3GPP TSG-RAN WG2 Meeting #116 electronic R2-2111381

Electronic meeting, 1st-12th November 2021

Agenda Item: 8.7.2.3

Source: MediaTek Inc.

**Title:** Summary of [AT116-e][627][Relay] Bearer mapping and PC5 PDU format in adaptation layer (MediaTek)

Document for: Discussion and Decision

# Introduction

This is to summarize the following offline discussion.

* [AT116-e][627][Relay] Bearer mapping and PC5 PDU format in adaptation layer (MediaTek)

Scope: Discuss P12/P13/P14 of [R2-2111274](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Inbox/R2-2111274.zip), and the first two bullets of P11.

Intended outcome: Report to CB session

Deadline: Thursday 2021-11-10 1600 UTC

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# Discussion

## Bearer mapping

**Proposal 12: For DL bearer mapping, RAN2 to down-select below two alternatives on how relay UE determines egress PC5 RLC bearer/LCID, whether remote UE ID is needed in the mapping is FFS.**

* **Alt-1: relay UE is configured by gNB with a mapping from Uu E2E bearer ID in Uu adaptation layer header to egress PC5 RLC bearer ID/LCID.**
* **Alt-2: relay UE is configured by gNB with a mapping from ingress Uu-RLC channel to egress PC5-RLC bearer ID/LCID.**

**Q1: Which alternative companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Alternative | Comments |
| Qualcomm | Alt-1 | Because we agreed PC5 adaptation layer can perform N:1 bearer mapping, Alt-2 will lose some flexibility (i.e., only E2E Uu bearers multiplexed in same PC5 RLC bearer can be multiplexed in a Uu RLC bearer). But Alt-1 can remove this restriction. And we think Alt-1 is more future-proof for multi-hop extension.  In addition, maybe we can go a step further to remove FFS. Because RAN2 has agreed a single PC5 adaptation entity is shared for multiple remote UEs, remote UE ID is needed in bearer mapping, i.e.  **relay UE is configured by gNB with a mapping from Uu E2E bearer ID and remote UE local ID in Uu adaptation layer header to egress PC5 RLC bearer ID/LCID** |
| Huawei, HiSiilicon | Alt-1 | Uu E2E bearer ID is anyway included in the header. There is no further efforts/overhead for alt 1, but alt 1 can support flexible mapping.  In IAB, alt-2 is used just because of not supporting bearer ID in header.  The consequence of alt.2 is more RLC is requires is NW wants to ensure the finer QoS provision.  Fine with the wording from QC, but can be discussed later. |
| Ericsson | Alt.1 | Agree with Qualcomm, also support wording changes suggested by Qualcomm |
| InterDigital | Alt-1 | For the reasons indicated by Qualcomm. |
| Lenovo, MotM | Alt-1 | Agree with QC |
| Samsung | Alt-1 | In RAN2#113bis-e we agreed that “The radio bearer ID in the adaptation layer header is the Uu radio bearer ID of the remote UE” and that “Mapping is done at Relay UE between PC5 RLC bearer IDs, identity information of remote UE and Uu radio bearer, and Uu RLC bearer IDs.” These two agreements together to us imply that we have already agreed Alt-1.  Even if someone had a different interpretation, since we already agreed to include the Uu radio bearer ID in the Adapt, then it may be wasteful not to use it for the mapping, as mentioned by Huawei above.  (As an aside, and in reference to Qualcomm’s comment on N:1, we have a different understanding. N:1 mapping done by PC5 Adapt in our understanding means that multiple bearers will be mapped at a Remote UE to a single PC5 RLC channel. Qualcomm seem to be referring to remapping from PC5 RLC channels to Uu RLC channels, and even if we do not use the radio bearer ID in the mapping [= Alt-2, which we do not support by the way], we can still do N:1 mapping between PC5 RLC channels and Uu RLC channel. But this mapping would be limited since we could not send bearers which came on same PC5 RLC channel to different Uu RLC channels, and vice versa, which we agree is a limitation. |
| CATT | Alt-1 | We share the same view as QC. |
| ASUSTeK | Alt-1 |  |
| Spreadtrum | Alt-1 |  |
| ZTE | Alt-2 | For the downlink bearer mapping, we prefer Uu RLC channel ID + Remote UE ID to PC5 RLC channel ID + remote UE ID mapping configuration. Since both the Uu RLC channel and PC5 RLC channel are configured by gNB based on the QoS of remote UE's Uu DRB, gNB may enable that certain Uu RBs of remote UE is mapped to same Uu RLC channels and then mapped to same PC5 RLC channels. In this case, relay UE may check the local ID in Uu adaptation layer header and the Uu RLC channel ID, then determine the egress PC5 RLC channel based on the mapping configuration. As we can see, the local ID is useful in bearer mapping and no waste.  Due to the N:1 bearer mapping on Uu RLC channel, the number of PC5/Uu RLC channels is generally less than that of Uu DRBs, less bearer mapping entry is needed for Alt-2. Therefore, Alt-2 may greatly reduce the signalling overhead for bearer mapping.  As far as we know, the IAB network support multihop relay and the bearer mapping at intermediate IAB node is based on the mapping between ingress RLC channel and egress RLC channel. Similarly, we don’t think Alt2 has multi-hop extension issue. |
| vivo | Alt-1 | We share the intention of Qualcomm. On the other hand, how the mapping looks like from a signaling perspective is a stage-3 issue. For agreement, perhaps we can simply say “**for a given remote UE**, relay UE is configured by gNB with a mapping from Uu E2E bearer ID in Uu adaptation layer header to egress PC5 RLC bearer ID/LCID”. |
| CMCC | Alt-1 | Same understanding with QC. |
| Intel | Alt-1 |  |
| MediaTek | Alt-1 |  |
| Xiaomi | Alt-1 |  |
| LG | Alt-1 |  |
| Philips | Alt-1 | We do not agree with the wording change by Qualcomm |

