3GPP TSG-RAN WG2 #119-e R2-2209023

Electronic meeting, 17th August–29th August 2022

Agenda Item: 6.13.4

Source: Ericsson

Title: [AT117e][801] Total RAN delay calculation (Ericsson)

Document for: Discussion, Decision

#  Introduction

This contribution addresses the following offline discussion:

 **[AT119e][801][R17 SON/MDT] Total RAN delay calculation (Ericsson)**

Based on related agreement in RAN2#118, considering R2-2207948, R2-2208206 together, to discuss the necessity and how to calculate the total RAN delay.

Intended outcome: Report

Deadline for comments: 15:00 UTC, Thursday Aug 24th

 Deadline: 04:44 UTC, Thursday Aug 25th

To aid better communication between the respective delegates handling this topic from different companies, it is requested to fill-in the contact information.

**Contact Information**

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#  Discussion

In RAN2#118-e meeting, RAN2 received a reply LS from RAN3 regarding M6 calculations in split-bearer scenario. RAN3 reply in [1] is quoted below-

*RAN3 thanks RAN2 for the reply LS in R2-2111290. Based on the answers in the reply LS, RAN3 studies the following use cases for M6 calculation for split bearers in MR-DC:*

* ***Case 1: PDCP duplication is activated within the report interval of M6***
* ***Case 2: PDCP duplication is not activated within the report interval of M6***
* ***Case 3: PDCP transmission mode switches between duplication and non-duplication within the report interval of M6***

*In order to calculate the M6 in TCE correctly, RAN3 agreed to allow the NG-RAN node to report the following additional measurements to TCE:*

* ***Number of PDCP PDUs sent via MN or SN within a measurement period, when PDCP duplication is enabled.***
* ***Number of PDCP PDUs sent over MN within a measurement period, when the PDCP duplication is not enabled.***
* ***Number of PDCP PDUs sent over SN within a measurement period, when the PDCP duplication is not enabled.***

In current version (V17.1.0) of 38.314, the additional measurements mentioned above are included.

However, set of formulas covering the totall RAN delay calculation in the three mentioned scenarios based on the additiopnal measurements agreed in RAN2 are not present.

This might raise the risk of inconsistency in calculating the total RAN delay calculation by different entitties. For example different RAN nodes (provided by different vendors) may calculate the total RAN delay differently and send to the core network. Or different OAM applications may calculate the total RAN delay differently that results inconsistent and ambegious analysis at the OAM.

Two papers [2,3] submitted to the AI 6.13.4 addresses this issue and provided CRs to add the corresponding formulars to assist a consistent calculation onf the total RAN delay by the RAN node (to be sent to the core network) and by the OAM for QoS verification purpose.

During the online session it has been discussed whether is is neccesary to have such formulas in the L2 measurement specification 38.314. Therefore the moderator would like to ask the following question:

**Q1: Do you agree that for a consistent calculation of the total RAN delay per UE at RAN nodes provided to core network, and at OAM, a set of formulas for total RAN delay calculation are needed?**

