3GPP TSG-RAN WG3 #116-e R3-223706

Online, 9th – 19th May 2022

Agenda Item: 9.1.2.1

Source: Lenovo (moderator)

Title: Summary of IAB corrections on TS 38.401

Document for: Approval

# Introduction

This paper provides the summary for following offline discussion: And in this paper, only some essential issues which may need to be discussed are listed, and the remaining stage-2 wording and editorial corrections are summarized in another parallel draft TP, and the output of the draft TP will be merged into the final single CR.

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| **CB: # IAB\_02\_CR38.401****- Agree on needed corrections****- Converge on Single CR**(Lenovo - moderator)Summary of offline disc [R3-223706](Inbox%5CR3-223706.zip) |

Phase I：Please give your feedback before Wednesday, 11th May 2022, 23:59 UTC. This allows us to give some inputs for Thursday’s online session (12th May 2022).

Phase II：TBD.

# For the Chairman’s Notes

# Discussion – 1st Round

## Issues for IAB Inter-CU Topology Redundancy

In the last RAN3 meeting, following agreements were achieved for IAB Inter-CU Topology Redundancy procedure of the boundary node.

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| **2a: The baseline procedure for inter-donor redundancy of the boundary node includes at least the following steps:****1). DC setup (IP address request or configuration need not be included)****2). XnAP Transport Migration Management Request: Includes QoS info per traffic without IP address.****3). RRC Reconfiguration by CU2: Includes configuration of additional IP addresses.****4). XnAP Transport Migration Management Response: Includes L2 info per traffic.****5). F1AP IAB UP CONFIGURATION UPDATE REQUEST: Includes new UL mappings for each migrated traffic****6). F1AP IAB UP CONFIGURATION UPDATE RESPONSE: Includes IP address selected for each migrated traffic****7). XnAP Transport Migration Management Request: Includes modification of each traffic with new IP address.****8). XnAP Transport Migration Management Response: Acknowledgement of modification.****IP addresses are requested to CU2. Options for the request are either Step 1 or Step 2 above or via RRC. Details on how the are requested are FFS.**  |

In contribution [2], IP addresses for the boundary node based on either Step1 or Step 2 are both discussed. And Step 1 is preferred in contribution [2] where RRC container with the boundary node’s IP address information is included in XnAP messages for dual connectivity setup or modification. And the corresponding CR is provided in contribution [3].

While in the current TS 38.401, IP address request for the boundary node is included in the IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message in Step 2, and the non-F1-terminating IAB-donor-CU sends the RRC configuration which include the new TNL address(es) anchored at the second-path IAB-donor-DU to the boundary node.

***Q1-1: Please share your views on the corrections for IP address request for boundary node in IAB Inter-CU Topology Redundancy in contribution [3]. And please provide the corresponding text proposal based on the [3] or based on the latest TS 38.401, if needed.***

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In contribution [3], it’s proposed to add the following texts for non-F1-terminating CU initiated traffic release procedure for inter-CU topology redundancy.

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| The traffic offload for descendant nodes follows the same procedure as defined for the partial migration in clause 8.17.3.2. The F1-terminating IAB-donor-CU may request full or partial release of the offloaded traffic from the non-F1-terminating IAB-donor-CU by initiating the IAB Transport Migration Management procedure towards the non-F1-terminating IAB-donor-CU (e.g., for the purpose of revoking or in case UE bearers are released). The non-F1-terminating IAB-donor-CU may request full or partial release of the offloaded traffic by initiating the IAB Transport Migration Modification procedure towards the F1-terminating IAB-donor-CU (e.g., for the purpose of revoking).The traffic offloaded through the inter-CU topological redundancy procedure described in steps 1 to 12 (including the offload of traffic pertaining to the dual-connecting boundary IAB-node and its descendant IAB-nodes and their served UEs) can be partially or fully revoked, resulting in the return of the offloaded traffic back to the F1-terminating IAB-donor-CU’s topology. Full or partial traffic revoking can be initiated by the F1-terminating IAB-donor-CU by initiating the IAB Transport Migration Management procedure towards the non-F1-terminating IAB-donor-CU. The non-F1-terminating IAB-donor-CU can request partial or full traffic revoking from the F1-terminating IAB-donor-CU by initiating the IAB Transport Migration Modification procedure towards the F1-terminating IAB-donor-CU. |

However, in contribution [9], they think that the description of the second paragraph has been covered in the third paragraph and the whole second paragraph looks redundant.

