**3GPP TSG-RAN WG2 Meeting #105bis R2-1903964**

**Xi’an, China, April 8th – 12th, 2019**

**Agenda item:** 11.1.3

**Source:** Ericsson (Rapporteur)

**Title:** Email discussion [105#47] [NR\_IAB-Core] Bearer Mapping

**Document for:** Discussion

# **Introduction**

This document contains email discussion:

R2-1902645 Email Discussions Qualcomm Inc

discussion

- Huawei think that Adapt entities should be discussed separately.

- Chair proposes to remove the part on entities

* [105#47] [NR\_IAB-Core] Bearer mapping (Ericsson)

Intended outcome: a report to identify options and possible “easy” agreements.

**Deadline:** Thursday 2019-03-28

*Discussion:*

The TR defines the term “bearer mapping” as “UE-bearer to RLC-channel mapping” but this is too restrictive since it does not apply to F1-C. Further, F1-C messages of different type might also have different priorities and therefore use different RLC channels. This raises the following questions:

* What are the criteria we want to allow for the mapping of an Adapt PDU to a BH RLC channel? (e.g. QoS, UP vs CP, PDU session, F1 connection, others).
* What information must be available at the access-IAB-node to enable this mapping in upstream direction? (e.g. mapping table with (F1-connection Id, BH LCID)-pairs).
* Which of these criteria require a re-mapping on intermediate IAB-nodes?
* What information must be available at the intermediate-IAB-node to enable this re-mapping? (e.g. none if remapping is not required).
* What information needs to be carried in the adapt header to enable the remapping on the intermediate-IAB-node?

# **2. Discussion**

The purpose of this email discussion is to apprehend different options for bearer mapping in an IAB network and identify common themes on this topic to be presented in RAN2#105bis. To make this discussion more productive, we have rephrased the above questions by bringing up explicitly the underlying issues of mapping in Donor DU, intermediate-IAB-node and Access-IAB-node. In addition, to provide companies the opportunity to express their point of view on how these issues can be tackled for N:1 and 1:1 mapping, as well as the mapping aspect of F1-C and OAM traffic, we have included three sets of questions.

It should be noted that we have not included the case of the DL mapping at the Access-IAB-node and UL mapping at the Donor DU because there is no BH RLC channel at the next hop and we can rely on F1/IP mechanisms.

Companies are invited to share their point of view, specifically about what information is used/needed for the mapping in each case, how the node(s) obtain the information, whether the information is provided via configuration or inband (e.g. Adaptation/IP header), and motivation behind remapping at the intermediate-IAB-node(s).

In the following, two sets of questions one for each type of mapping are provided, covering the bearer mapping issues raised in R2-1902645:

**Question 1: N:1 mapping UP**

**1a: How is the mapping performed for the UL at the Access-IAB-node?**

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Based on F1-U GTP TEID |
|  |  |
| Huawei, HiSilicon | Based on F1-U GTP TEID |
| Samsung | Adapt at MT part of IAB access node performs mapping based fully or in part on configuration received from the CU. The information used in the mapping process is based on UE DRB ID (tbc whether this is F1-U GTP TEID) and possibly IP header info.In a fully centralised approach, based on a look-up table containing as input the UE DRB ID and dest address, and as output the egress BH RLC channel, the Adapt performs the mapping. If some distributed decision-making is allowed, multiple egress BH RLC channels may be configured for a single pairing of UE DRB ID and dest address, from which the access IAB node can choose one based on e.g. QoS status of the outgoing links. |
| CATT | Basically I agree with Samsung that UE DRB ID is the original information that should be used for bearer mapping by adaption layer. However we haven’t discussed whether UE DRB ID should be carried in adaption layer header, but we are sure that F1-U GTP TEID is one to one mapped to UE DRB ID, so F1-U GTP TEID makes sense for the time being |
| Intel | The access IAB node maps incoming UE bearer ID to outbound F1-U GTP TEID. A table for this mapping is stored in the access IAB node. |
| Nokia, Nokia Shanghai Bell | UE DRB (C-RNTI/LCID) is mapped to F1-U GTP-U tunnel (TEID) and tunnel is mapped to BH RLC channel (LCID) (and DSCP) based on configured mapping table (UE DRB/TEID, BH RLC channel) (can also be LCID to LCID mapping). |
| ZTE | For N:1 bearer mapping, it can be based on the UE bearer id -> BH RLC channel mapping configured in access IAB node. Here the UE bearer id might be in the form of F1-U GTP TEID.Alternatively, it can be based on the DCSP ->BH RLC channel mapping. Here DSCP is associated with each UL data packet to be mapped to BH RLC channel. |
| LG | We think that supporting QoS in N:1 bearer mapping is one of the most important factor. Only DRBs which require same QoS level should be mapped to the same BH RLC channel. That is, one BH RLC channel should not be used to support different QoS level, i.e., a DRB for low QoS and a DRB for high QoS should not be mapped to same BH RLC channel. For this, the required information for N:1 bearer mapping for UL is UE ID and UE DRB ID, which can be replaced by F1-U GTP TEID. |
| AT&T | F1-U GTP TEID |
| KDDI | F1-U GTP TEID |
| Ericsson | Each UE bearer has a unique GTP TEID and a 5QI is associated with it. The DU part of the access IAB node maps 5QI of the UE bearer to a DSCP/flow label field in the IP (F1-U) packet. The MT part will then map this packet to the appropriate BH RLC channel, the same way as the donor DU does for DL traffic. |
| Lenovo&MotoM | F1-U GTP TEID can be used to map since it can identify UE bearer. |

