**3GPP TSG-RAN WG3 Meeting #117-eR3-225209**

**Online, August 15 – 26, 2022**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | 0246 | **rev** | **2** | **Current version:** |  |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Corrections for Rel-17 IAB on topology adaptation | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm | | | | | | | | | |
| ***Source to TSG:*** | R3 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | | 2022-08-10 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | |  |
|  | *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:*** | | **1:** For intra-donor topology adaptation in section 8.2.3, the present text specified:  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 yellow highlighted text is technically correct, but it omits that the BH RLC channel mappings may also have to be updated on the migrating IAb-node.  **2:** For intra-donor topology adaptation in section 8.2.3, RAN3#116 identified the following issue:  *Updates to stage2 for Alt1 to avoid the packet discarding due to no matched routing entries during parallel TNL migration of the descendant nodes in IAB intra-CU topology adaptation? LS to RAN2*  The present text already specified that for parrellel TNL migration of the descendent nodes, the RRCReconfiguration messages with the new TNL address(es) and the new default BAP configuration needs to be sent to the descendent node while the migrating IAB-MT is still connected with the source parent node. It misses that the BAP-sublayer routing entries on the migrating IAB-node and the descendent nodes also need to be reconfigured while the migrating IAB-MT is still connected with source parent node.  **3.** For inter-donor topology adaptation of the descendent nodes in section 8.17.3.2, the following section:  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.  omits the to include the name of the XnAP message used for this trigger. It further omits that based on this message, the source IAB-donor-CU should reconfigure the UL BH mappings on the descendent nodes, the routing entries and BH RLC channel mappings on the migrating node and the descendent nodes, and the BAP header rewriting entries on the migrating node, and acknowledge the modification via the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | **Change 1**: For intra-donor topology adaptation in section 8.2.3, the BH RLC channel mapping reconfiguration is included with the BAP-sublayer reouting entreis reconfiguration on the target path for the descendent nodes. This inlcudes all nodes on the path, i.e., also the migrating IAB-node.  **Change 2**: For intra-donor topology adaptation in section 8.2.3, it was added that the configuration of BAP-sublayer routing entries on the migrating IAB-node and the descendent nodes should also occur while the migrating IAb-MT is still connected with the source parent node.  **Change 3:** For inter-donor topology adaptation of the descendent nodes in section 8.17.3.2, the XnAP message name was added. It was further added that based on this message, the source IAB-donor-CU should reconfigure the UL BH mappings on the descendent nodes, the routing entries and BH RLC channel mappings on the migrating node and the descendent nodes, and the BAP header rewriting entries on the migrating node, and acknowledge the modification via the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Rel-17 IAB will not properly support reconfiguration of descendent nodes during intra-donor-migration.  Rel-17 IAB will not properly support reconfiguration of descendent nodes based on a L2 reconfiguration request by the non-F1-terminating IAB-donor. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 8.2.3.1, 8.17.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Rev 1: None  Rev 2:  1: Replace “should” with “may” in the second change.  2: Replace “..the source IAB-donor-CU reconfigures…” with “..the source IAB-donor-CU may reconfigure…” in the third change.  3: Replace “descendent node” with “descendant node” in all changes. | | | | | | | | |

-------------------------------------------START OF CHANGES-------------------------------------------

### 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 (IETF RFC 4555 [29]) 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.

If new TNL addresses for F1-C traffic are configured, new SCTP association(s) between the migrating IAB-node and the IAB-donor-CU may be established using the new TNL address information of the migrating IAB-node. The migrating IAB-node sends an F1AP gNB-DU CONFIGURATION UPDATE message to the IAB-donor-CU, which may include new (outer) IP addresses and corresponding new (inner) IP address for the F1-U traffic to be switched to the target path.

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 and BH RLC channel mappings on the target path for 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.

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 BAP configuration 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. Based on this indication, the parent IAB-DU retains the RRCReconfiguration message until the conditions for delivery are met, as specified in TS 38.473 [4]. The IAB-donor-CU may further configure the BAP-sublayer routing entries on the migrating IAB-node and the descendant nodes while the migrating IAB-MT is still connected with the source parent node.

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.

-------------------------------------------NEXT CHANGE-------------------------------------------

### 8.17.3 IAB Inter-CU Topology Adaptation

>> Skip

#### 8.17.3.2 IAB inter-CU topology adaptation procedure with descendant IAB-node

Figure 8.17.3.2-1 shows an example of the topology adaptation procedure where the migrating IAB-MT is migrated from a source IAB-donor-CU to a target IAB-donor-CU, and where the migrating IAB-node has a descendant IAB-node which retains both its RRC connection and F1 connection with the source IAB-donor-CU.



Figure 8.17.3.2-1: IAB inter-CU topology adaptation procedure with descendant IAB-node

0. The topology adaptation procedure of clause 8.17.3.1 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 address(es) for the descendant IAB-node(s), anchored at a target IAB-donor-DU. The source IAB-donor-CU includes an identifier of the migrating IAB-node in the request message. This could be performed in parallel with step 0 after the source IAB-donor-CU receives HANDOVER REQUEST ACKNOWLEDGE message, e.g., 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.

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 address(es) 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 indicated 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 address(es) obtained in step 3, if any.

NOTE: The target IAB-donor-CU should select the same IAB-donor-DU in its IAB 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-node’s 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 descendant IAB-node’s parent IAB-DU, which includes an RRCReconfiguration message for the descendant IAB-MT. The RRC configuration may include the new TNL addresses received in step 4.

7. The descendant IAB-node’s parent 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 and F1-U tunnels are switched to use the descendant IAB-node’s new TNL address(es), if any, as described in Steps 15 and 19 of the inter-CU topology adaptation procedure in clause 8.17.3.1.

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. The of steps above may be repeated, if needed, for the source IAB-donor-CU to request addition, modification or release of the offloaded traffic pertaining to 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 using the IAB TRANSPORT MIGRATION MODIFICATION REQUEST message. Based on this message, the source IAB-donor-CU may reconfigure the UL BH mappings on the descendant nodes, the routing entries and BH RLC channel mappings on the migrating node and the descendant nodes, and the BAP header rewriting entries on the migrating node, and acknowledges the modification via the IAB TRANSPORT MIGRATION MODIFICATION RESPONSE message. 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 or 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 8.17.3.1.

-------------------------------------------END OF CHANGES-------------------------------------------