**[Rapp]: 17 companies join Q1 discussion, 16 companies prefer Alt-1, 1 company prefer Alt-2, based on the majority. We suggest the following proposal:**

**Proposal 1: For DL bearer mapping, relay UE is configured by gNB with a mapping from Uu E2E bearer ID and remote UE local ID in Uu adaptation layer header to egress PC5 LCID.**

**Proposal 13: For UL bearer mapping, RAN2 to down-select below two alternatives on how relay UE determines egress Uu RLC bearer ID/LCID, whether remote UE ID is needed in the mapping is FFS.**

* **Alt-1: relay UE is configured by gNB with a mapping from Uu E2E bearer ID in PC5 adaptation layer header to egress Uu RLC bearer ID/LCID.**
* **Alt-2: relay UE is configured by gNB with a mapping from ingress PC5-RLC channel to egress Uu RLC bearer ID/LCID.**

**Q2: Which alternative companies prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Alternative | Comments |
| Qualcomm | Alt-1 | Same justification for Q1. And similar suggestion for wording:  **relay UE is configured by gNB with a mapping from Uu E2E bearer ID and remote UE local ID in PC5 adaptation layer header to egress Uu RLC bearer ID/LCID.** |
| Huawei, HiSilicon | Alt-1 | See comments above. P13 should be aligned with P12. |
| Ericsson | Alt.1 |  |
| InterDigital | Alt-1 |  |
| Lenovo, MotM | Alt-1 |  |
| Samsung | Alt-1 |  |
| CATT | Alt-1 |  |
| ASUSTeK | Alt-1 |  |
| Spreadtrum | Alt-1 |  |
| ZTE | Alt-2 | Similar to comments in Q2, we think that the Alt-2 is feasible and can greatly reduce the signalling overhead for bearer mapping. |
| vivo | Alt-1 | Same comments as in Q1 (“**for a given remote UE**, …”). |
| CMCC | Alt-1 |  |
| Intel | Alt-1 | Just a minor wording suggestion:  **Alt-1: relay UE is configured by gNB with a mapping from Uu E2E bearer ID used in PC5 adaptation layer header to egress Uu RLC bearer ID/LCID.**  We think the gNB can provide the Remote UE ID during configuration, but it does not necessarily mean that we need it in the PC5 adaptation header. |
| MediaTek | Alt-1 |  |
| Xiaomi | Alt-1 |  |
| LG | Alt-1 |  |
| Philips | Alt-1 |  |

