.**

Issue 11: Retaining XnAP IDs

**Proposal 11a: For consecutive partial migration, the F1-terminating donor-CU retains the UE XnAP IDs allocated for the mobile IAB-MT by itself 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 mIAB-MT’s CU until it is notified that the mIAB-MT has been handed over to another CU.**

**Proposal 11b: 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.**

**Proposal 11c: Capture P11a and P11b, if agreed, in BL CR for 38.413 following TP in R3-237455.**

Issue 10: Concurrent DU/MT migration

**Proposal 10a: Capture in BL CR to 38401 that in case the mIAB-MT migration occurs concurrently with an ongoing mIAB-DU migration, both the source and the target mIAB-DUs should update their respective donor CUs with the gNB-ID of mIAB-MT's target CU and mIAB-MT's new BAP address.**

Issue 13: RACH-less HO

**Proposal 13a: Send Reply LS to RAN2 on support of RACH-less HO capturing the following as a baseline:**

**RAN3 identified the following issues:**

**(1) During DU migration, UE handovers may not only occur from the source logical DU’s cell but also from other cells to the target logical DU’s cell. RAN3 assumes that RACH-less handover can only be applied to those UEs that are handed over from the source logical DU’s cell. The target logical DU therefore needs to be able to derive from the information it receives during UE handover preparation, whether the UE is presently connected to the source logical DU.**

**(2) When the target logical DU configures the UE’s beam to be used in the target cell for RACH-less handover based on network-implementation-specific knowledge, it needs to identify the beam configuration this UE presently uses in the source logical DU’s cell. For this purpose, it needs to able to derive from the information it receives during UE handover preparation an identifier the UE uses in the source logical DU’s cell.**

**(3) When the target logical DU configures the UE’s beam to be used in the target cell for RACH-less handover based on legacy measurements, it needs to able to obtain the beam information the UE reported to the source logical DU’s CU in the measurement report.**

**During UE handover preparation, the target logical DU receives the F1AP UE Context Setup Request message from the target CU containing the RRC container sent in the handover request. RAN3 kindly asks RAN2 to ensure that the above issues can be addressed through the information provided in this RRC container, and to get back to RAN3 in case explicit signaling via Xn or F1 is needed.**

Issue 12: TAC/RANAC reconfiguration

**Proposal 12a: RAN3 do decide whether TAC/RANAC of the mIAB-DU’s cell can also be obtained via the following options:**

* **Configured via DU’s CU**
* **Copied over from MT’s cell**
* **Configured via MT’s CU (if different that MT’s cell)**

Issue 9: Served- cell/neighbor-cell indication

**Proposal 9a: Introduce a new attribute for Served Cell Information NR and Neighbour Information NR IEs in XnAP to indicate that the cell is a mobile IAB cell.**

**Proposal 9b: Capture P9a, if agreed, in BL CR for 38.423 following TP in R3-237432**

# 3 Discussion

## Issue 0: Missing Stage-2 procedure and terminology issue

**Proposal 0-1: Capture the mIAB-MT RLF Recovery procedure via RRC Reestablishment in 38.401 section 8.YY**.

The term “non-F1-terminating donor” is used in Rel-17 to refer the boundary node’s donor that terminates RRC. For mIAB, this term cannot be reused since the mIAB-node is not referred to as a “boundary node”, and since the donor terminating RRC may be the same as the donor terminating F1. We will therefore use the term “RRC-terminating donor” for mIAB, instead of “non-F1-terminating donor”. Further, the term “F1-terminating donor” needs to be extended to mIAB-nodes since the IAB-node is not a boundary node.

**Proposal 0-2: 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.**

## Issue 1: Sequence of procedures for UE HO and IAB TMM in stage 2 of DU migration

The DU migration procedure in BL CR to 38.401 currently contains in Step 5:

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| 5. UE HANDOVER, IAB TMM procedure between Target F1-terminating IAB-donor-CU and the RRC-terminating IAB-donor CU. |

The TP to the stage-2 BL CR in R3-235776 includes the following Editor’s Note:

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| Editor’s NOTE: The sequence of procedures of UE HO and IAB TMM procedures is FFS. |

As discussed in F2F offline, TMM procedure may not be required for each UE HO. Therefore, a specific sequence for UE HO and IAB TMM procedure cannot be defined, but should be left up to implementation.

**Proposal 1-1: The sequence of procedures for UE HO and IAB TMM of DU migration is up to implementation. Remove corresponding Editor’s Note.**

The present procedure is missing for the DU migration, that the source DU’s CU should request release of traffic offloaded to the MT’s CU via TMM.

