**3GPP TSG-RAN WG2 Meeting #124** **R2-23xxxxx**

**Chicago, IL, USA, November 13 – 17, 2023**

**Agenda item: 7.5.1**

**Source: LG Electronics Inc. (Rapporteur)**

**Title: [Post124][042][XR] 38.323 CR (LG)**

**Document for: Discussion and Decision**

# Introduction

This document collects the comments received during the following email discussion on PDCP CR for XR.

* [POST124][042][XR] 38.323 CR (LG)

Intended outcome: Agree to CR

Deadline: 2 weeks

# Contact information

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# Discussions

Companies can provide comments and suggestions to the PDCP CR:

|  |  |  |  |
| --- | --- | --- | --- |
| Company + Issue Number (e.g., L001) | Issue | Comments and proposed changes | Rapporteur comment |
| N001 | Editorial | Just to make sure: the final version needs to remove changes on changes, and the Annex. | Yes, definitely.  The changes on changes and the Annex are only included during the discussion for easy checking. |
| N002 | 3.1 and 5.6 Delay Critical | While we understand modifying the definition makes the procedure on data volume lighter, we would prefer sticking to the previous text to avoid specifying a behaviour within a definition.  **In response to the rapporteur comments:** we have a slight preference for option 3 since it is the cleanest. | This is the most tricky issue I have.  I agree it is not good to specify a behaviour in the definition section. But, 5.6 is not a proper place to capture the UE behaviour of delay-critical indication to RLC because 5.6 only talks about the delay-critical data volume.  I think there are three options to capture the delay-critical indication to RLC.  1. Add the behaviour in the definition section (as in current CR)  2. Add the behaviour in a NOTE below delay-critical data volume in 5.6.  3. Add a new section to specify the delay-critical data volume calculation and indication to RLC.  Other options are also welcome.  Let me hear more opinions before making changes.  In r1, the CR is updated based on Option 3. |
| N003 | “ including both already stored PDCP SDUs and newly received PDCP SDUs” | We do not recall an agreement justifying this, so unless we have misunderstood something, this change should be removed.  **In response to the rapporteur comments:** for discard, we believe the previous wording covered the discard of all SDUs. The wording “newly received” is a bit ambiguous since anything received should become an SDU right away. How about a note instead, to state that discard should also apply to any future SDUs of the PDU set ?  For data volume, we also agree that the whole PDU set should be reported but if SDUs are not stored yet, we need to rely on the RTP header extension (PSSize) and since we left PSI handling up to UE implementation, it would seem logical to also leave that to UE implementation. That is, only state that all SDUs of the PDU set should be taken into account. If needed, a note could be added like we did for the PSI, e.g. *Identification of the size of a PDU Set when not all SDUs have been received is left up to UE implementation* | For delay-critical data volume in 3.1, there was an agreement in R2#123.  The data volume calculation to be reported in the DSR will consider the at size of the full remaining PDUs in the PDU set (if any PDU within the PDU set is with remaining time below the threshold), if the PDU set discard is configured.  For SDU discard, I think it is common understanding that all newly received SDUs are discarded if they belong to the same PDU Set.  Let me hear more opinions before making changes.  In r1, for discard, a NOTE is added. For data volume, the definition of delay-critical PDCP SDU is updated to cover this. |
| N004 | 5.3 : “stored” | We do not recall an agreement justifying changing how discard operates (the change also affects legacy operation). So unless we have misunderstood something, this change should be removed.  **In response to the rapporteur comments:** since this impacts legacy behaviour, we would prefer not adding “stored”. | This change is made from R2-2311908 (vivo), but I’m ok without “stored”.  Let me hear more opinions before making changes.  In r1, “stored” is removed. |
| A001 | psi-BasedDiscard (5.2.1 and 7.3 *)* | The current text uses in sections 5.2.1 and 7.3 the term *“if psi-BasedDiscard is configured and PSI based SDU discard is activated”*. However, the RRC CR does not have a configuration for *psi-BasedDiscard*, we just have a capability there, since RAN2 agreed to control PSI based discard with a MAC CE. On the other hand, we have an RRC config for the new discard timer (*discardTimerForLowImportance*) which the network only configures if *psi-BasedDiscard* is supported by the UE.  So, the PDCP CR may use *“if discardTimerForLowImportance is configured and PSI based SDU discard is activated”* instead. | Thanks, that’s correct observation.  I’ll change “if psi-BasedDiscard is configured” to “if discarTimerForLowImportance is configured” in 5.2.1.  In 7.3, I’ll remove “psi-BasedDiscard is configured and”.  In r1, above changes are made. |
