3GPP TSG-RAN WG3 #114-e R3-215902

Online, 01-11 Nov, 2021

Agenda Item: 13.2.3

Source: Huawei (moderator)

Title: Summary of Offline Discussion on CB # 1304\_IAB\_Top\_Red

Document for: Approval

# Introduction

This paper is for the following offline discussion:

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| **CB: # 1304\_IAB\_Top\_Red****- Is it agreeable that RAN3 works on a unified design of XnAP IEs and F1AP IEs for supporting inter-donor routing setup in all Rel-17 IAB WI scenarios where inter-donor routing is present?****- Can RAN3 agree to any principles/solution for topology redundancy?****- What granularity to choose?****- QoS information handling?****- Can the dependencies with RAN2 be identified?** **- Any other issue?**(HW - moderator)Summary of offline disc R3-215902 |

The following papers will be covered as assigned by the chairman:

[1] R3-214824, Inter-Donor Routing in IAB Topology Redundancy Scenarios (Ericsson)

[2] R3-214875, (TP to BL CR of TS38.423) Discussion on inter-donor topology redundancy (Samsung)

[3] R3-214926, Discussion on inter-donor topology redundancy (ZTE)

[4] R3-214955, Inter-donor topology transport (Qualcomm Incorporated)

[5] R3-215015, Discussion on inter-CU topology redundancy (CATT)

[6] R3-215304, Discussion on IAB inter-donor topology redundancy (Lenovo, Motorola Mobility)

[7] R3-215611, Inter-CU topology redundancy (Huawei)

[8] R3-215346, discussion on Inter-Donor IAB Topology Redundancy (Nokia, Nokia Shanghai Bell)

Phase I：Please give your feedback before Thursday, 4th Nov, 2021, 23:59 UTC. This allows us to give some input for Monday’s online session (8 Nov, 2021).

Phase II：TBD.

# For the Chairman’s Notes

For Chairlady to copy:

Discussion details:

# Discussion

In last RAN3 113-e meeting, the following agreements were achieved about Topology Redundancy:

* *1a: RAN3 assumes that the boundary node has only one BAP address in each topology.*
* *1b: RAN3 assumes that for each topology, the boundary node’s BAP address for that topology is only used to identify packets that have to be passed to upper layers.*
* *1d: Liaise RAN2 to consider RAN3’s preferences when discussing BAP processing at the boundary node.*
* *1e: For DL traffic, the configurations of BAP routing entry and BAP-routing-ID mapping at the boundary node need to indicate the ingress topology they refer to. For UL traffic, they need to indicate the egress topology they refer to. The indications may be implicit.*
* *2a: The QoS info can be passed gradually using multiple Xn messages.*
* *2b: As a baseline, RAN3 assumes that each of BAP-routing-ID mapping and BH RLC CH mapping at the boundary node are constraint to 1:1 and N:1. Support for 1:N mapping is FFS. RAN3 to liaise RAN2 on this assumption.*
* *2c: For UP access traffic to the boundary node, QoS info to be passed over the Xn interface with granularity of one or multiple F1-U GTP-U tunnels.*
* *If IAB node establishes NRDC before F1-C, the IAB node can implicitly derive whether MN or SN is the F1-terminating donor, e.g., based on who provides the default BAP configuration.*

Moderator’s Note: the discussion tries to split into three parts, the first one is for inter-donor routing which should cover partial migration, dual connectivity and re-establishment under RLF case; the second one is about CP/UP separation where the main focus should be the info exchange between two donors, the third is about others.

## Inter-Donor routing

Here the first question we need to discuss is about the general principles, i.e. new or existing procedure, UE associated or non-UE associated and the overlaps with RAN2. Then, we need to discuss the further details about F1-terminating CU/non-F1 terminating CU, handling of concatenated traffic

### Procedure

**Q1: Whether a new Xn procedure is needed, whether it is UE associated or non-UE associated?**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | There is some overlap with CB1302.The question presumable addresses exchange of QoS info (CU1->C2)/L2 info (CU2->CU1).We propose:* QoS info/L2 info exchange can use IAB-MT’s HO preparation.
* It can also occur via a new Xn procedure, e.g., if the info is too large to fit into Xn HO preparation, if new bearer arrives, gradual load offloading in DC, etc.