**Proposal 1-2: Capture in BL CR to 38.401, section 8.YY.3 for DU migration that the source DU’s CU should request release of traffic offloaded to the MT’s CU via TMM.**

## Issue 2: WA that BAP address is used to indicate mIAB-node

Last meeting agreed the following WA:

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| **WA: Use the BAP address as the identifier for the MT in the initial TMM message sent by the DU’s CU to the MT’s CU.** |

The TP to BL CR 38.473 in [R3-235918](file:///C:\temporary\RAN3\RAN3%20October%2023\Outcome\TPs\Inbox\R3-235918.zip) includes the following Editor’s Note:

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| Editor’s Note: it is a working assumption to use the BAP address as the identifier for the MT in the initial TMM message sent by the DU’s CU to the MT’s CU. |

**Proposal 2: Turn the following WA into agreement: “Use the BAP address as the identifier for the MT in the initial TMM message sent by the DU’s CU to the MT’s CU.” Remove Editor’s Note in BL CR to TS 38.473 related to this WA.**

## Issue 3: BAP address in UL F1AP messages

Since Rel-16, the F1 Setup Request contains the BAP address and defines the following behaviour:

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| If the *BAP Address* IE is included in the F1 SETUP REQUEST, the receiving gNB-CU shall, if supported, consider the information therein for discovering the collocation of an IAB-DU and an IAB-MT. |

The TP to BL CR 38.473 in [R3-235918](file:///C:\temporary\RAN3\RAN3%20October%2023\Outcome\TPs\Inbox\R3-235918.zip) introduces the RRC-terminating CU’s gNB-ID to the F1 Setup Request and defines the following behaviour:

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| If the *RRC Terminating IAB-Donor gNB-ID* IE is included in the F1 SETUP REQUEST message, the gNB-CU shall, if supported, use this information for the subsequent IAB Transport Migration Management procedure as specified in TS 38.423 [28]. |

Present BL CR to 38473 uses explicit IEs for BAP address and gNB-ID of MT’s CU in F1 Setup Request, but a new IE, that includes both, BAP address and gNB-ID of MT’s CU, in GNB-DU Configuration Update Request. To align both messages, it is better to allow using the new IE also for the F1 Setup Request in case the MT’s CU is different from the DU’s CU.

**Proposal 3: In BL CR to 38473, the 9.3.1.X3 IE with BAP address and gNB-ID of MT’s CU to be included in the F1 Setup Request and to replace the explicit gNB-ID for the MT’s CU. The procedure text to be updated accordingly. The semantics description of the IE to capture that the 9.3.1.X3 IE is used in case the MT’s CU is different from DU’s CU.**

## Issue 4: “Authorized” indication by MT’s CU to DU’s CU

**Proposal 4a: Agree** **TP to BL CR for TS 38.413 in R3-237200: Transfer of mobile IAB authorization state in NGAP DOWNLINK NAS TRANSPORT.**

**Proposal 4b: Add mIAB authorization status indicator in mIAB-MT’s Xn Context Retrieve Response analogue to Xn HO Request.**

**Proposal 4c: 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 TMM toward the MT’s CU to indicate the release of all traffic. After traffic release, the MT’s CU removes the backhaul support.**

**Proposal 4d: RAN3 to decide whether MT’s CU sends an NGAP indication to AMF to inform that BH has been removed and F1 properly released (potentially SoH).**

**Proposal 4e: Capture in BL CR to 38.401, section 8.9.X1, the following behavior for the scenario, where the AMF indicates to the MT’s CU that the mIAB-node is authorized again:**

* **In case the AMF’s re-authorization indication arrives at the MT’s CU before orderly F1 release has been completed, the MT’s CU sends the authorization status change to “authorized” to the DU’s CU via the TM Modification Request. In case the AMF’s re-authorization indication arrives after orderly F1 release, the mIAB-DU integration follows the DU integration procedure as defined in section 8.12.X for network integration.**

## Issue 5: Support for dual connectivity

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| * + The mobility of dual-connected IAB-nodes is down-prioritized. |

**Proposal 5: Dual-connectivity is not supported for the mobile IAB-MT.**

## Issue 6: Concurrent operation as mobile IAB-node and legacy IAB-node

The RAN3 chair notes include the following statement [1]:

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| **It is common understanding that a mIAB node cannot be supported by a non mIAB capable gNB.** |

In the last meeting, RAN2 discussed whether a node can concurrently operate as mIAB-node and as IAB-node. RAN2 achieved the following agreements [2]:

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| * From R2 perspective It is not supported that Rel-18 mobile IAB-node concurrently operate as a Rel-16/17 IAB-node, as e.g. mobile-IAB doesn’t support child IAB nodes. * This means that there are restrictions for the network in configuring concurrent use of R-18 mIAB feature(s) and rel-16/17 IAB features (details FFS). * FFS if an IAB-node may send both MSG5 indications to the network, and the network decides (or if the IAB-node should decide). |

Open issues:

* Should the (m)IAB-node be allowed to simultaneously include both mIAB and IAB indicators in Msg. 5?
* If yes, how does the network select the operation mode?
* How is the operation mode indicated to the node?