***Q1-2: Do you agree to add the texts for non-F1-terminating CU initiated traffic release procedure for inter-CU topology redundancy? Or to delete the second paragraph?***

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In contributions [4], [5] and [11], it’s proposed to remove the following NOTE in the IAB Inter-CU topological redundancy procedure and IAB inter-CU topology adaptation procedure since there is no BAP header re-writing for the boundary IAB’s F1-C/U.

NOTE: The non-F1-terminating IAB-donor-CU should select the same IAB-donor-DU in its topology for all to-be-offloaded traffic, whose UL BH mappings received from the F1-terminating IAB-donor-CU in step 2 share the same BAP address.

While in contributions [8] and [9], they think the intention of the above NOTE is for the source IP address selection for the descendant nodes of the boundary node and the content is not appropriate for the boundary node. And they propose another NOTE as follow.

NOTE: The boundary node selects the TNL address for UP/non-UP traffic to be forwarded towards the (Non)-F1-terminating topology corresponds to an anchored donor DU’s BAP address, among the TNL address(es) configured by donor (MN/SN) of the egress topology.

***Q1-3: Do you agree to remove the first NOTE above*** ***in the IAB Inter-CU topology redundancy procedure and IAB inter-CU topology adaptation procedure? And do you agree to add the second NOTE?***

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In contribution [6], F1AP gNB-DU CONFIG UPDATE and SCTP association establishment are proposed to be added in Step 9 of IAB inter-CU topology redundancy with following correction.

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| 9. The F1-terminating IAB-donor-CU updates the boundary node with the UL BH information received form the non-F1-terminating IAB-donor-CU in Step 8. This step may also update UL FTEID and DL FTEID associated with individual GTP-tunnel(s). The affected GTP tunnel(s) will be switched to use the dual-connecting IAB-node’s new TNL address(es). This step may use non-UE associated signaling in E1 and/or F1 interface to provide updated UP configuration for F1-U tunnels of multiple connected UEs or child IAB-MTs. Implementation must ensure the avoidance of potential race conditions, i.e., no conflicting configurations are concurrently performed using UE-associated and non-UE-associated procedures.  The F1-terminating IAB-donor-CU may also provide UL BH information associated with non-UP traffic. New TNL addresses for F1-C traffic configured in step 3, if any, can be added to the dual-connecting IAB-DU’s F1-C association(s) with the F1-terminating IAB-donor-CU.The dual-connecting IAB-node sends F1AP gNB-DU CONFIG UPDATE to the F1-terminating IAB-donor-CU, which may include new (outer) IP addresses and corresponding new (inner) IP address for offloaded F1-U traffic. If new TNL addresses for F1-C traffic are configured, new SCTP association(s) between the dual-connecting IAB-node and the F1-terminating IAB-donor-CU may be established using the new TNL address information of the dual-connecting IAB-node.  |

In contribution [11], it’s also proposed to clarify that the boundary node updates the IAB-donor-CU with DL IP addresses it decided to use for the offloaded traffic.

***Q1-4: Please share your view to add the F1AP gNB-DU CONFIG UPDATE and SCTP association establishment in Step 9?***

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In contribution [6], it’s proposed that the non-F1-terminating donor cannot obtain boundary node’s new IP address for each GTP-U tunnel until step 10. So the DL mapping configured by non-F1-terminating IAB-donor in step 7 is only for CP traffic while the DL mapping configured in step 10 is for UP and non-UP traffic, which is similar as in inter-donor migration procedure.

***Q1-5: Do you agree that DL mapping configured by non-F1-terminating IAB-donor in step 7 is only for CP traffic and the DL mapping configured in step 10 is for UP and non-UP traffic?***

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In contribution [9], it’s proposed that the non-F1 terminating donor is not aware of the DL TNL address for a given offloaded F1-U/C traffic before Step 7, thus the DL mapping configuration cannot be performed in this step.