The new Xn procedure must be UA (i.e., on behalf of boundary IAB-MT) to indicate the boundary node it is referring to. |
| Samsung  |  | New Xn procedure is needed. We prefer to have NUA procedure since this procedure is used to transfer QoS info of multiple UEs. |
| Lenovo |  | A new Xn procedure is needed for passing of the QoS info. And UE associated is preferred since the QoS info is specific for per boundary node. |
| CATT | New Xn procedure;Non UE associated | We would like to use a new XnAP message to cover more than one F1-Us’ QoS information. These QoS information are related to descendant nodes and UEs hence it is a non UE associated signaling. A list with the (BAP routing ID/BH RLC CH, QoS) may be needed. The normal Xn handover request conveys the QoS information of boundary node only. The new Xn procedure also allows add/modify the QoS information. |
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**Q2: BAP operation, whether to wait for RAN2 progress or not? If not, please indicate what RAN3 specific issues to address and proposals.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | RAN2 should to the BAP internal processing. RAN3 should focus on overall procedure, configurations, and inter-CU signaling. |
| Samsung |  | For BAP operation, it is in RAN2 scope. Thus, the configuration for BAP related configurations at the boundary node side (e.g., header rewriting, routing, bearer mapping) can wait for RAN2 progress. However, as commented QC, RAN3 can work on the overall procedure, inter-CU signaling.  |
| Lenovo |  | BAP operation has been discussed by RAN2. We may no need to discuss the same issues in RAN3.And agree with QC to focus on overall procedure, configurations, and inter-CU signaling in RAN3. |
| CATT | Yes  | Currently, we do not see any RAN3 specific impact |
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### Handling of concatenated traffic

**Q3: For concatenated traffic, whether to agree that the F1-terminating CU divides E2E QoS requirement into two parts: provided by its own topology fragment, provided by the non-F1-terminating CU’s topology fragment which is informed by F1-terminating CU.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | The term “concatenated traffic” has not been used in RAN3, and it has not been agreed in RAN2 either. We may want to use the term “inter-topology descendent node” traffic. On Q3: This is up to implementation of CU1. |
| Samsung  |  | We understand that “concatenated traffic” means the traffic needs to be transferred via two topologies. With this understanding, the E2E QoS requirement should be divided. However, we are unclear if there are any specification impact. |
| Lenovo |  | Firstly, it’s hard for the F1-terminating CU to divide the E2E QoS requirement into two fragments accurately unless the F1-terminating CU has all topology information of the non-F1-terminating CU’s, And F1-terminating CU and non-F1-terminating CU can perform routing and bearer mapping well with the E2E QoS requirement in their own topology fragment. |
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**Q4: For downstream concatenated traffic, whether to agree that the informed QoS requirement info are associated with one egress routing ID and one egress BH RLC CH at the boundary node; the non-F1-terminating CU feedbacks one or multiple ingress routing ID(s) associated with each egress routing ID, and one or multiple ingress BH RLC CH(s) associated with each egress BH RLC**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | For DL, each QoS info passed to CU2 should be associated with a DL mapping used in Top1 before the migration, since the DL mapping = {BAP routing ID, BH RLC CH} represents the finest granularity of QoS.CU2 needs to create the Top2 DL mappings in a manner that avoids 1:N mapping for BAP routing ID as well as 1:N mapping for BH RLC CH at the boundary node. For this purpose, CU2 should know which QoS infos share the same BAP routing IDs or BH RLC CHs in Top 1. **CU1 should therefore include the BAP routing ID and top-1egress BH RLC CH at the boundary node with the QoS Info.**CU2 should return the (BAP routing ID, top2-ingress BH RLC CH at the boundary node) for each QoS info it receives. |
| Samsung  |  | We understand that the inter-CU signaling should ensure that the configurations at the CU2 side will not cause the 1:N mapping w.r.t. BAP routing ID/BH RLC CH. There are two ways:* Way 1: ensured by CU1

e.g., the provide QoS info. corresponds to the traffic with the same BAP routing ID and same egress BH RLC CH. By this way, the CU1 does not need provide any information related to BAP routing ID and egress BH RLC CH. The only additional information is to provide the DL IP address(es) for the traffic. After receiving this information, the CU2 can freely configure the target path for DL since 1:N mapping will never happen, and ensure the traffic is mapped to the same BAP routing ID and egress BH RLC CH for UL. In particular, the inter-CU signaling is:From CU1 to CU2:* + QoS info. of traffic with the same BAP routing ID and same egress BH RLC CH
	+ A list of DL destination IP address(es) of the traffic

