**3GPP TSG-RAN WG3 Meeting #115-e R3-222919**

**Feb. 21 - Mar. 03 2022, E-meeting**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.401** | **CR** | **0179** | **rev** | **10** | **Current version:** | **16.8.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | BL CR to TS 38.401 on support of eIAB | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R3 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB\_enh-Core | | | | |  | | ***Date:*** | | 2022-03-07 |
|  |  | | | |  | | |  | |  |
| ***Category:*** | **B** |  | | | | | | ***Release:*** | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Support the inter-donor IAB topology update for Rel-17 eIAB | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * **RAN3#112e** * Add the procedure for the IAB inter-donor migration. * **RAN3#113e** * Add MOBIKE in Stage-2 for IAB intra-donor migration. * **RAN3#114e** * Update the definition of boundary IAB node (Rapporteur) * Update the MOBIKE operation in case IPsec tunnel mode is used for TNL protection * **RAN3#114bise** * Remove change on change * **RAN3#114bise** * Merge the TPs agreed in RAN3#114bise, including procedures for traffic adaptation, RLF related, etc. * **RAN3#115e** * Merge the TPs agreed in RAN3#115e, including clean-ups and clarifications to inter-donor-DU Re-routing | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Cannot support the inter-donor IAB topology update for Rel-17 eIAB in stage 2 spec. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 3.1; 8.2.3.1; 8.y (new), 8.z (new), 8.z.1 (new), 8.xx (new), 8.xx.1 (new), 8.xx.2(new); 8.A (new), 8.12.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | |  | | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | TS/TR ... CR ... | | | |
| ***affected:*** | |  | **x** | Test specifications | | | TS/TR ... CR ... | | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | TS/TR ... CR ... | | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

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| --- | --- |
| ***This CR's revision history:*** | Rev -:   * Add the procedure for the IAB inter-donor migration, according to agreements in RAN3-112e meeting.   Rev 1: R3-212971   * Rewording step 13 as ” The F1-C and F1-U are switched to the target path, details are FFS” * Add an Editor note after step 13, to indicate that whether to align step 13 with the corresponding R16 text. * Add “may” in step 15, and remove the FFS part.   Rev 2: R3-213178   * Submit to the RAN3-112e meeting, rebase the v16.6.0 of the latest spec.   Rev 3: R3-214507   * add MOBIKE in Stage-2 related TP agreed in R3-214398   Rev 4: R3-214656   * Submit to the RAN3-114e meeting, rebase the v16.7.0 of the latest spec.   Rev 5: R3-216061   * Update the definition of boundary IAB node   Rev 6: R3-216260   * To merge TP agreed in R3-216090   Rev 7: R3-220063   * Submit to the RAN3-114bise meeting, rebase the v16.8.0 of the latest spec.   Rev 8: R3-221286   * Editorial changes   Rev 9: R3-221595   * To merge TPs agreed in R3-221231, R3-221256, R3-221429, R3-221460 in RAN3#114bise   Rev 10: R3-222919   * To merge TPs R3-222509, R3-222674, R3-222740 agreed in RAN3#115e |

*START OFCHANGE*

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.300: "NR; Overall description; Stage-2".

\*\* Unchanged part is skipped \*\*

[26] 3GPP TS 38.472: "NG-RAN; F1 signalling transport".

[xx] IETF RFC 4555 (2006-06): "RFC IKEv2 Mobility and Multihoming Protocol (MOBIKE)".

# 3 Definitions and abbreviations

## 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].

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

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

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

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

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

**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.

**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.

**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].

**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-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].

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

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

*NEXTCHANGE*

8.2.3 Intra-CU topology adaptation procedure

### 8.2.3.1 Intra-CU topology adaptation procedure in SA

During the intra-CU topology adaptation in SA, 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 have common nodes with the target path. Figure 8.2.3.1-1 shows an example of the topology adaptation procedure, where the target parent node uses a different IAB-donor-DU than the one used by the source parent node.

Figure 8.2.3.1-1: IAB intra-CU topology adaptation procedure

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

2. The source parent node IAB-DU sends an UL RRC MESSAGE TRANSFER message to the IAB-donor-CU to convey the received MeasurementReport.