During F2F offline discussion, companies we aligned that RAN3 should not pursue this issue until RAN2 has made progress on this matter.

## Issue 7: DU migration issues

**Proposal 7a: RAN3 to decide how to resolve reception of DU migration triggers from OAM and from the source DU’s CU with these triggers hold conflicting information about the target DU’s CU:**

* **Option 1: Based on OAM configuration, the (source) mIAB-DU indicates in its F1 Setup Request message that OAM-triggered DU migration is preferred. The DU’s CU can overwrite this preference in the F1 Setup Response message with an indication that it itself will trigger DU migration.**
* **Option 2: Both, OAM and source mIAB-DU’s CU can trigger DU migration. In case the trigger is first received from the CU, the mIAB-node ignores OAM-based triggers until DU migration has completed. In case the trigger is first received from OAM, the mIAB-node ignores CU-based triggers until DU migration has completed, and it reports the gNB-ID of target DU’s CU to the source DU’s CU in the MIAB F1 Setup Outcome Notification.**

**Proposal 7b: Capture RAN3’s decision on this matter in BL CRs to 38.473 and 38.401, section on DU migration.**

Issues identified by MITRE in R3-237469:

**Proposal 7c: For DU migration, capture in BL CR to 38401 in section on DU migration, that the MT’s CU might receive traffic offload requests for a UE from the target CU, while it still holds traffic offload from the source CU for the same UE, and that the MT’s CU can identify by implementation that such traffic offload from two CUs is due to DU migration.**

## Issue 8: MT migration

Based on R3-237430 (Nokia, Nokia Shanghai Bell, Huawei, ZTE):

**Proposal 8a: The target gNB shall ignore the PDU Session Resource Setup List IE and not take action to setup the PDU session, when the IAB-MT does not have PDU session.**

**Proposal 8b: Capture P8a, if agreed, in BL CR for 38.413 following TP in R3-237430.**

## Issue 9: Served- cell/neighbor-cell indication

Based on R3-237432, Nokia, Nokia Shanghai Bell.

Observation 2-1: The current Cause values in XnAP Handover Preparation Failure do not allow the source donor to conclude that the target cell requested in Handover Request is a mobile-IAB cell.

Observation 2-2: Exchanging the information about the mobile cells over Xn allows the source node to optimize IAB-MT measurement configuration, to eliminate useless IAB-MT measurement reporting and to avoid initiation of unnecessary HO procedures.

**Proposal 9a: Introduce a new attribute for Served Cell Information NR and Neighbour Information NR IEs in XnAP to indicate that the cell is a mobile IAB cell.**

**Proposal 9b: Capture P9a, if agreed, in BL CR for 38.423 following TP in R3-237432.**

## Issue 10: Concurrent DU/MT migration

Issue identified by MITRE in R3-237469:

**Proposal 10a: Capture in BL CR to 38401 that in case the mIAB-MT migration occurs concurrently with an ongoing mIAB-DU migration, both the source and the target mIAB-DUs should update their respective donor CUs with the gNB-ID of mIAB-MT's target CU and mIAB-MT's new BAP address.**

## Issue 11: Retaining XnAP IDs

Issues identified by Huawei in R3-237355

**Proposal 11a: For consecutive partial migration, the F1-terminating donor-CU retains the UE XnAP IDs allocated for the mobile IAB-MT by itself 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 mIAB-MT’s CU until it is notified that the mIAB-MT has been handed over to another CU.**

**Proposal 11b: 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.**

**Proposal 11c: Capture P11a and P11b, if agreed, in BL CR for 38.413 following TP in R3-237455.**

## Issue 12: TAC/RANAC reconfiguration

**Proposal 12a: RAN3 do decide whether TAC/RANAC of the mIAB-DU’s cell can also be obtained via the following options:**

* **Configured via DU’s CU**
* **Copied over from MT’s cell**
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## Issue 13: RACH-less HO

**Proposal 13a: Send Reply LS to RAN2 on support of RACH-less HO capturing the following as a baseline:**

**RAN3 identified the following issues:**

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**(2) When the target logical DU configures the UE’s beam to be used in the target cell for RACH-less handover based on network-implementation-specific knowledge, it needs to identify the beam configuration this UE presently uses in the source logical DU’s cell. For this purpose, it needs to able to derive from the information it receives during UE handover preparation an identifier the UE uses in the source logical DU’s cell.**

**(3) When the target logical DU configures the UE’s beam to be used in the target cell for RACH-less handover based on legacy measurements, it needs to able to obtain the beam information the UE reported to the source logical DU’s CU in the measurement report.**

**During UE handover preparation, the target logical DU receives the F1AP UE Context Setup Request message from the target CU containing the RRC container sent in the handover request. RAN3 kindly asks RAN2 to ensure that the above issues can be addressed through the information provided in this RRC container, and to get back to RAN3 in case explicit signaling via Xn or F1 is needed.**