From CU2 to CU1* + Accepted QoS info.
	+ DL traffic: DSCP/FL setting for each IP addr., ingress BH RLC CH, prior-hop BAP address, ingress BAP routing ID
* Way 2: ensured by CU2

It seems this is aligned with QC’s proposal. We are open for discussion. However, we feel Way 1 would be an easy implementation since 1) not too much information should be provided by CU1, 2) CU2 just configures its target path freely. So, we prefer to start from **way 1 with the following information exchange as the starting point (which provide the smallest set of information to be provided by CU1)**: **From CU1 to CU2:*** + **QoS info. of traffic with the same BAP routing ID and same egress BH RLC CH**
	+ **A list of DL destination IP address(es) of the traffic**

**From CU2 to CU1*** + **Accepted QoS info.**
	+ **DL traffic: DSCP/FL setting for each IP addr., ingress BH RLC CH, prior-hop BAP address, ingress BAP routing ID**
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| Lenovo |  | The definition of concatenated traffic is not clear here. We may replace it with “UP BH traffic to the boundary node” corresponding to “UP access traffic to the boundary node” agreed in last meeting.Anyway, we agree with the BH RLC CH granularity and routing ID granularity when passing QoS info over Xn interface for UP BH traffic to the boundary node. |
| CATT | See comments | For DL, F1-terminating donor sends QoS associated with BAP routing ID and ingress BH RLC channel to identify different F1-U. Note that the F1-U with same BAP routing ID may have different ingress BH RLC and egress BH RLC hence we need BH RLC channel information. Mapping at boundary node based on the BAP header rewrite related information, which has a table (BAP routing ID in topo2, ingress BH RLC in topo2, prior hop in topo2)🡪( BAP routing ID in topo1, egress BH RLC in topo 1, next hop in topo1). In order to configure this table, non F1 terminated node should provide BAP routing ID in topo2, egress BH RLC in topo 2 to F1 terminated nodeNon-F1-terminating CU feedbacks DSCP/flow label. In general, F1-terminating donor sends QoS associated with BAP routing ID and ingress BH RLC channel; Non-F1-terminating CU feedbacks DSCP/flow label+ (BAP routing ID in topo2, egress BH RLC in topo 2) |
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**Q5: For uplink concatenated traffic, whether to agree that the informed QoS requirement info are associated with one ingress routing ID and one ingress BH RLC CH at the boundary node; the non-F1-terminating CU feedbacks one egress routing ID associated with each ingress routing ID, and one egress BH RLC associated with each ingress BH RLC CH**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | For UL, each QoS info passed to CU2 should be associated with an uplink mapping used in Top1, since the UL mapping = {BAP routing ID, BH RLC CH} represents the finest granularity of QoS.To ensure that 1:N mapping is avoided, **CU1 should include the BAP routing ID and top-1ingress BH RLC CH at the boundary node with the QoS Info.**CU2 should return (BAP routing ID, top2-egress BH RLC CH at the boundary node) for each QoS info it receives. |
| Samsung  |  | As commented for DL, we think Way 1 requires the smallest info, which only include the QoS info. of the traffic associated the same BAP routing ID and ingress BH RLC CH.**From CU1 to CU2:*** + **QoS info. of traffic with the same BAP routing ID and same ingress BH RLC CH**

**From CU2 to CU1*** + **Accepted QoS info.**
	+ **UL traffic: egress BH RLC CH, next-hop BAP address, egress BAP routing ID**