3. The IAB-donor-CU sends a UE CONTEXT SETUP REQUEST message to the target parent node IAB-DU to create the UE context for the migrating IAB-MT and set up one or more bearers. These bearers can be used by the migrating IAB-MT for its own signalling, and, optionally, data traffic.

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

5. The IAB-donor-CU sends a UE CONTEXT MODIFICATION REQUEST message to the source parent node IAB-DU, which includes a generated RRCReconfiguration message. The RRCReconfiguration message includes a default BH RLC channel and a default BAP Routing ID configuration for UL F1-C/non-F1 traffic mapping on the target path. It may include additional BH RLC channels. This step may also include allocation of TNL address(es) that is (are) routable via the target IAB-donor-DU. The new TNL address(es) may be included in the RRCReconfiguration message as a replacement for the TNL address(es) that is (are) routable via the source IAB-donor-DU. In case IPsec tunnel mode is used to protect the F1 and non-F1 traffic, the allocated TNL address is outer IP address. The TNL address replacement is not necessary if the source and target paths use the same IAB-donor-DU. The Transmission Action Indicator in the UE CONTEXT MODIFICATION REQUEST message indicates to stop the data transmission to the migrating IAB-node.

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

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

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

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

10. The target parent node IAB-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 IAB-DU. These UL packets belong to the IAB-MT’s own signalling and, optionally, data traffic.

11. The IAB-donor-CU configures BH RLC channels and BAP-sublayer routing entries on the target path between the target parent IAB-node and target IAB-donor-DU as well as DL mappings on the target IAB-donor-DU for the migrating IAB-node’s target path. These configurations may be performed at an earlier stage, e.g. immediately after step 3, or before step 3. The IAB-donor-CU may establish additional BH RLC channels to the migrating IAB-MT via RRC message.

12. The F1-C connections are switched to use the migrating IAB-node’s new TNL address(es), IAB-donor-CU updates the UL BH information associated to each GTP-tunnel to migrating IAB-node. This step may also update UL FTEID and DL FTEID associated to each GTP-tunnel. All F1-U tunnels are switched to use the migrating 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. The IAB-donor-CU may also update the UL BH information associated with non-UP traffic. 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.

In case IPsec tunnel mode is used for TNL protection, the IAB-node may use MOBIKE to migrate the IPsec tunnel to the new IP outer addresses. After the completion of the MOBIKE procedure, the IAB-DU initiates an F1AP gNB-DU Configuration Update procedure from which the IAB-donor-CU can conclude whether the existing inner IP address(es) (e.g. for SCTP association) and the DL F-TEID can be reused.

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

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

15. The IAB-donor-CU releases BH RLC channels and BAP-sublayer routing entries on the source path between source parent IAB-node and source IAB-donor-DU.

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

Steps 11, 12 and 15 should also be performed for the migrating IAB-node’s descendant nodes, as follows:

The IAB-donor-CU may allocate new TNL address(es) that is (are) routable via the target IAB-donor-DU to the descendent nodes via RRCReconfiguration message.

If needed, the IAB-donor-CU may also provide a new default UL mapping which includes a default BH RLC channel and a default BAP Routing ID for UL F1-C/non-F1 traffic on the target path, to the descendant nodes via RRCReconfiguration message.

If needed, the IAB-donor-CU configures BH RLC channels, BAP-sublayer routing entries on the target path for the descendant nodes and the BH RLC channel mappings on the descendant nodes in the same manner as described for the migrating IAB-node in step 11.

The descendant nodes switch their F1-C connections and F1-U 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 step 12.

Based on implementation, these steps can be performed after or in parallel with the handover of the migrating IAB-node. If performed 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].

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.

NOTE: In-flight downlink data in the source path may be discarded, up to implementation via the NR user plane protocol (TS 38.425 [24]).

