**3GPP TSG-RAN WG2 Meeting #113-eR2-21xxxxx**

**Online, 25th Jan – 5th Feb 2021**

**Agenda item: 8.1.1**

**Source: Chairman (Mediatek Inc)**

**Title: [Offline-038][MBS] UP Architecture Desicions**

**Document for: Discussion**

# 1 Introduction

This is to report the result of the following email discussion.

* [AT113-e][038][MBS] UP architecture decisions (Chairman)

Scope: Gather comments to facilitate a CB to address two decisions: A) on L2 ARQ for PTM, B) for PTM PTP switch, which layer to be the anchor.

Intended outcome: Report with collection of comments

Deadline: Friday Jan 29 1200 UTC

The Discussion scope is to gather comments to facilitate a online CB discussion to address two decisions: A) on L2 ARQ for PTM, B) for PTM PTP switch, which layer to be the anchor.

Companies are strongly encouraged to voice their opinions here.

# 2 Contact Information

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

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| --- | --- |
| Company | Contact: Name (E-mail) |
| Chairman (Mediatek Inc.) | Johan.johansson@mediatek.com |
| LG | Seong Kim (sj117.kim@lge.com) |
| Huawei | Zhenzhen Cao (caozhenzhen@huawei.com) |
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# 3 Discussion

## 3.1 Need for UP decisions

Chairman’s View:

First, pointing out the obvious: The MBS Work Item is large, there is a lot of functionality that need to be supported in RAN2, it impacts many specifications, has impact in all other group with need for work coordination. Both User Plane and Mobility is impacted which both are among the most difficult to progress topics in RAN2. Behind each alternative, also behind the seemingly “simple” alternatives, there is a lot of detailed issues that requires significant work and significant lead times to converge on.

The non-decided architecture blocks the possibility to progress many parts. Architecture = which functionality exists and where is it located (which protocol layer, which peer entity).

The current decision status is that there was a working assumption established last meeting that PTM will not support RLC-AM, and no further decision has been taken since to either overturn or confirm this. For the anchoring of PTP PTM switch there is no present decision.

It is important that RAN2 consolidates MBS user plane architectural decisions soon.

## 3.2 UP decisions

**The main two points that seems to need resolution/consolidation are the following**

*A. L2 ARQ for PTM for normal data transfer*

*B. Which layer anchors the PTM PTP switch, i.e. at PTM PTP switch which layer remains the same, (and might be responsible for service continuity).*

Both point A and B are included here because several companies indicate that they are inter-dependent,

**For A. there seems to be the following options on the table:**

A1. No L2 ARQ for PTM

A2. L2 ARQ by PDCP for PTM

A3. L2 ARQ by RLC-AM for PTM

**For B. There seems to be the following options on the table:**

B1. PDCP anchored PTM/PTP switch

B2. RLC anchored PTM/PTP Switch

Different combinations of Ax/Bx seems to be technically possible, but they seems to come with different complexity, different level of reuse and different characteristics.

## 3.3 This email discussion

The purpose of this discussion is to have opportunity to put on the table opinions and arguments of all interested companies with less time consumption.

As this is a controversial topic it seems there will not be sufficient on-line time to allow everyone to voice their opinions on-line on all these aspects. It is encouraged that companies voice their main opinions / suggestions and supporting arguments relating to the options and combination of A and B.

Similar to online debate It is furthermore encouraged that companies respond to other companies’ comments (not endlessly but maybe one round). Comments are numbered to facilitate this.