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| Company | Agree (i.e., it is needed)Disagree (i.e., not needed. Please comment your solution for consistent measurements) | Comment |
| Qualcomm | Disagree | In RAN2, we agreed on computing delay when packet duplication and packet aggregation are used. RAN3 agreed to report the number of packets sent over MN or SN in different scenarios to TCE. Based on the reported measurements, TCE calculates the total RAN2 delay. As the total RAN delay is not computed at the RAN node, I do not think this should be captured in the RAN2 specification.  |
| Huawei, HiSilicon | Agree | At RAN2#118-e, we had the following agreements, and the two metrics are missing in current spec. If we do not capture them in specs, CN will not get the delay measurements and thus QoS monitoring function may be incomplete.We think both measurements are about L2M, and either RAN2 or SA5 can capture them in their own specs. For example, for R16 UL/DL delay measurements, some were captured in RAN2 spec (TS 38.314) and some were captured in SA5 specs. We are open to discuss where to capture them. The previous RAN2 agreements should be captured in TS 38.314, and detailed changes are postponed to the next RAN2 meeting: For QoS monitoring related delay reporting to CN, ‘weighted average (consider the number of packets) over MN and SN’ is used to calculate the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication. For QoS monitoring related delay reporting to CN, the minimum value between two legs is defined as the total delay measurement M6 over MCG/SCG for split bearers WITH PDCP duplication. |
| Ericsson | Agree | Given that these are per UE and per DRB measurements, it is more appropriate to specify them as part of TS 48.314 . Please note that the relevant counters (PDC dupplictaed and non-dupplicated packets) are already defined in the L2 measurement spec. |
| Nokia | Disagree | RAN2 has gone through number of discussions in Rel-17 discussions on the total packet delay. E.g.:RAN2#113: RAN2 will NOT enhance the current delay measurement mechanism.For QoS monitoring related delay reporting to CN, ‘weighted average (consider the number of packets) over MN and SN’ is used to calculate the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication.RAN2#118-e:R2-2206676 Report of [AT118-e][805][SON/MDT] Corrections on TS.38.314 HuaweiAgreement: The previous RAN2 agreements should be captured in TS 38.314, and detailed changes are postponed to the next RAN2 meeting: For QoS monitoring related delay reporting to CN, ‘weighted average (consider the number of packets) over MN and SN’ is used to calculate the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication. We believe the last agreement from the previous meeting based on R2-2205076 – which is the key motivation used in the proposed CR - intended to capture the agreement in TS38.314, was intentionally to keep the record of the agreements, **without imposing a need for new standardized definitions/formulas.** As the total delay calculation can take different approaches, it was supposed to be left to NW implementation, without limiting to one definition. As noted by Ericsson, there can be different realisations, potentially based on SA5/RAN3 changes too. Therefore, we think pure definition in RAN2 specification is too limiting. RAN2 did not conclude Rel-17 WI with the need to dfine new metric definition. |
| ZTE | See comments | As commented by Nokia there could be different implementations due to different scenarios which cannot be concluded in R17 at this stage. But still we already made an high level principle on how to compute the delay measurements for split bearers with/without duplication for QoS monitoring use case as indicated by HW, therefore I think the only thing we can do is to capture the agreements as in below without further differentiating different scenarios. ----------------------- TP to 38314 ------------------------4.2.1.2.1 GeneralPacket delay includes RAN part of delay and CN part of delay.[Partially omitted]If network disables the PDCP re-ordering function, the value of Average PDCP re-ordering delay i.e. D2.4 should be set to 0.For the QoS monitoring in TS 23.501 [4], RAN informs the RAN part of UL packet delay measurement, or the RAN part of DL packet delay measurement, or both to the CN.For QoS monitoring related delay reporting to CN, ‘weighted average over MN and SN’ is used to calculate the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication and the minimum value between two legs is defined as the total delay measurement M6 over MCG/SCG for split bearers WITH PDCP duplication. NW may calculate calculate the total delay measurement M6 over MCG/SCG for split bearers with joint consideration on Number of PDCP Packets in Split-DRB Scenario specified in 4.2.1.8.----------------------- TP to 38314 ------------------------Further enhancements if needed can be discussed in R18. |
| CATT | Agree | Firstly, it is said “*to calculate the M6 in TCE correctly*” in the RAN3 LS, so the PDCP SDU number calculation is not used for the **QoS monitoring** with is reported to the CN. Only the TCE (used by OAM for **QoS verification** purpose) has such requirement;Secondly, the M6 delay measurement reported to TCE has already defined in TS38.314, so it is reasonable to include the involved assisted information in the TS38.314 as well. |
| China Telecom | Agree | Agree with Huawei.Since additional measurements for the total RAN delay calculation was agreed in previous RAN2 meetings, it seems reasonable to capture new corresponding formulas in TS 38.314. In our understanding, it will be beneficial to clarify the total RAN delay formulas, considering that different entities (RAN nodes or OAM) may have different calculation methods and this would result in inaccurate results received by CN. |
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Concerning the first question, 7 companies in total provided their comments

4 companies want to have total RAN delay calculation formulas in the L2M TS 38.314.

1 company wants to add agreements concerning total RAN delay calculation with/without PDCP duplication as further clarification to the TS 38.314

2 companies argues that it is not needed to have any formula, although agreeing that there might be different realization and interpretation when calculating the total RAN delay

Based on the fact that 5 out of 7 companies agree to have the formula (or further clarification) the following conclusion is made

**Proposal 1: RAN2 agree that for a consistent calculation of the total RAN delay per split DRB per UE, a set of formulas for total RAN delay calculation are needed. RAN2 has already agreed that the total RAN delay calculation can be used for QoS monitoring and MDT purposes.**

If companies conclude that it is needed to define the formulas for total RAN delay calculation, the moderator would like to ask them to provide their wiew on the following question.

In [2] it has been proposed to deifne the formulas for all the three scenarios quoted by RAN3 and the additonal measurements agreed by RAN3 i.e., defining total RAN delay formulars for the following scenarios:

1. **PDCP duplication is not enabled during the delay measurement period**
2. **PDCP duplication was enabled during the delay measurement period**
3. **PDCP duplication was enabled per packet basis i.e., some packets transmitted with dupplication and some packets without dupplication in a delay measurement period.**

While the solution proposed in [3] covers two first scenarios. Hence moderator would like to ask the companies to provide their view on the following question.