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

*NEXTCHANGE*

## 8.y IAB Inter-donor-DU Re-routing

When an IAB-donor-DU is configured with the information to support inter-donor-DU re-routing, the IAB-donor-DU may identify a re-routed UL IP packet based on the source IP address field of the UL packet, and forward the re-routed UL IP packet to the peer IAB-donor-DU via a tunnel. In the intra-donor-CU scenario for UL inter-donor-DU rerouting, the IAB-donor-DU and its peer IAB-donor-DU are controlled by the same IAB-donor-CU. In the inter-donor-CU case, the IAB-donor-DU and its peer IAB-donor-DU are controlled by different IAB-donor-CUs. The inter-donor-DU tunnel is a GTP-U tunnel. IAB-donor-CU configures the IAB-donor-DU with a list of TNL addresses and/or prefixes that are subject to inter-donor-DU tunneling and exempt from TNL address filtering.

NOTE: Other tunnel types may be used for the inter-donor-DU tunnel, by implementation.

*NEXTCHANGE*

## 8.z IAB Inter-CU Topology Redundancy

8.z.1 IAB Inter-CU topological redundancy procedure

The inter-CU topological redundancy procedure enables the establishment and release of redundant paths in IAB-topologies underneath different IAB-donor-CUs. Since topological redundancy uses NR-DC for the IAB-MT, it is only supported for IAB-nodes operating in the SA mode.

Figure 8.z.1-1 shows an example of the inter-CU topological redundancy procedure, where a second path for the F1 connection of the dual-connecting IAB-node with the F1-terminating IAB-donor-CU is established in the topology of the non-F1-terminating IAB-donor-CU. By retaining the F1-connection of the dual-connecting IAB-node’s IAB-DU with the F1-terminating IAB-donor-CU and having a second RRC connection for the dual-connecting IAB-node’s IAB-MT with the non-F1-terminating IAB-donor-CU, this procedure renders the dual-connecting IAB-node as a boundary IAB-node.



**Figure 8.z.1-1 IAB inter-CU topology redundancy procedure**

1. The NR-DC establishment procedure is performed for the IAB-MT of the dual-connecting IAB-node as described in TS 37.340 [12], clause 10.2.

2. The F1-terminating IAB-donor-CU sends an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the non-F1-terminating IAB-donor-CU to provide the context of the traffic to be offloaded. This message may include a request for new TNL addresses.

3. The non-F1-terminating IAB-donor-CU sends a DL RRC MESSAGE TRANSFER message to the second parent IAB-node’s IAB-DU, which includes an *RRCReconfiguration* message for the dual-connecting IAB-node’s IAB-MT. The RRC configuration includes a BAP address for the boundary node in the non-F1-terminating IAB-donor-CU’s topology. The RRC configuration may include new TNL addresses anchored at the second-path IAB-donor-DU for the dual-connecting IAB-node. In case IPsec tunnel mode is used to protect the F1 and non-F1 traffic, the new TNL address is outer IP address.

4. The second parent IAB-DU forwards the received *RRCReconfiguration* message to the dual-connecting IAB-MT.

5. The dual-connecting IAB-MT responds to the second parent IAB-node’s IAB-DU with an *RRCReconfigurationComplete* message.

6. The second parent IAB-node’s IAB-DU sends an UL RRC MESSAGE TRANSFER message to the non-F1-terminating IAB-donor-CU to convey the received *RRCReconfigurationComplete* message.

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. The DL mappings may be based on the TNL addresses allocated to the dual-connecting IAB-node in step 3. These configurations may support the transport of UP and non-UP traffic on the second path.

8. The non-F1-terminating IAB-donor-CU responds with an IAB TRANSPORT MIGRATION MANAGEMENT RESPONSE message to the F1-terminating IAB-donor-CU to provide the mapping information for the traffic to be offloaded as indicated in step 2. The message includes the L2 info necessary to configure the dual-connecting IAB-node with the UL mappings for this traffic. The message includes the DSCP/IPv6 Flow Label values to be used for the DL traffic to be offloaded.

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.

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-tunnels. The affected GTP tunnels may 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.

10. The F1-terminating IAB-donor-CU sends an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the non-F1-terminating IAB-donor-CU to modify the context of the dual-connecting IAB-node’s offloaded traffic. The message may include the DL TNL address information used for the offloaded traffic and reported by the boundary node in step 9. The non-F1-terminating IAB-donor-CU may use this information to configure or modify DL mappings on the second-path IAB-donor-DU.