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| 7. The non-F1-terminating IAB-donor-CU may configure or modify BH RLC channels and BAP-sublayer routing entries on the second path between the dual-connecting IAB-node and the second-path IAB-donor-DU as well as DL mappings on the second-path IAB-donor-DU for the dual-connecting IAB-node’s second path. These configurations may support the transport of UP and non-UP traffic on the second path. |

Similar problems observed in step 14 in Section 8.17.3.1, and step 2 in 8.17.3.2.

***Q1-6: Do you agree that the non-F1 terminating donor is not aware of the DL TNL address for a given offloaded F1-U/C traffic before Step 7? If yes, do you agree to delete the corresponding sentence in Step 7 of Section 8.17.2.1, Step 14 of Section 8.17.3.1, and Step 2 of Section 8.17.3.2?***

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In contribution [10], they want to clarify the header rewriting, routing update, and BAP mapping configuration update for inter-donor topology redundancy as below.

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| 9. The F1-terminating IAB-donor-CU updates the boundary node with the UL BH information received form the non-F1-terminating IAB-donor-CU in Step 8. This step may also update UL FTEID and DL FTEID associated with individual GTP-tunnel(s). The affected GTP tunnel(s) will be switched to use the dual-connecting IAB-node’s new TNL address(es). This step may use non-UE associated signaling in E1 and/or F1 interface to provide updated UP configuration for F1-U tunnels of multiple connected UEs or child IAB-MTs. Implementation must ensure the avoidance of potential race conditions, i.e., no conflicting configurations are concurrently performed using UE-associated and non-UE-associated procedures.  The F1-terminating IAB-donor-CU may also provide UL BH information associated with non-UP traffic. New TNL addresses for F1-C traffic configured in step 3, if any, can be added to the dual-connecting IAB-DU’s F1-C association(s) with the F1-terminating IAB-donor-CU.The F1-terminating IAB-donor-CU also configures the dual-connecting IAB-node with the BAP-sublayer routing, header-rewriting and BH RLC CH mapping entries. |

In addition, same clarification is added for inter-donor topology adaptation procedure.

***Q1-7: Do you agree to clarify the header rewriting, routing update, and BAP mapping configuration update for inter-donor topology redundancy and inter-donor topology adaptation procedure?***

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## Issues for IAB Inter-CU Topology Adaptation

In both contributions [5] and [6], same text of MOBIKE is proposed to be added in the inter-CU topology adaptation procedure.

***Q2-1: Please share your views on adding the texts for MOBIKE in the*** ***inter-CU topology adaptation procedure? And if you agree with it, please share your preference on Opt.1 (after Step 15[5]) or Opt.2 (after Step 19[6])?***

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In contribution [6], it’s proposed that the source IAB-donor-CU couldn’t derive the new IP addresses for each F1-U tunnel until F1-U redirection (i.e. step 19). So, the migrating IAB-node cannot report IP address for each F1-U tunnel and non-UP traffic type via the gNB-DU configuration update message in Step 15, and two the IAB Transport Migration Management procedure needs to be performed twice. For the first one, it doesn’t include the new DL TNL address information necessary for the target IAB-donor-CU to configure or modify DL mappings on the target IAB-donor-DU and it can be performed earlier, e.g. after receiving HO request ACK in step 4. And the second one is introduced after Step 19 which include the new DL TNL address information necessary for the target IAB-donor-CU to configure or modify DL mappings on the target IAB-donor-DU.

***Q2-2: Please share your views on the changes above for IAB inter-CU topology adaptation?***

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In contribution [6], it’s proposed that the Step 1 for descendant IAB-node can be performed in parallel with the Step 0 after the source IAB-donor-CU receives HANDOVER REQUEST ACKNOWLEDGE message. For example, the context of the traffic to be offloaded for the migrating/descendant nodes and IP address request information could be contained in the same IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message.

***Q2-3: Do you agree that Step 1 for descendant IAB-node can be performed in parallel with the Step 0?***

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In contribution [9], the second paragraph of traffic revocation seems not necessary in Section 8.17.3.1, since the previous paragraph has stated that the IAB-MT is handed over in reverse direction.