Summary: There seems to be a consensus regarding the mapping from UE bearer to BH RLC channel at the access IAB node. Most companies think that the GTP TEID is a good identifier for the UE bearer. Some companies also think the mapping could be based on DSCP (e.g. from GTP TEID / 5QI to DSCP to BH RLC bearer).

The mapping for N:1 in the UL at the access IAB node can be configured using the GTP TEID. FFS if it can also be based on DSCPs.

**1b: How is the mapping performed for the DL at the Donor DU?**

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| **Company** | **Comments** |
| Qualcomm | Upfront: If RAN2 wants to have a new transport format on the **wireline** network, they need to get RAN3 involved. Same applies if RAN2 wants E2E security protection of F1 to be broken at the Donor DU.  QC does **not** want to see a new transport format for IAB support on wireline network, or split up of E2E security layer for F1.  We propose:  - Derive mapping from IPv6 flow label and DSCP on IP header.  - For IPv4, only DSCP is available. If operator wants to support fine-granular QoS, they can deploy IPv6. |
| Huawei | First, we think we should have a common solution for 1:1 and N:1 bearer mapping.For DL bearer mapping, the donor DU should map the DL packets to different BH RLC channel. There are generally 3 solutions on the table:Option-1: based on flow ID/DSCP in IP header; Option-2: based on TEID of the UE bearer and make donor DU being able to see this TEID;  Option-3: Based on TEID which is mapped from the original TEID of the UE bearer by the CU; The problem for option-1 is that it does not support 1:1 mapping. Note that even flow ID in IPv6 may not be sufficient to support 1:1 in our observation.Actually, in all these solutions, the TEID information of the UE bearer is somewhat visible to the donor DU but for option 1/3 it is translated into another ID (i.e. flow ID/DSCP or another TEID). For the security aspect of these solutions, it is better to leave this for SA3 for further discussion, and the LS can be triggered by RAN3 based on their discussion on these ptions. From RAN2’s point of view, perhaps we don’t need to discuss now how the donor DU performs this mapping to BH RLC channel for DL which can be decided after we get more info from RAN3/SA3. RAN2 can focus on the discussion of bearer mapping at IAB nodes, i.e. how the IAB node maps the DL/UL packets to the BH RLC channels. |
| Samsung | Adapt at Donor DU performs mapping based fully or in part on configuration received from the CU. Actual information to be used for this is tbc, based on considerations on the protocol stack design. |
| CATT | From the Donor DU ‘s aspect, the DL mapping is the reversed behaviour of access IAB node. So by the configured mapping rules from Donor DU, Donor DU should use F1-U GTP TEID which is seen by the Donor CU to perform bearer mapping. |
| Intel | We think this should be discussed in RAN3 first. |
| Nokia, Nokia Shanghai Bell | As pointed out by companies, we need more input from RAN3 about the architecture, hence, we provided separate answers for Options A and B as presented in R2-1901480 in all the questions where appropriate.  Option A, IPv4: Mapping based on a mapping table between DSCP and BH RLC channel.  Option A, IPv6: Mapping based on a mapping table between DSCP/Flow Label and BH RLC channel.  Option B, IPv4/IPv6: Outer TEID is mapped to BH RLC channel based on configured mapping table. Alternatively, N:1 mapping is done in the Donor CU and outer TEID is 1:1 mapped to BH RLC channel (normal DU operation). |
| ZTE | For the donor DU, it might perform the bearer mapping based on the UE bearer id suppose donor DU could obtain the TEID from the GTP header. On the other hand, if the UE bearer id is not available, donor DU might perform the bearer mapping based on the DSCP/flow label. |
| LG | N:1 bearer mapping for DL should be also based on QoS as in bearer mapping for UL. For the required information, it would be good to use same information as in UL case, which is UE ID/UE bearer ID or F1-U GTP TEID, but if this requires modification of the protocol stack design and needs to wait for other WG’s progress, we are fine with flow ID/DSCP for DL bearer mapping for now. |
| AT&T | The mapping can be derived from the IPv6 flow label and DSCP on IP header. |
| KDDI | We share the view with Qualcomm |
| Ericsson | We agree with QC. The mapping is based on information in the IP header (e.g. DSCP).Each UE bearer has a unique GTP TEID and a 5QI is associated with it. The CU will assign a DSCP/flow label field in the IP (F1-U) packet that is sent to the donor DU. The donor DU will map this packet to the appropriate BH RLC channel. Mapping on inner GTP information should not be required for traffic using N:1 since doing so would drastically increase the processing required in the Donor DU and/or CU-CU, e.g. to support extra IPsec decapsulation/encapsulation, tunnel in tunnels, … This will have a negative impact on latency, maximum throughput, HW usage, … |
| Lenovo&MotoM | We agree with QC. But, we need wait for RAN3 input. |