Meanwhile, for the information from CU1 to CU2, it may not need to differentiate DL and UL.  |
| Lenovo |  | Same to Q4. |
| CATT |  | For UL, boundary decides whether to perform reroute i.e., transmission on target path. It is transparent for descendant node. If reroute is needed, it based on the BAP header rewrite related information which has a table about (BAP routing ID in topo1, ingress BH RLC in topo1, prior hop in topo1)🡪 ( BAP routing ID in topo2, egress BH RLC in topo 2, next hop in topo2). In order to configure this table, non F1 terminated node should provide BAP routing ID in topo2, egress BH RLC in topo 2 to F1 terminated node.In general, F1-terminating donor sends QoS associated with BAP routing ID and ingress BH RLC channel; Non-F1-terminating CU feedbacks DSCP/flow label+ (BAP routing ID in topo2, egress BH RLC in topo 2) |
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**Q5.bis: If non-F1-terminating CU is not able to guarantee the per topology fragment QoS requirement by configuring less or equal egress routing ID/BH RLC CH than the ingress ones, whether it should reject the request from F1-terminating CU.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM | Yes |  Fine with us. |
| Samsung  | Yes  |  |
| Lenovo |  | That's not going to happen because we have sufficient space for routing ID and BH RLC CH. |
| CATT | Maybe no | We consider partial accept for both UL and DL. If we do not allow 1:N mapping, the non-F1-terminating CU can accept some of QoS if non-F1-terminating CU cannot meet the all the QoS from F1-terminating CU |
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**Q6: What is the granularity of the informed QoS requirement info, “per GTP-U tunnel”, “per group of GTP-U tunnels” or BAP routing ID, and it is up to F1-terminating CU’s implementation?**

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| **Company** | **“per GTP-U tunnel”, “per group of GTP-U tunnels” or BAP routing ID** | **Comments if any** |
| QCOM | See comment | Again, use same reporting mechanism for descendent node traffic as for boundary node traffic, i.e., per one or bundle of F1-U tunnels.  |
| Samsung  |  | Per one or bundle of F1-U tunnels, which is up to F1-terminating CU’s decision.  |
| Lenovo |  | For the UP BH traffic to the boundary node, we prefer the BH RLC CH granularity and routing ID granularity for cross topology bearer mapping and routing respectively.Granularity with per GTP-U tunnel may introduce too much overhead and doesn’t see strong benefit than per BH RLC CH granularity and per routing ID granularity. |
| CATT  | Per one or multiple F1-U GTP-U tunnels. | Same as F1 terminated at boundary node |
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**Q7: What are the information about non-F1-U traffic, to be exchanged between the F1-termination donor and non-F1-termination donor?**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | For descendent node traffic, the same info should be exchanged as for the boundary node traffic., which is traffic-type granularity. |
| Samsung  |  | Non-F1-U traffic type (e.g., F1-C, non-F1, both), and for DL, the IP address list should be provided |
| Lenovo |  | DL egress and UL ingress BH RLC CH/routing ID for each non-F1-U traffic type can be provided via Xn. |
| CATT |  | F1-termination donor to non-F1-termination Non UP traffic type, BAP routing ID, ingress BH RLCnon-F1-termination donor to F1-termination donorDSCP/ flow label for DL, (BAP routing ID in topo2, egress BH RLC in topo 2) |
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## CP/UP separation

Here moderator would suggest that the discussion focus on the information related with F1-U and non F1-U traffic.

### Configuration of F1-U and non F1-U traffic

**Q8: Whether to add Add “IAB Node Indication” to set up dual-donors DC for the IAB node?**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM | Yes | We also have this for ENDC. |
| Samsung  | Yes  |  |
| Lenovo | Yes |  |
| CATT | Maybe yes for scenario 1 | For scenario 1, SN (IAB donor) should configure the BAP related configuration to IAB node.While, for scenario 2, SN may not need to know this is a IAB node access. It only send the RRC message to this DC node |
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**Q9-1: Whether the IAB-node can be configured with the CG to be used to transmit F1-C, i.e., via f1c-TransferPath-r17 {mcg, scg, both}?**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM | Yes | We should have the same behavior as for Rel-16 IAB in ENDC.  |
| Samsung  |  | {mcg, scg, both} is fine to us. Also, to be future proof, we can configure this by indicating the cell group ID if multi-connectivity is supported in the future. BTW, this is also discussed in RAN2, shall we wait for RAN2 progress? |
| Lenovo | Yes | But this can be discussed by RAN2. |
| CATT | Yes |  |
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**Moderator’s note: ff the answer is Yes to Q9-1, companies are invited to provide further comments to the following question Q9-2, Q9-3, Q-4.**