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| The traffic offloaded through the inter-CU topology adaptation described in steps 1 to 20 (including the offloaded traffic pertaining to the migrating IAB-node and its descendant IAB-nodes and their served UEs) can be fully revoked. In this case, the migrating IAB-MT is handed over in reverse direction, i.e., from the non-F1-terminating IAB-donor-CU to the F1-terminating IAB-donor-CU, and the traffic of the migrating IAB-DU and the descendant IAB-DUs is routed again along the former source path. |

***Q2-4: Do you agree to delete the second paragraph above for traffic revoke?***

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## Issues for IAB Intra-CU Topology Adaptation

To enable the parallel TNL migration of the descendant nodes, it’s proposed to clarify the routing entry in the migrating IAB and descendant IAB should be configured before the migration [4]. Otherwise, the migrating IAB cannot forward the further *RRCReconfigurationComplete* message received from child IAB node, and the parallel TNL migration cannot be performed. In addition, the corresponding stage-2 update in [5] is pasted below.

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| Based on implementation, these steps can be performed after or in parallel with the handover of the migrating IAB-node. To enable performing these steps in parallel, the IAB-donor-CU sends the RRCReconfiguration message with the new TNL address(es) and the new default UL mapping to the descendent node while the migrating IAB-MT is still connected with source parent node, for example, before Step 5. In this case, the UE CONTEXT MODIFICATION REQUEST message carrying this RRCReconfiguration message includes a conditional delivery indication for the descendent node’s parent IAB-DU to withhold the delivery of the RRCReconfiguration message, as specified in TS 38.473 [4]. The IAB-donor-CU also configure the migrating IAB-node and descendant IAB node(s) with routing entry, at least the routing entry for the default UL BAP Routing ID, while the migrating IAB-MT is still connected with source parent node. |

Same issue is discussed in contribution [7], and 2 alternatives are given as follows to solve it,

* Alt #1: The trigger condition for the descendent IAB node to transfer the buffered RRC message to its child IAB node is that the descendent IAB-node has one or more routing entries for the target path.
* Alt #2: In case no routing entry exists for the received packets, use the default configuration of the descendant nodes to forward the TNL migration related UL packets received from the child node.

***Q3: Please share your view on the trigger condition of descendant node? And do you agree to the stage-2 update in [5]?***

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## Issues for IAB Inter-CU Backhaul RLF recovery

In contributions [6] and [11], the following texts are added in the Step 14.

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| 14. The new IAB-donor-CU sends a DL RRC MESSAGE TRANSFERmessage to the new parent IAB-DU, which includes an *RRCReconfiguration* message for the IAB-MT undergoing recovery. The RRC configuration may include new TNL addresses anchored at the new IAB-donor-DU. The RRC configuration includes a BAP address for the recovery IAB-node in the new IAB-donor-CU’s IAB topology, default BH RLC channel and a default BAP routing ID configuration for UL F1-C/non-F1 traffic mapping on the recovery path.  |

***Q4-1: Do you agree to clarify that the RRC configuration further includes the BAP address and the default configuration?***

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For the definition of the IAB-node which performs BH RLF recovery to another parent node underneath a different IAB-donor-CU. Following 3 options are suggested in different contributions.

* Option 1: Boundary IAB-node [5]
* Option 2: Recovery IAB-node [6]
* Option 3: Recovering IAB-node [1] [11]

***Q4-2: Please share your preference for the definition of the IAB-node which perform inter-CU BH RLF recovery?***

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## Issues for IP address allocation for IAB-nodes

In contribution [7], it’s proposed to add the stage-2 description of IP address allocation for IAB inter-CU topology management in clause 8.9.13 as follow.