Summary: Most companies think DL mapping in the Donor DU can be performed based on DSCP/Flow labels. Some companies think details are FFS or that this should be discussed further in RAN3. Also, some companies think it is important to align the solution with how we handle 1:1 mapping.

The mapping in the DL at the donor DU for N:1 should be discussed further at the meeting, as no consensus can be reached in the email discussion.

**1c: How is the mapping performed for the UL/DL at the intermediate-IAB-node(s)?**

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| **Company** | **Comments** |
| Qualcomm | Based on 1:1 mapping between ingress and egress RLC channels. There is no need for a “remapping”.  We don’t see why the reasons for the bearer mapping, e.g. such as bearer’s QoS, PDU session, slice, etc., would change on the intermediate IAB-node. |
| Huawei, HiSilicon | 1:1 mapping between ingress and egress RLC channels is a possible solution, but it seems putting too much restrictions on network configuration. In a IAB network, for bearer mapping, upstream IAB nodes which are closer to IAB donor may have problems to support finer granularity bearer mapping (e.g. 1:1) as they are serving many UEs and sometimes support of a large amount of BH RLC channels may be limited by its capability. However, at the same time it is beneficial to allow the downstream IAB nodes to do “remapping” based on an “ID” so that more BH RLC channels can be supported in downstream IAB nodes. |
| Samsung | The Adapt at the intermediate IAB node (modelled as a single or two entities – tbc) routes the traffic from an ingress to an egress BH RLC channel, based fully or in part on configuration received from the CU. There are three possible approaches:The intermediate nodes perform the mapping of UE DRBs (rather than ingress BH RLC channels) to BH RLCs, while the donor only decides on the mapping for the first hop.The intermediate nodes perform the mapping of ingress BH RLC channels to egress BH RLCs, while the donor decides on the mapping of UE DRBs to BH RLC channels end-to-end.The intermediate nodes perform the mapping of ingress BH RLC channels to egress BH RLCs, while the donor decides on the mapping of UE DRBs to BH RLC channels end-to-end. However, the intermediate nodes may need to – due to local issues (change in QoS status of a link or BH RLC channel) – perform remapping of UE DRBs to BH RLCs so that alternative routes may need to be used and/or different BH RLC channels on the same route (link).All 3 of the above options can be done in a fully centralized manner (i.e., the mapping rule is decided by donor CU) – for numbers 1 and 2 this is obvious, while for 3 the CU could configure multiple options and signal which one to be chosen based on feedback from intermediate nodes (this is still considered a fully centralized option as no distributed decision-making is done).All 3 of the above options can also be done using some element of distributed decision-making (i.e., the mapping rule is decided by donor DU or IAB node). For this, the QoS profiles of the UE DRBs need to be available at intermediate nodes. The Adapt header itself does not need to contain any QoS info. |
| CATT | For the UE bearers aggregated in the same RLC channel, it is unnecessary to tear down this RLC channel remapping there UE bearers to other egress RLC channels, since the ingress aggregation is a prove of a reasonable bearer mapping. |
| Intel | 1:1 mapping of ingress RLC channel to egress RLC channel is fine. This implies that there are as many RLC channels on each backhaul link as UE bearers carried on the link. |
| Nokia, Nokia Shanghai Bell | Ingress BH RLC channel (LCID) is mapped to egress BH RLC channel (LCID) and Destination IAB Node ID + route ID. |
| ZTE | For the intermediate IAB node, N:1 bearer mapping can be performed with one of the following approaches: 1) the UE bearer id->BH RLC channel mapping; 2) DSCP in IP header -> BH RLC channel mapping; 3) based on ingress RLC channel’s QoS. |