11. The non-F1-terminating IAB-donor-CU responds with an IAB TRANSPORT MIGRATION MANAGEMENT RESPONSE message to the F1-terminating IAB-donor-CU.

12. Repetition of steps above, as needed, where the F1-terminating IAB-donor-CU can request addition, modification, or release of the offloaded traffic. The non-F1-terminating IAB-donor-CU can fully or partially reject the addition or modification requests by the F1-terminating IAB-donor-CU.

The non-F1-terminating IAB-donor-CU may request the modification of the L2 transport for the offloaded traffic in the non-F1-terminating IAB-donor-CU’s topology using the IAB TRANSPORT MIGRATION MODIFICATION REQUEST message. The F1-terminating IAB-donor-CU reconfigures UL BH mappings accordingly and acknowledges the modification via the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message. The non-F1-terminating IAB-donor-CU may further reconfigure the TNL addresses of the dual-connecting IAB-node via RRC.

The traffic offload for descendant nodes follows the same procedure as defined for the partial migration in clause 8.xx.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 traffic offload 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.

*NEXTCHANGE*

## 8.xx IAB Inter-CU Topology Adaptation

8.xx.1 IAB inter-CU topology adaptation procedure

During the inter-CU topology adaptation for a single-connected IAB-node, the IAB-MT switches connection (i.e., migrates) it’s RRC from an old parent node to a new parent node, where the old and the new parent nodes are served by different IAB-donor-CUs. Without loss of generality, the old parent node can be referred to as source parent node, and the new parent node can be referred to as target parent node.

Figure 8.xx.1-1 shows an example of the topology adaptation procedure where the migrating IAB-MT is migrated from one IAB-donor-CU to another IAB-donor-CU. Since the IAB-DU of the migrating IAB-node retains its F1 connection with the first IAB-donor-CU (i.e. the source IAB-donor-CU) after the migrating IAB-MT connects to the second IAB-donor-CU (i.e. the target IAB-donor-CU), this procedure renders the migrating IAB-node as a boundary IAB-node.



**Figure 8.xx.1-1: IAB inter-CU topology adaptation procedure**

1. The source IAB-donor-CU sends a HANDOVER REQUESTmessage to the target IAB-donor-CU over the Xn interface. Thismessage may include the migrating IAB-node’s TNL address information in the RRC container.

2. The target IAB-donor-CU sends a UE CONTEXT SETUP REQUESTmessage to the target parent node IAB-DU to create the UE context for the migrating IAB-MT and set up one or more bearers. These bearers can be used by the migrating IAB-MT for its own signaling, and, optionally, data traffic.

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

4. The target IAB-donor-CU performs admission control and provides the new RRC configuration as part of the HANDOVER REQUEST ACKNOWLEDGE message. The RRC configuration includes a BAP address for the boundary node in the target IAB-donor-CU’s topology, default BH RLC channel and a default BAP routing ID configuration for UL F1-C/non-F1 traffic mapping on the target path. The RRC configuration may include the new TNL addresses anchored at the target IAB-donor-DU for the migrating node.

5. The source IAB-donor-CU sends a UE CONTEXT MODIFICATION REQUESTmessage to the source parent node IAB-DU, which includes the received *RRCReconfiguration* message from the target IAB-donor-CU.

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

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

8. A random access procedure is performed at the target parent node IAB-DU.

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

10. The target parent node IAB-DU sends an UL RRC MESSAGE TRANSFER message to the target IAB-donor-CU to convey the received RRCReconfigurationComplete message.

11. The target IAB-donor-CU triggers the path switch procedure for the migrating IAB-MT, if needed.

12. The target IAB-donor-CU sends UE CONTEXT RELEASE message to the source IAB-donor-CU.

NOTE: The XnAP UE IDs of the migrating node are retained at target and source IAB-donor-CU as long as the target path is used for transport of traffic between the migrating node and the source IAB-donor-CU.

13. The source IAB-donor-CU may release BH RLC channels and BAP-sublayer routing entries on the source path between source parent IAB-node of the migrating IAB-node and the source IAB-donor-DU.