# 4 Discussion

**For A. there seems to be the following options on the table:**

A1. No L2 ARQ for PTM

A2. L2 ARQ by PDCP for PTM

A3. L2 ARQ by RLC-AM for PTM

**For B. There seems to be the following options on the table:**

B1. PDCP anchored PTM/PTP switch

B2. RLC anchored PTM/PTP Switch

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| **N** | **COMPANY** | **COMMENT** |
| 1 | Chairman | **My high level understanding of the proposals:**  **A1:** No L2 ARQ for PTM, UNDERSTANDING: For normal data transfer, reliability is handled by L1, HARQ, and switching from PTM to PTP if the link gets bad and vice versa. PTP could be configured different to PTM, e.g. with RLC-AM.  **A2:** L2 ARQ by PDCP for PTM, UNDERSTANDING: In addition to A1, there is possibility to have PDCP retransmission of SDUs across PTP at lost data, which could be triggered by a PDCP status report (other trigger FFS).  **A3**: L2 ARQ by RLC-AM for PTM, UNDERSTANDING: RLC-AM is adapted such that dedicated protocol control and dedicated retransmissions uses the PTP leg. RLC-AM segments are retransmitted at lost data (as normal). It is assumed possible to keep current protocol including also e.g. Poll/Ack Nack supervision and retriggering mechanisms. Further It is proposed that both PTP and PTM is one single RLC-AM protocol instance (same SN, buffer status etc) and this would bring benefits at PTP PTM switching. However, this doesn’t seem to be a core part, so for a good discussion this point could be considered FFS. A1 or A2 could be supported in addition to A3 in order to support RLC-UM.  **B1**: PDCP anchored PTM/PTP switch, UNDERSTANDING: Similar as Mobility, PDCP SN is the basis for service continuity. Receiver packet handling is anyway in PDCP, reordering duplicate handling, triggering of status report (FFS new triggers). When lost data at switch need to be recovered, transmitter can perform retransmissions of SDUs on PTP.  B1 Can work with all of the alternatives of A1 A2 A3 and requires no particular interdependency from the lower protocols (e.g. RLC AM for PTP and RLC-UM for PTM would be ok).  **B2:** RLC anchored PTM/PTP Switch, UNDERSTANDING: RLC anchored PTP PTM switch is intended for the case that both PTP and PTM is one single RLC-AM protocol instance where data lost at the switch is retransmitted as RLC-AM segments by the same protocol mechanisms as during normal data transfer.  For RLC-UM cases, B2 would not be used, in particular if RLC-AM/PTP and RLC-UM/PTM shall be supported (my understanding). |
| 2 | LG | **Summary of LG’s view**:   * A1: strong support * A2: support * A3: not support * B1: strong support * B2: not support   **A1**: We have same understanding with Chairman. Switching from PTM to PTP should be considered for high reliability because A2 and A3 cannot be as reliable as PTP because PTM should consider Ack/Nack feedbacks from multiple UEs. Either the rx and tx windows would be stuck for the worst case UE, or some of UE would suffer packet losses.  **A2**: We have same understanding with Chairman. We can re-use the MRB structure for dynamic PTM/PTP switch where there is a common PDCP and two legs for PTM and PTP. PDCP already essential functionality for retransmission and status report, and the PTP leg can provide PTM with uplink path for UL feedback and additional downlink path for retransmission. We can mainly focus on enhancement of status report triggers. We think, the main benefit of reliability enhancement of PTM is that UEs can be kept more to be served by PTM and this would increase resource efficiency.  **A3**: Although A3 could be considered for enhancing reliability of PTM, we don’t see reasons for adopting A3 rather than A2. We can enhance reliability of PTM by A2. The required functionalities for retransmission and uplink feedback are same for A2 and A3 at high level description. We think that the enhanced reliability levels which can be achieved are expected to be similar considering that PTM should consider multiple UE’s behaviours as mentioned in A1. However, A3 would require new changes which are related to essential RLC function, for example, rx/tx window management, and induce more complexity. We prefer A2 to A3 for enhancing reliability of PTM.  **B1**: We shares Chairman’s understanding. We support B1 (PDCP anchored PTM/PTP switch). We also considered that it is well-aligned with mobility procedure and it can work with A1 A2 A3 as mentioned by Chairman.  **B2**: Basically, states of the RLC entity would be different for PTM and PTP because the state for PTP is specific to the UE and the state of PTM is common for UEs of the group. Moreover, RLC mode can be different between PTM and PTP. So, we believe that PTM/PTP switching may requires full change of RLC state of the RLC entity. We think this kind of change is not desirable for an anchor entity. |
| 3 | Huawei, HiSilicon | First, many thanks to Chair to lead this offline. From rapporteur’s point of view, we really need to conclude the user plane architecture as soon as possible, as many discussions would be stuck if the architecture is not clear in both RAN2 and RAN3.  We share the same understanding with Chair on overall picture of issues and solutions on the table for the architecture discussion. Our view is summarized as below:   * A1: acceptable in Rel-17 * A2: acceptable (a simple solution only in Rel-17) * A3: not support * B1: support * B2: strong concern (not working technically for RLC UM)   **A1**: most of MBS services are video/audio, which mostly use UDP/IP and doesn’t require very high reliability (e.g. lossless). In LTE, these services are supported by eMBMS with RLC UM only without L1 feedback and retransmission. In NR, it has already been agreed that L1 HARQ would be supported for MBS, which is a significant feature to improve the reliability and efficiency for MBS delivery. Therefore, we think it should be acceptable at least for the first release of NR MBS without L2 ARQ.  **A2**: in case people have strong view to support very high reliabilities (lossless) in this release, we can accept a simple PDCP based solution. A benefit of PDCP based solution would be that retransmissions can be delivered on PTP leg, which can improve the transmission reliability.  **A3**: implementation of A3 could be simple from the UE side, but it will introduce significant complexity to the network side, as the RLC entity(ies) at the gNB need to take care of RLC contexts of multiple UEs. The transmission window management at the gNB would be extremely complicated and not possible to be specified. Someone may argue that this can be done up to gNB implementation and doesn’t need standardization, but we still need to assume what kind of gNB implementation could be when discussing if there is any problem, which would be time consuming if there is no common understanding on a gNB implementation.  **B1**: PDCP based split is already a symbol of NR, and a lot of features are now based on this architecture, e.g. duplication, CU-DU and etc, which would make the support PTP/PTM switch easier and require much less specification efforts.  **B2**: The biggest problem in option B2 is the support of RLC UM, which is most practical configuration for MBS as mentioned above. A difference in NR compared to LTE was that for RLC UM only the segmented RLC SDUs are associated RLC SNs (as in NR the re-ordering function has been moved up to PDCP). For RLC AM, each RLC SDU is associated with a SN.  The problem for RLC UM now is that if we support PTP/PTM dynamic switch, PTP scheduling should be adapted to radio links of different UEs, and the scheduled grants would be different for UEs, and for sure will be different from the PTM scheduling. As the consequence the RLC SN allocation would become different if some UEs are scheduled based on PTP and some others are based on PTM, which will make PTM UM+PTP UM not working as SNs are not aligned.  The problem has been illustrated in the following figure of our contribution R2-2101012.  cid:image001.png@01D6F412.F7C83490  Note that it is unacceptable to apply different user plane architectures for UM and AM, e.g. B1 used for UM and B2 used for AM, at least from rapporteur’s point of view, given the heavy work load of this WI already. |
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