| LG | Ingress BH RLC channel should be mapped to egress BH RLC channel only when those two BH RLC channels provide same QoS. Another point is that when one IAB node is connected to two child IAB nodes, for DL case, one ingress BH RLC channel can be mapped two separate BH RLC channels that each BH RLC channel is for each child IAB node. In this case, one ingress BH RLC channel and two separate BH RLC channels should provide same QoS. Mapping between ingress and egress BH RLC channel should not be remapped by the IAB node itself. Only IAB donor CU can change mapping between ingress and egress BH RLC channel when donor CU want to remap. |
| AT&T | We agree with comments from Huawei that 1:1 mapping of ingress to egress RLC channels may be very restrictive and that for nodes closer to the donor there could be a need to perform remapping. We also agree with comments from Samsung that there are number of ways to accomplish such remapping. We prefer the centralized configuration of bearer mapping/re-mapping rules from the donor CU. Since the donor CU may control configuration of routing tables, and is fully aware of QoS requirements of individual bearers, it may be in the best position to also decide bearer mapping/re-mapping rules. |
| KDDI | We share the view with AT&T. In Rel-15, we would like to focus on the centralized configuration of bearer mapping/re-mapping rules from the donor CU |
| Ericsson | An ingress packet will be mapped to an egress backhaul channel of the same LCID (i.e. QoS level), once the correct route has been decided by the routing function. As such, there will be no problem of requiring more backhaul RLC channels at the nodes closer to the donor. |
| Lenovo&MotoM | The different UE bearers mapping to the same BH RLC channel have the same QoS treatment. If the different UE bearers are mapping to the same BH RLC channel in one IAB node, it seems unnecessary to remap in another node since QoS is not changed. |

Summary: There is a proposal for a simple 1:1 mapping between ingress/egress BH RLC channel. Some companies support this proposal, while other companies think it is too restrictive and it would worth to have mechanism to map also based on target node/route so that two ingress BH RLC channels with the same QoS but belonging to different routes can be mapped on a single egress BH RLC channel with the same QoS. Companies also expressed their views that the mapping is controlled centrally.

At intermediate IAB nodes, N:1 mapping can be based on ingress BH RLC channel + target node/route (from Adaptation Layer) to egress BH RLC channel.

**1d: Additional comments/aspects related to N:1 mapping?**

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| **Company** | **Comments** |
| Qualcomm | There should be no difference between N:1 and 1:1 bearer mapping. 1:1 bearer mapping should simply be a special case of N:1 mapping with N=1. |
| Samsung | Agree with QC on N:1 v 1:1 comment. Additionally, for us these are the key issues:  1. Need to decide on whether we adopt a fully centralized approach or whether we allow some distributed decision-making; 2. Based on 1 we need to decide the required signaling flow and content of information exchange between the nodes; 3. Need to decide if donor decides UE DRB to BH RLC mapping end to end, or just for the first hop. |
| CATT | We should have to common design for N:1 and 1:1. |
| Intel | Agree with Qualcomm. |
| Nokia, Nokia Shanghai Bell | UL mapping in Donor DU for Option B: BH RLC channel is mapped to outer GTP-U tunnel TEID (aggregated tunnel). |
| LG | We think that 1:1 bearer mapping is the special case of N:1 bearer mapping, i.e., 1:1 bearer mapping can be achieved when N=1. |
| AT&T | Agree with comments by Qualcomm and others that 1:1 is only a special case of N:1 mapping. |
| KDDI | We share the view with Qualcomm |
| Ericsson | We think it is sufficient in Rel-16 that the intermediate nodes perform static mapping based on configuration. Any dynamic re-mapping or re-routing based on load etc. should be studied as part of Rel-17. |
| Lenovo&MotoM | We need design the common framework for both N:1 and 1:1 mapping. |