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| In case of IAB-donor-based IP address allocation, the IP address(es) is(are) allocated by the IAB-donor-CU or IAB-donor-DU. In both cases, the IAB-node requests the IP address(es) via RRC from the IAB-donor-CU. It includes a separate IP address request for each usage, where the usages defined are all traffic, F1-U, F1-C and non-F1. The IAB-donor-CU may initiate the IAB TNL Address Allocation procedure to obtain IP addresses from the IAB-donor-DU. The IAB-donor-CU sends the IP addresses allocated for each usage to the IAB-node via RRC. In case of IAB inter-CU topology management, the F1-terminating IAB-donor-CU may obtain the IP addresses for each usage from the non-F1-terminating IAB-donor-CU for the boundary IAB-node and descendant IAB-nodes of the boundary IAB-node. |

***Q5: Do you agree to clarify IP address allocation for inter-CU cases in clause 8.9.13?***

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## Issues for IAB node Integration

In contribution [9], it’s proposed to add a NOTE to capture the following agreement for the OAM based F1-terminating donor selection in Section 8.12.1.

*For OAM-based donor selection, the IAB-node indicates the F1-terminating donor node by signaling its IP address(es) to this donor node using the Rel-16 RRC-based signaling mechanism*.

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| NOTE: If the IAB-node establishes NR-DC before the establishment of F1-C connection, and the IAB-donor is selected by OAM, the MN or SN of the IAB-node will perform as the F1-terminating donor if receiving IP address(es) of the IAB node through RRC signaling. |

***Q6-1: Do you agree to add the NOTE above for IAB node Integration?***

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In contribution [11], it’s proposed to capture the following RAN3 agreement for IAB-donor determination.

*For donor-based IP-address allocation, the MN determines the F1-terminating node.*

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| NOTE: If the IAB-node establishes NR-DC before the establishment of F1-C connection, the MN decides which of MN or SN becomes the F1-terminating IAB-donor. In case it decides that the SN become the F1-terminating IAB-donor, it signals via Xn to the SN to establish the backhaul connectivity (phases 2.1 and 2.2). The IAB-node can implicitly derive whether the MN or the SN is the F1-terminating donor, e.g., based on the entity which provides the default BAP configuration. |

***Q6-2: Do you agree to modify the NOTE above to capture the agreement for IAB node Integration?***

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## Issues for IAB protocol stack

***Q7: Do you agree to add the protocol stacks for CP-UP separation scenarios 1 and 2 [11]?***

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## Others

***Q8: Please provide view if any issue is missing in above discussion (except for the rewording and editorial correction in another draft CR).***

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# Discussion – 2nd Round

[TBD]

# References

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| 1 | [R3-223116](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223116.zip) | (CR TS 38.401): IAB Rel-17 Corrections (Ericsson) | CR0203r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 2 | R3-223219 | Discussion on IP address request for boundary node in inter-donor redundancy (Fujitsu) | discussion |
| 3 | [R3-223220](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223220.zip) | CR for 38.401 on inter-donor redundancy (Fujitsu) | CR0208r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 4 | [R3-223250](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223250.zip) | Corrections for IAB (Nokia, Nokia Shanghai Bell) | discussion |
| 5 | [R3-223251](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223251.zip) | Corrections for IAB (Stage-2) (Nokia, Nokia Shanghai Bell) | CR0212r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 6 | [R3-223294](file:///D%3A%5C%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5C%5CTSGR3_116-e%5C%5CDocs%5C%5CR3-223294.zip) | Corrections on procedures for inter-donor topology adaptation, redundancy, and BH RLF recovery in TS 38.401 (ZTE) | CR0215r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 7 | [R3-223308](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223308.zip) | Correction on IP address allocation (Lenovo) | CR0216r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 8 | [R3-223384](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223384.zip) | Remaining issue for source IP selection and concurrent TNL migration (Huawei) | discussion |
| 9 | [R3-223385](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223385.zip) | Miscellaneous correction for IAB enhancement (Huawei) | CR0218r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 10 | [R3-223541](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_116-e%5CDocs%5CR3-223541.zip) | Correction on Rel-17 eIAB(Stage-2) (Samsung, Huawei) | CR0221r, TS 38.401 v17.0.0, Rel-17, Cat. F |
| 11 | [R3-223673](Inbox%5CR3-223673.zip) | CR to 38.401 for Rel-17 IAB (Qualcomm Incorporated) | CR0231r, TS 38.401 v17.0.0, Rel-17, Cat. FLate contribution |