14. The target IAB-donor-CU configures BH RLC channels and BAP-sublayer routing entries on the target path between the migrating IAB-node and target IAB-donor-DU, as well as DL mappings on the target IAB-donor-DU for the migrating IAB-node’s target path. These configurations support the transport of F1-C traffic on the target path.

15. The F1-C connection between the migrating IAB-node and the source IAB-donor-CU may be switched to the target path using the new TNL address information of the migrating IAB-node. The migrating IAB-node may report the new TNL address information it wants to use for each F1-U tunnel and non-UP traffic type to the source IAB-donor-CU via the gNB-DU CONFIGURATION UPDATE message.

16. The source IAB-donor-CU sends an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the target IAB-donor-CU to provide the context of the traffic to be offloaded. The message may 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.

17. The target IAB-donor-CU may configure or modify BH RLC channels and BAP-sublayer routing entries on the target path between the target parent IAB-node and target IAB-donor-DU as well as DL mappings on the target IAB-donor-DU for the migrating IAB-node’s target path. These configurations may support the transport of UP and non-UP traffic on the target path.

18. The target IAB-donor-CU responds to the source IAB-donor-CU with an IAB Transport Migration Management Response message to provide the mapping information for the traffic to be offloaded. The message includes the L2 info that is used in the target IAB-donor-CU’s IAB topology and necessary to configure the migrating IAB-node with the UL mappings of traffic included in step 16. The message includes the DSCP/IPv6 Flow Label values used to configure the DL mappings of traffic included in step 16.

NOTE: The target 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 source IAB-donor-CU in step 16 share the same BAP address.

19. The F1-U connections of the migrating IAB-node with the source IAB-donor-CU may be switched to use the migrating IAB-node’s new TNL address(es). The source IAB-donor-CU provides to the IAB-DU of the migrating IAB-node the updated UL BH information for the traffic included in step 16 based on the UL BH information received from the target IAB-donor-CU in in step 18. The source IAB-donor-CU may also update the UL BH information associated with non-UP traffic. This step may use UE associated signaling or non-UE associated signaling in E1 and/or F1 interface. 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.

20. Repetition of steps 16 to 19, as needed, where the source IAB-donor-CU can request addition, modification or release of QoS information for non-UP and UP traffic. The target IAB-donor-CU can fully or partially reject addition or modification requests by the source IAB-donor-CU.

The target IAB-donor-CU may request the modification of the L2 transport for the offloaded traffic in the target IAB-donor-CU’s topology using the IAB TRANSPORT MIGRATION MODIFICATION REQUEST message. The source IAB-donor-CU reconfigures UL BH mappings accordingly and acknowledges the modification via the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message. The target IAB-donor-CU may further reconfigure the TNL addresses of the migrating IAB-node via RRC.

The traffic offload through the inter-CU topology adaptation described in steps 1 to 20 (including the offload of 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.

The non-F1-terminating IAB-donor-CU can trigger the full traffic revoking by executing the XnAP Handover Preparation procedure for the migrating IAB-MT towards the F1-terminating IAB-donor-CU.The F1-terminating IAB-donor-CU can trigger the full revoking of traffic offload by requesting the release of all offloaded traffic from the non-F1-terminating IAB-donor-CU through the IAB TRANSPORT MIGRATION MANAGEMENT REQUEST towards the non-F1-terminating IAB-donor-CU. This messages triggers the XnAP Handover Preparation procedure for the migrating IAB-MT towards the F1-terminating IAB-donor-CU.

The F1-terminating IAB-donor-CU may request full or partial release of the offloaded traffic from the non-F1-terminating IAB-donor-CU via the IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message.

8.xx.2 IAB inter-CU topology adaptation procedure with descendant IAB-node

Figure 8.xx.z.2-1 shows an example of the topology adaptation procedure where the migrating IAB-MT is migrated from one IAB-donor-CU to another IAB-donor-CU, the IAB-DU of the migrating IAB-node retains its F1 connection with the first IAB-donor-CU and the descendant IAB-node retains both its RRC connection and F1 connection with the first IAB-donor-CU.