Summary: There is wide support for harmonizing N:1 and 1:1 mapping. Overall, this is most likely straight forward for UL packets or for mapping in intermediate node(s). For mapping in Donor DU, however, there seems to be different views on how this harmonization is done. Some companies discuss if there is any need for any dynamic mapping. It is proposed to leave this for later releases. One company proposed to map to outer GTP TEID.

**Question 2: 1:1 mapping UP**

**2a: How is the mapping performed for the UL at the Access-IAB-node?**

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| **Company** | **Comments** |
| Qualcomm | Same as for N:1 bearer mapping: Based on GTP-U TEID. |
| Huawei, HiSilicon | Based on F1-U GTP TEID |
| Samsung | Same as for N:1 bearer mapping case (see our response). Strictly speaking, for the one-to-one mapping case, presence of UE DRB ID in the Adapt header is not required as it can be derived at the destination node from the GTP-U tunnel info and also because the intermediate node can perform the mapping to the outgoing BH RLC channel without knowing the UE DRB ID. However, not having UE DRB ID in some cases while having it in others would cause fragmented design and need for additional configuration parameters. Moreover, not having UE DRB ID in some cases while having it in others would further limit the configuration options and routing algorithms that network implementation can support. Therefore we think that Adapt should always contain destination address and UE DRB ID. |
| CATT | Same as for N:1 bearer mapping: Based on GTP-U TEID. |
| Intel | Same as N:1 bearer mapping. |
| Nokia, Nokia Shanghai Bell | UE DRB (C-RNTI/LCID) is mapped to F1-U GTP-U tunnel (TEID) and tunnel is mapped to BH RLC channel (LCID) (and DSCP) based on configured mapping table (UE DRB/TEID, BH RLC channel) (can also be LCID to LCID mapping). |
| ZTE | Based on UE bearer id. The UE bearer id might be in the form of GTP-U TEID. |
| LG | Same as for N:1 bearer mapping. |
| AT&T | Same as for N:1 bearer mapping |
| KDDI | Same as for N:1 bearer mapping |
| Ericsson | Same as for N:1 bearer mapping. |
| Lenovo&MotoM | Same as for N:1 bearer mapping. |

Summary: Most companies seem to think that the same solution as for N:1 mapping can be applied for 1:1 UL mapping. There is a proposal from one company to include DRB ID in the adaption layer.

There seems to be a consensus that the mapping for 1:1 in the UL can be configured using the GTP TEID. FFS if it can also be based on DSCPs.

**2b: How is the mapping performed for the DL at the Donor DU?**

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| **Company** | **Comments** |
| Qualcomm | Same as for N:1 bearer mapping.  - Based on DSCP and IPv6 flow label.  - If operators wish to perform fine granular 1:1 mapping they can deploy IPv6. |
| Huawei, HiSilicon | No difference between N:1 and 1:1. We think this discussion can be postponed in RAN2 until we get more inputs from RAN3/SA3. |
| Samsung | Same as for N:1 bearer mapping. |
| CATT | Same as for N:1 bearer mapping. |
| Intel | Same as N:1 bearer mapping. |
| Nokia, Nokia Shanghai Bell | Option A, IPv4: If e2e IPsec is used, 1:1 mapping is not possible.  Option A, IPv6: Mapping based on a mapping table between DSCP/Flow Label and BH RLC channel.  Option B, IPv4/IPv6: Outer TEID is mapped to BH RLC channel (LCID) based on configured mapping table (normal DU operation). |
| ZTE | For the donor DU, it might perform the bearer mapping based on the UE bearer id suppose donor DU could obtain the TEID from the GTP header. |
| LG | Same as for N:1 bearer mapping. |
| AT&T | Same as for N:1 bearer mapping. Based on IPv6 flow label and DSCP. |
| KDDI | We share the view AT&T. |
| Ericsson | It can be based on DSCP and IPv6 flow labels as suggested by Qualcomm. For IPv4, for bearers requiring 1:1 mapping, two-hop IPsec can be configured, enabling the donor DU to inspect the inner GTP headers and perform 1:1 mapping. |
| Lenovo&MotoM | Same as for N:1 bearer mapping |

Summary: Most companies think it should be done in the same way as for N:1 mapping, however, they disagree on how this can be done.The 1:1 mapping in the DL should be discussed further in RAN2 as no consensus can be reached in the email discussion.