**Q9-2: Whether to agree the following proposal, if the answer is Yes to Q9-1?**

* **If “*both*” is configured, whether to agree that it is IAB-node’s implementation to choose the CG for F1-C?**
* **If the indicated/selected CG for F1-C includes default BH RLC, IAB-node uses “F1-C over BAP”. Otherwise, IAB-node uses “F1-C over RRC”.**
* **If the CG for F1-C is not configured, IAB-node chooses the CG including default BH RLC and uses “F1-C over BAP”, i.e., the default CG.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM | See comment | First bullet: Yes, if both are configured, it is up to implementation which of the two the IAB-node uses.Second bullet needs clarification: if BAP is available for the CG then BAP should be used. We don’t have to get into the details if there must a default BH RLC CH or not, because it may ride us into some corner cases.Third bullet: This is not clear. It sounds like an erroneous configuration. |
| Samsung  |  | Shall we wait for RAN2 progress? |
| Lenovo |  | This can be discussed by RAN2. |
| CATT | 1. yes;2. Yes;3. no  | 3. If a CG for F1-C is not configured, IAB node choose another CG for F1-C, it should be F1-C over RRC. Otherwise, CP-UP separation cannot be supported |
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**Q10: introduce an explicit request for MN to indicate to SN its intention to send F1-C traffic over SRB.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM | Not | We discussed this already last meeting. MN requests split-SRB from SN. SN can reject. We don’t need to duplicate this for every reason under the sun that might exist to use split-SRB. |
| Samsung  | Yes  | If Split-SRB is rejected by SN without knowing this reason, the F1-C via SN is impossible, which means that we will face a case the CP-UP separation is not supported.  |
| Lenovo | Yes | Agree with Samsung. |
| CATT | No  | Whether to establish a split SRB depends on SN’s decision. SN cannot establish a split SRB2 which is likely related to resource and capacity constraints. Hence even providing some cause value to SN, it may not change SN's decision. Note that there is no cause value can affect the split SRB establishment in the current specification. It is propose to follow the current principle. |
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**Q11: whether a node broadcasting “IAB-support” just supports the IAB-functionality of a “non-donor CU for CP-UP separation” but not full donor capability, or it is just node implementation?**

The issue is mainly about whether a node broadcasting “IAB-support” may not be able to act as a full capability IAB node but just could forward F1-C over RRC towards another neighbor node when performing CP/UP separation, i.e. support the IAB-functionality of a “non-donor CU for CP-UP separation” but not full donor capability, or it is just node implementation.

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | We discussed this last time. There should only be two levels of IAB support on CU:1. CU supports IAB. This means it transmits IAB-supported over SIB and it can, but need not, assume donor functionality.2. CU does not support IAB. Period. |
| Samsung  |  | In our understanding, if IAB-support is broadcast, the node can be either donor CU with full IAB functionality, or a node being able to find a donor CU with full IAB functionality. |
| CATT | No | If a node broadcast IAB support, it means that this node has full donor capability but just not act as a donor for this IAB node. It is no need to design a third type of donor. The benefit is not clear. |
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## Others

**Q12: where any enhancements needed to support revoking mechanism? If yes, please also share further understandings of potential enhancements.**

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| **Company** | **Yes/No** | **Comments if any** |
| QCOM |  | Discussed in CB 1302 |
| CATT | Yes  | Source CU should inform target CU to release or suspend the configuration for F1 transmission on target path after revoking. Only the source CU and boundary node know the revoke procedure is finished rather than target CU. Note that it is not UE context release message because there is no UE context in target CU.  |
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**Q13: Any other issues related to the, but not covered by?**

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| **Company** | **Comment** |
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# References

[1] R3-214824, Inter-Donor Routing in IAB Topology Redundancy Scenarios (Ericsson)

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