**Figure 8.xx.2-1: IAB inter-CU topology adaptation procedure with descendant IAB-node**

0. The topology adaptation procedure of clause 8.xx.1 is performed for the migrating IAB-node.

1. The source IAB-donor-CU sends an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the target IAB-donor-CU to provide the context of the descendant IAB-node’s traffic to be offloaded. The message may include a request for new TNL addresses anchored at a target IAB-donor-DU for the descendant IAB-node(s). The source IAB-donor-CU includes an identifier of the migrating IAB-node in the request message.

2. The target IAB-donor-CU determines the target IAB-donor-DU based on the identifier of the migrating IAB-node. The target IAB-donor-CU may configure or modify BH RLC channels and BAP-sublayer routing entries on the target path between the boundary IAB-node and target IAB-donor-DU as well as DL mappings on the target IAB-donor-DU for the migrating IAB-node’s target path. These configurations may support the transport of UP and non-UP traffic on the target path.

3. The target IAB-donor-CU may obtain new TNL addresses from the target IAB-donor-DU based on the request for TNL address(es) received in step 1.

4. The target IAB-donor-CU responds with an IAB TRANSPORT MIGRATION MANAGEMENT RESPONSE message to the source IAB-donor-CU to provide the mapping information for the traffic to be offloaded. The message includes the L2 info from the target IAB-donor-CU topology that is necessary to configure the migrating IAB-node with the BAP-sublayer routing, header-rewriting and BH RLC CH mapping entries of traffic included in step 1. The message includes the DSCP/IPv6 Flow Label values to be used for the DL traffic to be offloaded as indicated in step 1. The message may include the new TNL addresses obtained in step 3, if any.

NOTE: The target 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 source IAB-donor-CU in step 1 share the same BAP address.

5. The source IAB-donor-CU configures the migrating IAB-DU with the BAP-sublayer routing, header-rewriting and BH RLC CH mapping entries of the migrating IAB-node.

6. The source IAB-donor-CU sends a DL RRC MESSAGE TRANSFER message to the migrating IAB-node’s IAB-DU, which includes an RRCReconfiguration message for the descendant IAB-node’s IAB-MT. The RRC configuration may include the new TNL addresses received in step 4.

7. The migrating IAB-node’s IAB-DU forwards the received RRCReconfiguration message to the descendant IAB-MT.

8. The descendant IAB-MT responds to the migrating IAB-node’s IAB-DU with an RRCReconfigurationComplete message.

9. The migrating IAB-node’s IAB-DU sends an UL RRC MESSAGE TRANSFER message to the source IAB-donor-CU to convey the received RRCReconfigurationComplete message.

10. The F1-C connections may be switched to use the migrating IAB-node’s new TNL address(es), if any, as described in Step 15 of the inter-CU topology adaptation procedures in section 8.xx.1,

11. The source IAB-donor-CU sends an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the target IAB-donor-CU to modify the context of the descendant IAB-node’s offloaded traffic. The message may include the DL TNL address information received in step 10 that is necessary for the target IAB-donor-CU to configure or modify DL mappings on the target IAB-donor-DU.

12. The target IAB-donor-CU responds with an IAB TRANSPORT MIGRATION MANAGEMENT RESPONSE message to the source IAB-donor-CU.

13. Repetition of steps above, as needed, where the source IAB-donor-CU can request addition, modification or release of for the offloaded traffic of the descendant IAB-node. The target IAB-donor-CU can fully or partially reject addition or modification requests by the source IAB-donor-CU.

The target IAB-donor-CU may trigger the modification of the L2 transport of the offloaded traffic in the target IAB-donor-CU’s topology. The target IAB-donor-CU may further provide updated TNL address information for the descendant IAB-node to the source IAB-donor-CU.

The full or partial release (e.g. for revoking) of traffic offload pertaining to the descendant IAB-nodes and their served UEs follows the same procedure as defined for the partial migration in clause 8.xx.1.

*NEXTCHANGE*

## 8.A IAB Inter-CU Backhaul RLF recovery for single connected IAB-node

The inter-CU backhaul RLF recovery procedure for IAB-nodes in SA mode enables recovery of an IAB-node to another parent node underneath a different IAB-donor-CU, when the IAB-MT of the IAB-node declares a backhaul RLF.