**2c: How is the mapping performed for the UL/DL at the intermediate-IAB-node(s)?**

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| **Company** | **Comments** |
| Qualcomm | Same as for N:1 bearer mapping: Based on 1:1 mapping between ingress and egress RLC channels. There is no need for a “remapping”. |
| Huawei, HiSilicon | Same comments as N:1 |
| Samsung | [Similar to N:1, but for 1:1 there is no need for remapping (there’s nothing to remap in 1:1 case), whereas for N:1 we believe in some cases there is, as explained above.]For the UL, the Adapt at the intermediate IAB node (modelled as a single or two entities – tbc) routes the traffic from an ingress to an egress BH RLC channel, based fully or in part on configuration received from the CU. There are two possible approaches:The intermediate nodes perform the mapping of UE DRBs (rather than ingress BH RLC channels) to BH RLCs, while the donor only does this for the first hop.The intermediate nodes perform the mapping of ingress BH RLC channels to egress BH RLCs, while the donor decides the mapping of UE DRBs to BH RLC channels end-to-end.The intermediate nodes may need to – due to local issues (change in QoS status of a link or BH RLC channel) – use alternative route and/or different BH RLC channels on the same route (link) from the one originally configured by the CU. For this, the QoS profiles of the UE DRBs need to be available at intermediate nodes. The Adapt header itself does not need to contain any QoS info. |
| CATT | There is nothing to do remapping in the intermediate node in 1:1 mapping. And for mapping, we need to map each UE bearer to a RLC BH channel. The RLC BH channel is per UE RB in 1:1 mapping. As a DRB of an intermediate IAB node MT, the RLC BH channel is established by Donor CU, so upon a UE DRB is established, the Donor CU should establish all corresponding RLC BH channels along all intermediate IAB nodes. |
| Intel | Same as N:1 bearer mapping. |
| Nokia, Nokia Shanghai Bell | Ingress BH RLC channel (LCID) is mapped to egress BH RLC channel (LCID) + Destination IAB Node ID + route ID. |
| ZTE | For the intermediate IAB node, 1:1 bearer mapping can be performed with one of the following approaches: 1) the UE bearer id->BH RLC channel mapping; 2) based on ingress RLC channel. |
| LG | Same as in N:1 mapping. |
| AT&T | Same as for N:1 bearer mapping |
| KDDI | We share the view AT&T. |
| Ericsson | Based on 1:1 mapping between ingress and egress RLC channel. |
| Lenovo&MotoM | Same as for N:1 mapping. |

Summary: For UL/DL at the intermediate node(s), most companies think this can be done using 1:1 mapping between ingress and egress BH RLC channel.

**2d: Additional comments/aspects regarding 1:1 mapping?**

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| **Company** | **Comments** |
| Qualcomm | Should be same as for N:1 mapping with N=1. |
| Samsung | Please see our comments for N:1 mapping, where we list key questions that need to be addressed in both cases. |
| Nokia, Nokia Shanghai Bell | UL mapping in Donor DU for Option B: BH RLC channel (LCID) is mapped to outer GTP-U tunnel TEID. Option A, IPv4: If e2e IPsec is used, 1:1 mapping is not really possible. |
| LG | We think that 1:1 bearer mapping is the special case of N:1 bearer mapping, i.e., 1:1 bearer mapping can be achieved when N=1. |
| AT&T | Should be same as N:1 bearer mapping with N=1 |
| KDDI | We share the view AT&T. |

Summary: Similar views as for N:1 mapping. One company thinks that 1:1 mapping is not possible using IPv4 and IPsec.