**[Rapp]: 17 companies join Q2 discussion, 16 companies prefer Alt-1, 1 company prefer Alt-2, based on the majority. We suggest the following proposal:**

**Proposal 2: For UL bearer mapping, relay UE is configured by gNB with a mapping from Uu E2E bearer ID used in PC5 adaptation layer header and remote UE local ID to egress Uu LCID.**

**Proposal 14: For UL bearer mapping, remote UE is configured by gNB with a mapping from Uu E2E bearer ID to egress PC5 RLC bearer/LCID.**

**Q3: Does companies agree above proposal?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | Yes |  |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Ericsson | Yes |  |
| InterDigital | Yes |  |
| Lenovo, MotM | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| ASUSTeK | Yes |  |
| Spreadtrum | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| CMCC | Yes |  |
| Intel | Yes |  |
| MediaTek | Yes |  |
| Xiaomi | Yes |  |
| LG | Yes |  |
| Philips | Yes |  |

**[Rapp]: 18 companies join Q3 discussion, all companies agree with the proposal.**

**Proposal 3: For UL bearer mapping, remote UE is configured by gNB with a mapping from Uu E2E bearer ID to egress PC5 LCID.**

## PC5 PDU format

**Proposal 11: RAN2 to discuss detail PC5 PDU format, questions are listed below:**

* **Whether the remote UE ID field in PC5 adaptation layer header can be configured to be absent.**
* **Whether apply same PDU format for PC5 and Uu adaptation layer or not?**

**Q4-1:** **Whether the remote UE ID field in PC5 adaptation layer header can be configured to be absent?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | See comment | No strong view, but mandate it to be absent is not preferred, considering same PDU format for Uu and PC5 hop helps on simplicity and forwards compatibility. |
| Qualcomm | Yes | From technique perspective, we agree that remote UE is not necessary in PC5 adaptation layer in this release (due to single hop restriction). However, we have same concern with OPPO on its simplicity and forward combability if it is mandated to be absent in this release. In multi-hop, remote UE ID is required to be included PC5 adaptation layer header anyway.  Thus, we believe that configurable is a good way forward. |
| Huawei, HiSilicon | No.  No remote UE ID in PC5 header. | 1. Remote UE ID will never be used at remote UE for DL   In R16, relay UE can determine the PC5 link based on the remote UE ID in Uu adaptation layer. Then, all the data received from the PC5 link is remote UE’s data. What’s the usage to keep remote UE ID in the PC5 adaptation header?   1. Remote UE ID is not needed for future proof   For future release, anyway we may need new PC5 adaptation header. This is because “Path ID” is required in multi-hop routing. So, let’s face it, i.e. in the future for multi-hop, anyway we need to extend the PC5 adaption header.  R bits should be sufficient to extend in the future.   1. For unified header   We understand, in the multi-hop case, the unified/same format refer to: a) Uu adaptation header and PC5 adaptation header between relay UEs are same; b) The last hop PC5 adaptation header will be different with the PC5 adaptation header between relay UEs. This is aligned with the IAB design, i.e only last hop use difference format.     1. For compromise of configured to be absent   We are wondering if it means: In R17, PC5 adaption header will include remote UE ID, but remote UE will never set this field.  Otherwise, configuration only make it more complicated. This is because the setting remote UE ID at remote UE will require the remote UE ID configuration from gNB to remote UE. But, again, remote UE ID will never be used by remote UE for DL. |
| Ericsson | comment | Share the same view as Qualcomm and OPPO. |
| InterDigital | No | To enable forward compatibility, the ID can always be present |
| Lenovo, MotM | Comment | Same view as Oppo |
| Samsung | No remote UE ID in PC5 Adapt haeader, please see comment | We fully agree with Huawei that remote UE ID will not be used by Adapt on PC5. And to have it inside of the PC5 Adapt header just for the sake of forward-compatibility is – as Huawei pointed out – not even enough to ensure forward compatibility. |
| CATT | See comments | Same concern as HW. |
| ASUSTeK | Yes | We share the same view with Qualcomm. |
| Spreadtrum | No | Remote UE ID should be mandated to be absent in this release. |
| ZTE | No | To simplify the adapation layer design, we think the remote UE ID may be always present both in the PC5 and Uu adaptation layer subheader. |
| vivo | No | It seems the discussion here has completely turned out to be a discussion on how to support future-release features. We don’t think this is the right way, since when we introduced the PC5 adaptation layer last time, the consensus seemed to be only focusing on the necessary functionality in this release (i.e. bearer mapping).  Also, share Huawei’s view that new header needs to be defined in future releases. So, there’s no need to worry about what’s going to happen at that time for the time being. |
| CMCC | With comment | Same understanding with OPPO and QC. |
| Intel | No, no need for Remote UE ID in the header | We don’t prefer configurable option. Moreover, it is most likely that we are not going to support multi-hop in Rel-18, so, we can use R bits in future release if we support multi-hop, with the corresponding ID, other information and save on signalling for this release. |
| MediaTek | No | Agree with InterDigital. |
| Xiaomi | No | We agree with vivo and Huawei |
| LG | No | Same concern as HW. |
| Philips | Yes | We agree with not having the UE ID field in PC5 adaptation layer header |