Figure 8.A-1 shows an example of the backhaul RLF recovery procedure for an IAB-node in SA mode. In this example, the IAB-node changes from its initial parent node to a new parent node, where the new parent node is served by an IAB-donor-CU different than the one serving its initial parent node. In case the IAB-DU of the recovery IAB-node retains its F1 connection with the initial IAB-donor-CU after the recovering IAB-MT connects to the new IAB-donor-CU, this procedure renders the recovery IAB-node as a boundary IAB-node.



Figure 8.A-1: IAB inter-CU backhaul RLF recovery procedure for an IAB-node in SA mode

1. The IAB-MT of the IAB node declares backhaul RLF.

2. The IAB-MT attempts RLF recovery by performing Random Access towards a new parent IAB-DU.

3. The IAB-MT undergoing RLF recovery sends an *RRCReestablishmentRequest* message to the new parent IAB-DU.

4. The new parent IAB-DU sends an INITIAL UL RRC MESSAGE to the new IAB-donor-CU to convey the received *RRCReestablishmentRequest* message.

5. The new IAB-donor-CU retrieves the UE Context for the IAB-MT undergoing recovery, through the Retrieve UE Context procedure on the Xn interface. The initial IAB-donor-CU may include the TNL address information of the IAB-node undergoing recovery in the RRC container of the RETRIEVE UE CONTEXT RESPONSE message.

6. The new IAB-donor-CU sends a DL RRC MESSAGE TRANSFER message to the new parent IAB-DU to convey the generated *RRCReestablishment* message.

7. The new parent IAB-DU sends an *RRCReestablishment* message to the IAB-MT undergoing recovery.

8. The IAB-MT undergoing recovery sends an *RRCReestablishmentComplete* message to the new parent IAB-DU.

9. The new parent IAB-DU sends an UL RRC MESSAGE TRANSFER message to the new IAB-donor-CU to covey the received *RRCReestablishmentComplete* message.

10. The new IAB-donor-CU triggers the UE Context Setup procedure toward the new parent IAB-DU to create the UE context for the IAB-MT undergoing recovery and set up one or more bearers. These bearers can be used by the IAB-MT undergoing recovery for its own signalling, and, optionally, data traffic.

11. The new IAB-donor-CU triggers the path switch procedure for the IAB-MT undergoing recovery, if needed.

12. The new IAB-donor-CU sends UE CONTEXT RELEASE message to the initial IAB-donor-CU.

NOTE: The XnAP UE IDs of the recovery IAB-node are retained at initial and new IAB-donor-CU as long as the recovery path is used for transport of traffic between the IAB-node undergoing recovery and the initial IAB-donor-CU.

13. The initial IAB-donor-CU may release the BH RLC channels and BAP-sublayer routing entries on the initial path between the initial parent IAB-node and the initial IAB-donor-DU.

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.

15. The new parent IAB-DU forwards the received *RRCReconfiguration* message to the IAB-MT undergoing recovery.

16. The IAB-MT undergoing recovery responds to the new parent IAB-DU with an *RRCReconfigurationComplete* message.

17. The new parent IAB-DU sends an UL RRC MESSAGE TRANSFER message to the new IAB-donor-CU to convey the received *RRCReconfigurationComplete* message.

18. The remaining part of the procedure follows the steps 14-20 of the inter-CU topology adaptation procedure defined in clause 8.xx.1.

Traffic offload for descendant nodes follows the same procedure as that of clause 8.xx.2.

The new IAB-donor-CU may trigger the modification of the L2 transport of the offloaded traffic in the new IAB-donor-CU’s topology. The new IAB-donor-CU may further reconfigure the TNL addresses of the IAB-node that underwent recovery via RRC.

The traffic offload due to inter-CU RLF recovery described in steps 1 to 18 (including the offload of traffic pertaining to the IAB-node undergoing RLF recovery and its descendant IAB-nodes and their served UEs) can be revoked. In this case, the IAB-MT that previously underwent RLF recovery is handed over in reverse direction, i.e., from the former new IAB-donor-CU to the former initial IAB-donor-CU, after which the traffic of the IAB-DU whose collocated IAB-MT underwent RLF recovery, and the traffic of descendant IAB-DUs, are routed again along the path under the former initial IAB-donor-CU.