**Question 3:** **Mapping of F1-C and OAM**

**3a: How is the mapping performed for the UL at the Access-IAB-node?**

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| **Company** | **Comments** |
| Qualcomm | F1-C should be provided with a separate RLC channel.OAM is essentially UP traffic and could be aggregated with mobile UP traffic. De-multiplexing is no issue since OAM traffic and mobile UP traffic use different dst IP addresses in upstream direction. |
|  |  |
| Huawei, HiSilicon | Regardless control plane and user plane, we think traffic/signalling of the MT itself and BH traffic/signalling (i.e. F1-U and F1-C) should use separate RLC channels. Existing mechanism can be used for traffic/signalling of the MT itself, including OAM traffic.  For F1-C, mapping should be based on F1-AP messages to support 1:1 bearer mapping, similar to TEID used in UP solutions. |
| Samsung | Same view as QC. Additionally, our view is that different F1-C messages may be transmitted via different logical channels. |
| CATT | Same view as QC. But additionally, whether different F1-C messages are transmitted via different RLC channels should be up to the configuration of 1:1 mapping or 1:N mapping, which also applies to F1-C. |
| Intel | No reason to deviate from UP mapping, other than the need for a separate RLC channel. |
| Nokia, Nokia Shanghai Bell | UE SRB (C-RNTI/LCID) is mapped in normal way to F1-C (UE associated F1-C) and F1AP/SCTP/IP packet is mapped to BH RLC channel (LCID) (and DSCP) based on configured mapping table (UE SRB (C-RNTI/LCID), BH RLC channel) (can also be C-RNTI/LCID to LCID mapping).IAB DU initiated F1AP (e.g., non-UE associated F1AP) mapped to configured BH RLC channel (can be same or different than for UE associated F1AP). |
| ZTE | F1-C could be mapped to BH RLC channels based on priority. Considering the the number of F1-C signalling is far fewer than UP data packets and the QoS of F1-C is also quite simple which encapsulate all the RRC message into F1AP message, it is suggested to only consider N:1 bearer mapping. That is , it is not necessary to setup BH RLC channels for each access UE’s SRBs.  With regard to OAM traffic could be regarded as the MT’s UP traffic. It could follow the N:1 or 1:1 user plane bearer mapping. |
| LG | We think that OAM traffic is user plane traffic and same bearer mapping scheme for UP traffic can be applied to OAM traffic too. But, F1-C should not be aggregated with UP traffic and may be transmitted with separate RLC channel. |
| AT&T | We agree with views expressed by LG. |
| KDDI | F1-C should be provided with a separate RLC channel.  We don’t have clear answer for the priority of OAM traffic, however if we can set another priority on OAM traffic, it may be beneficial. |
| Ericsson | The mapping can be based on IP header info (e.g. DSCP). The DU sending F1-C or OAM traffic (or other node backhauling IP traffic via this IAB node) should (based on configuration) mark the traffic with DSCP or Flow labels. The MT part will then map this to the proper BH RLC channels (e.g. map F1-C on a BH RLC channel(s) different from OAM or UE bearers). |
| Lenovo&MotoM | The different F1-C signalling can perform N:1 mapping to one BH RLC channel.  OAM traffic is considered as normal data from AS point of view. |

Summary: Many companies think F1-C traffic can be mapped on a separate RLC channel. For OAM traffic, this should be treated as user plane. Exactly how the OAM mapping is performed is not disclosed but it is assumed the IAB node will know what traffic is what and can do the mapping. Two companies mentioned using DSCP for mapping OAM and F1-C traffic to BH RLC channels. Overall, it seems feasible to adopt a similar solution as for user plane handling.

**3b: How is the mapping performed for the DL at the Donor DU?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | F1-C PDUs should be marked with unique DSCP on wireline network, so that F1-C priority can also be achieved for IPv4 deployments. OAM can use same marking as mobile UP traffic. Demultiplexing in downstream direction will be based on L4 (i.e. UDP with F1-U port number for mobile UP traffic vs. TCP connection for OAM traffic) |
| Huawei, HiSilicon | Similar to comments to UP part above, this discussion can be deferred until we get a clear answer about the architecture. |
| Samsung | Adapt at Donor DU performs mapping based fully or in part on configuration received from the CU.OAM traffic can be mapped as UP traffic. |
| CATT | Same comment with the mapping in access IAB node. OAM traffic can be mapped as UP traffic, and F1-C can be mapped separately. |
| Nokia, Nokia Shanghai Bell | Option A: Mapping to BH RLC channel can be done based on the IP address, DSCP and Flow Label (IPv6).  Option B: F1-C (F1AP/SCTP/IP) transferred over intra donor F1 using outer F1AP, mapping to BH RLC channel based on F1AP id (e.g., gNB-DU UE F1AP ID). |
| ZTE | F1-C could be mapped to BH RLC channels based on priority. Considering the the number of F1-C signalling is far fewer than UP data packets and the QoS of F1-C is also quite simple which encapsulate all the RRC message into F1AP message, it is suggested to only consider N:1 bearer mapping. That is , it is not necessary to setup BH RLC channels for each access UE’s SRBs.  With regard to OAM traffic could be regarded as the MT’s UP traffic. It could follow the N:1 or 1:1 user plane bearer mapping. |
| LG | Same comments as in question 3a. |
| AT&T | Same comment as our response to Question 3a |
| KDDI | Same comment as our response to Question 3a |
| Ericsson | The mapping can be based on IP header info (e.g. DSCP). The nodes sending F1-C or OAM traffic, or other IP traffic should (based on configuration) mark the traffic with DSCP or Flow labels. The Donor DU will then map this to BH RLC channels.Whether a separate RLC channels are used or not is up to operator configuration. |
| Lenovo&MotoM | Same comments as for 3a. |