**Q2: If companies agree that defineing total RAN delay formulas are needed, do companies agree that the total RAN delay formulas are requried for all three scenarios mentioned in the RAN3 LS.**

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| Company | Agree (to all 3 scenarios)Disagree (please comment which scenarios do you think are needed to be covered) | Comment |
| Huawei, HiSilicon | Agree to firstly check RAN2#118-e agreements, and FFS for others | As we commented in Q1, the previous RAN2 agreements were made but no specs had captured them, which will lead to some problems.So we can firstly check these RAN2 agreements, and see how to capture them (either in RAN2 or SA5). For others, it may need some discussions.For bullet 3, we have some analysis in [3], i.e. copied as below:\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*For the scenario where the duplicated/non-duplicated status changes during the M6 measurement period, the calculation is complicated. One reasonable method is:* Firstly, the delay over one leg should be calculated in segments according to the duplicated/non-duplicated status of each packet during the measurement period
* and then, the delay over two legs is calculated based on the “weight average” over MCG/SCG

In this case, the DU needs to record and send the duplicated/non-duplicated of each packet to the CU, which brings extra signalling costs and specification impacts.**Proposal 2: In Rel-17, there is no need to consider the scenario where the dup/non-dup status changes during one period of M6 measurement.**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |
| Ericsson | Agree to all 3 scenarios | Concerning the comment provided by Huawei, we disagree on the analysis. Dupplication of PDCP packets takes place at the CU-UP and hence CU is aware of it. So there is no need to send any information about dupplication/non-dupplication from DU to the CU. To calculate the total RAN delay in third scenario (i.e., when PDCP duppliaction is enabled/disabled per packet basis) the following formula can be used.$$Total RAN Delay=\frac{\#TotalPackets\_{Non-Dup}×Delay\_{Non-Dup}+ \#TotalPackets\_{Dup}×Delay\_{Dup}}{\#TotalPackets\_{Non-Dup}+ \#TotalPackets\_{Dup}}$$wherein the $Delay\_{Non-Dup}$ and $Delay\_{Dup}$are calculated based on the first and second scenarios that Huawei agree on them. Hence calculating the total RAN delay in third scenario (enabling PDCP duplication per packet basis) is very easy and does not require extra information from DU. |
| Nokia | Disagree | Standardized formulas were out of scope in Rel-17 |
| CATT | See comments | For DL, it is the NW to control whether the PDCP duplication is performed, and the CU-UP could know it;But for UL, the MAC CE could be used to open/close the PDCP duplication from the UE. So if count in the NW side, the CU can not know clearly from which SDU the duplication starts, and DU also can not count the PDCP layer duplication. So some information should be sent from DU to CU for such statistic. Scenario 3 is hard to achieved based on current specification. |
| China Telecom | Agree and see comments | It seems that the issue depends on whether the relevant formula for scenario 3 should be included in the RAN3 LS. As both Huawei and Ericsson's formulas cover three scenarios, we agree to support all three scenarios.Considering that the first two scenarios are also sufficient to cover all cases, we are fine with only the two first scenarios, if that is preferred by the majority. |
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5 companies provided their comments and 4 companies support at least two first scenarios, therefore rapporteur provides the following proposals:

**Proposal 2: Total RAN delay calculation formula for split DRB in RAN node is to be specified in Rel 17, for the following scenarios:**

* **PDCP duplication is not enabled during the delay measurement period**
* **PDCP duplication was enabled during the delay measurement period**

**Proposal 3: Total RAN delay calculation formula for split DRB is to be discussed in Rel-18, for the following scenario:**

* **PDCP duplication was enabled per packet basis i.e., some packets transmitted with duplication and some packets without dupplication in a delay measurement period.**

Based on the discussion on [AT119e][801] in the reflector, the following proposal is also provided.

**Proposal 4: RAN2 discuss whether to specify the total RAN delay formula in TS 38.413 or liaise SA5 to consider the formulas in their specification.**

#  Conclusion

**Proposal 1: RAN2 agree that for a consistent calculation of the total RAN delay per split DRB per UE, a set of formulas for total RAN delay calculation are needed. RAN2 has already agreed that the total RAN delay calculation can be used for QoS monitoring and MDT purposes.**

**Proposal 2: Total RAN delay calculation formula for split DRB in RAN node is to be specified in Rel 17, for the following scenarios:**

* **PDCP duplication is not enabled during the delay measurement period**
* **PDCP duplication was enabled during the delay measurement period**

**Proposal 3: Total RAN delay calculation formula for split DRB is to be discussed in Rel-18, for the following scenario:**

* **PDCP duplication was enabled per packet basis i.e., some packets transmitted with duplication and some packets without dupplication in a delay measurement period.**

**Proposal 4: RAN2 discuss whether to specify the total RAN delay formula in TS 38.413 or liaise SA5 to consider the formulas in their specification.**

#  References

1. R2-2204498 – Reply LS on MDT M6 calculation for split bearers in MR-DC, RAN3, 3GPP TSG RAN WG2#118-e, e-Meeting, 9th - 20th May, 2022.
2. R2-2208206, Total RAN Delay calculation, Ericsson, 3GPP TSG-RAN2 Meeting #119, Electronic Meeting , 17th Aug - 29th Aug 2022.
3. R2-2207948 - Discussion on Capturing L2M Agreements in TS 38.314, Huawei, HiSilicon, 3GPP TSG-RAN WG2 Meeting #119, Electronic Meeting, Online, 17th – 29th August, 2022.