The former new IAB-donor-CU can trigger this return of offloaded traffic back to the initial IAB-donor-CU by executing the XnAP Handover Preparation procedure for the migrating IAB-MT towards the former initial IAB-donor-CU.

The former initial IAB-donor-CU can trigger the revoking by sending an IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message to the former new IAB-donor-CU in the same manner as described in section 8.xx.1.

The former initial IAB-donor-CU may request full or partial release of the offloaded traffic from the former new IAB-donor-CU via the IAB TRANSPORT MIGRATION MANAGEMENT REQUEST message.

*NEXTCHANGE*

## 8.12 IAB-node Integration Procedure

### 8.12.1 Standalone IAB integration

A high-level flow chart for SA-based IAB integration is shown in the Figure 8.12.1-1:



Figure 8.12.1-1: The integration procedure for IAB-node in SA

Phase 1: IAB-MT setup. In this phase, the IAB-MT of the new IAB-node (e.g. IAB-node 2 in Figure 8.12.1-1) connects to the network in the same way as a UE, by performing RRC connection setup procedure with IAB-donor-CU, authentication with the core network, IAB-node 2-related context management, IAB-node 2’s access traffic-related radio bearer configuration at the RAN side (SRBs and optionally DRBs), and, optionally, OAM connectivity establishment by using the IAB-MT’s PDU session. The IAB-node can select the parent node for access based on an over-the-air indication from potential parent node IAB-DU (transmitted in SIB1). To indicate its IAB capability, the IAB-MT includes the IAB-node indication in RRCSetupComplete message, to assist the IAB-donor to select an AMF supporting IAB.

NOTE: The signalling flow for UE initial access procedure as shown in Figure 8.1-1/Figure 8.9.1-1 is used for the setup of the IAB-MT.

Phase 2-1: BH RLC channel establishment. During the bootstrapping procedure, one default BH RLC channel for non-UP traffic e.g. carrying F1-C traffic/non-F1 traffic to and from the IAB-node 2 in the integration phase, is established. This may require the setup of a new BH RLC channel or modification of an existing BH RLC channel between IAB-node 1 and IAB-donor-DU. The IAB-donor-CU may establish additional (non-default) BH RLC channels. This phase also includes configuring the BAP Address of the IAB-node 2 and default BAP Routing ID for the upstream direction.

NOTE: If the OAM connectivity is supported via backhaul IP layer by implementation, one or more BH RLC channels used for OAM traffic can also be established.

Phase 2-2: Routing update. In this phase, the BAP sublayer is updated to support routing between the new IAB-node 2 and the IAB-donor-DU. For the downstream direction, the IAB-donor-CU initiates F1AP procedure to configure the IAB-donor-DU with the mapping from IP header field(s) to the BAP Routing ID related to IAB-node 2. The routing tables are updated on all ancestor IAB-nodes (e.g. IAB-node 1 in Figure 8.12.1-1) and on the IAB-donor-DU, with routing entries for the new BAP Routing ID(s). This phase may also include the IP address allocation procedure for IAB-node 2. IAB-node 2 may request one or more IP addresses from the IAB-donor-CU via RRC. The IAB-donor-CU may send the IP address(es) to the IAB-node 2 via RRC. The IAB-donor-CU may obtain the IP address(es) from the IAB-donor-DU via F1-AP or by other means (e.g. OAM, DHCP). IP address allocation procedure may occur at any time after RRC connection has been established.

Phase 3: IAB-DU part setup. In this phase, the IAB-DU of IAB-node 2 is configured via OAM. The IAB-DU of IAB-node 2 initiates the TNL establishment, and F1 setup (as defined in clause 8.5) with the IAB-donor-CU using the allocated IP address(es). The IAB-donor-CU discovers collocation of IAB-MT and IAB-DU from the IAB-node’s BAP Address included in the F1 SETUP REQUEST message. After the F1 is set up, the IAB-node 2 can start serving the UEs.

NOTE: The IAB-DU can discover the IAB-donor-CU’s IP address in the same manner as a non-IAB gNB-DU.

NOTE: If IAB node establishes NR-DC before the establishment of F1-C connection, 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.

*END OF CHANGE*