Summary: Most companies seem to have similar view as for the UP mapping. Overall, it does not seem feasible to reach a consensus on the DL mapping in the email discussion.

**3c: How is the mapping performed for the UL/DL at the intermediate-IAB-node(s)?**

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| **Company** | **Comments** |
| Qualcomm | Same as UP: There should be 1:1 mapping between ingress and egress RLC channels. |
| Huawei, HiSilicon | The common solution for UP and CP can be applied. From network point of view, we think it is more flexible if the intermediate IAB nodes can do remapping as discussed above: In a IAB network, for bearer mapping, upstream IAB nodes which are closer to IAB donor may have problems to support 1:1 bearer mapping as they are serving too many UEs, but it is beneficial to allow the downstream IAB nodes to do “remapping” based on an “ID” so that more BH RLC channels can be supported in downstream IAB nodes. |
| Samsung | Same as UP for N:1 mapping and 1:1 mapping. |
| CATT | Same as UP for N:1 mapping and 1:1 mapping. |
| Nokia, Nokia Shanghai Bell | Ingress BH RLC channel (LCID) is mapped to egress BH RLC channel (LCID) and Destination IAB Node ID + route ID. |
| ZTE | The following approach could be considered for F1-C bearer mapping at intermediate IAB node: 1) based on priority; 2) based on ingress RLC channel. |
| LG | Same as UP for N:1 mapping. |
| AT&T | Common solution should be applied for UP and CP. |
| KDD | Common solution should be applied for UP and CP. |
| Ericsson | Same as UP. |
| Lenovo&MotoM | Same as UP for N:1 mapping(1:1 is a special case). |

Summary:

**3d: Additional comments/aspects regarding F1-C/OAM mapping?**

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| --- | --- |
| **Company** | **Comments** |
|  | CP and UP should use the same principles. Further, F1-C should be aggregated onto same BH RLC channel. OAM can be aggregated with BE UP traffic. |
| Samsung | Like QC mentioned, CP and UP should use the same principles. However, F1AP can be allowed to be aggregated onto different BH RLC channel depending on the F1AP message type. |
| Nokia, Nokia Shanghai Bell | UL mapping in Donor DU for Option B: BH RLC channel dedicated for UE SRB (1:1 mapping), for several UE SRBs (N:1 mapping) or for IAB DU initiated F1AP (e.g., non-UE associated F1AP) is mapped to outer F1AP id (e.g., gNB-DU UE F1AP ID) in Donor DU. |
| AT&T | Common design should be used for UP and CP. |

Summary: Companies thinks the same design can be applied for CP and UP.

# **3. Summary**

Based on the input from different companies, it seems reasonable to reach a consensus on the mapping for the UL in the IAB node and for the UL/DL in the intermediate node(s). For the DL in the Donor DU, there is no consensus as roughly half of the companies think it can be based on DSCP/flow labels while the other half of the companies have other views.

1. The UL mapping in the IAB access node to BH RLC channels should be based on the knowledge about UE bearers (identified with GTP TEID) and F1-C signaling. FFS if the mapping should also consider DSCP/Flow labels (e.g. as an intermediate step).
2. The UL/DL mapping in intermediate IAB node(s) to egress BH RLC channel should be done based on ingress BH RLC channel + some ID(s) (from Adaptation Layer). The solution is applicable for all types of traffic (e.g. UP, CP, OAM).
3. It was not possible to reach on a consensus for the DL mapping in the Donor DU. This should be further discussed.