**Q4-2: Whether apply same PDU format for PC5 and Uu adaptation layer or not?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| OPPO | Yes | As replied in Q4-1, we see it helps on simplicity and forwards compatibility. |
| Qualcomm | Yes | Same view as OPPO |
| Huawei, HiSilicon | No, or pending | This depends on Q4-1 on remote UE ID presence. This proposal should not be discussed before that. |
| Ericsson | Yes | Agree with OPPO and Qualcomm |
| InterDigital | Yes |  |
| Lenovo, MotM | Yes |  |
| Samsung | No | First need to discuss and agree answer to Q4-1. |
| CATT | No | See our comments in Q4-1. |
| ASUSTeK | Yes |  |
| Spreadtrum | No |  |
| ZTE | Yes |  |
| vivo | No |  |
| CMCC | Yes |  |
| Intel | No |  |
| MediaTek | Yes |  |
| Xiaomi | No |  |
| LG | No |  |
| Philips | Yes |  |

**[Rapp]: 18 companies join Q4-1 and Q4-2 discussion, based on the above comments, we think that companies understand that the remote UE ID field is not necessary in this release, but for simplicity and forwards compatibility, 10 companies want to apply the same PDU format for PC5 and Uu adaptation layer from Q4-2. Among these 10 companies, from Q4-1, at least 2 companies, are willing to comprise to be configurable. Up to now, we think companies still not get consensus, suggest RAN2 to further down-select three options.**

**Proposal 4: RAN2 to further down-select below options on remote UE local ID in PC5 adaptation layer header.**

* **Option 1: always absent in this release**
* **Option 2: always present in this release**
* **Option 3: always present but always remains to “00000000” in this release (i.e. remote/relay UE will never use this filed in R17)**

# Conclusion and proposals

Based on the above summary, following proposals are given.

**Proposal 1: For DL bearer mapping, relay UE is configured by gNB with a mapping from Uu E2E bearer ID and remote UE local ID in Uu adaptation layer header to egress PC5 LCID.**

**Proposal 2: For UL bearer mapping, relay UE is configured by gNB with a mapping from Uu E2E bearer ID used in PC5 adaptation layer header and remote UE local ID to egress Uu LCID.**

**Proposal 3: For UL bearer mapping, remote UE is configured by gNB with a mapping from Uu E2E bearer ID to egress PC5 LCID.**

**Proposal 4: RAN2 to further down-select below options on remote UE local ID in PC5 adaptation layer header.**

* **Option 1: always absent in this release**
* **Option 2: always present in this release**
* **Option 3: always present but always remains to “00000000” in this release (i.e. remote/relay UE will never use this filed in R17)**

# Reference

1. [R2-2111274](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Inbox/R2-2111274.zip) Summary of Agenda item 8.7.2.3: Adaptation layer design MediaTek Inc. discussion Rel-17