| A002 | Identify that PSI based discarding is activated by MAC (5.2.1 and 7.3) | Add a reference to the MAC spec for places where the term “PSI based SDU discard” is used, e.g., “PSI based SDU discard is activated as specified in TS 38.321 [4]”, for linking and identification. | I worry that it breaks the consistency of the specification. Overall procedure is similar to PDCP duplication, but there is no reference to MAC for PDCP duplication. |
| NEC001 | * 1. definition   The definition of “Delay-critical PDCP SDU” | Suggest deleting following text and moving it to other section if necessary.  ~~If~~ *~~pdu-SetDiscard~~* ~~is configured, all PDCP SDUs (including both already stored PDCP SDUs and newly received PDCP SDUs) belonging to the PDU Set to which at least one delay-critical PDCP SDU belongs are considered as delay-critical PDCP SDUs. If the corresponding PDCP Data PDU has already been submitted to lower layers, the delay-critical indication for the PDCP Data PDU is provided to lower layers.~~  Regarding Rapporteur comment on N002, we prefer Option 3. | In r1, the definition of delay-critical PDCP SDU is updated, and a new section is added for data volume calculation for DSR. |
| NEC002 | * 1. definition   Propose to add the definition of “Delay-critical PDCP data volume” if Option 3 is adopted. | Delay-critical PDCP data volume: the amount of delay-critical data available for transmission in a PDCP entity. | The definition is not really needed, so I didn’t include it in r1. But, if many companies think it is needed, I’ll add it to the next version. |
| NEC003 | 5.3 SDU discard | Suggest modifying as following  if *pdu-SetDiscard* is configured:  - discard all PDCP SDUs ~~(including both already stored PDCP SDUs and newly received PDCP SDUs)~~ belonging to the PDU Set ~~to which the PDCP SDU belongs~~ along with the corresponding PDCP Data PDUs; | In r1, the first suggestion is moved to a NOTE. The second suggestion is not adopted. |
| FW001 | 3.1 Definition of delay-critical PDCP SDU | We agree with N002 and NEC001 that procedural text should be no part of the definition. We also think the definition needs to be self-contained, i.e., not using “delay-critical PDCP SDU” in defining delay-critical PDCP SDU. Hence, we suggest the following changes against the previous definition:  **Delay-critical PDCP SDU**: a PDCP SDU for which the corresponding remaining time till *discardTimer* expiry is less than the *remainingTimeThreshold,* or when *pdu-SetDiscard* is configured, a PDCP SDU belonging to a PDU Set of which at least one PDCP SDU has the corresponding remaining time till *discardTimer* expiry less than the *remainingTimeThreshold*. | In r1, the definition of delay-critical PDCP SDU is updated based on the suggestion. |
| FW002 | 5.2.1 Transmit operation | If *discardTimerForLowImportance* is configured with an initial value of zero, we wonder whether the UE still needs to start *discardTimerForLowImportance* under the “if”. What is the UE’s behaviour when the UE starts a timer of zero, e.g., will the timer ever expire? Or, should we consider, for this case, that the UE immediately discards the SDU without starting *discardTimerForLowImportance*? | If the timer value is zero, the timer expires immediately after starts, which means that the SDU is immediately discarded. I believe this is common understanding. |
| FW003 | 5.3 SDU discard | We partially agree with NEC003 in deleting “(including both already stored PDCP SDUs and newly received PDCP SDUs)”, but not the second deletion in NEC003. | In r1, the changes are made based on suggestions. |
| FW004 | 5.6 indication of delay-critical PDCP PDU to RLC | We think the following new paragraph, using similar style as the legacy discard indication, can be added in 5.6, after the new text for delay-critical PDCP data volume calculation:  If the corresponding PDCP Data PDU that contains the delay-critical PDCP SDU has already been submitted to lower layers, the delay-criticality is indicated to lower layers.  because the title of 5.6 is “Data volume calculation” and it didn’t say it has to be PDCP data volume until we get to the leading sentences of the following paragraphs, i.e., a new section is unnecessary.  However, if this is not agreeable, Option 3 mentioned by the Rapporteur would be our second choice. Option 2 is not preferable because even the legacy discard indication is captured by a normatic text. | In r1, the CR is updated based on Option 3. |
| FW005 | 5.6 Data volume calculation when associated with at least two RLC entities | Since we haven’t prohibited XR from using more than one RLC entities under a transmitting PDCP entity, we think, in some cases, the delay-critical PDCP data volume may need to be indicted to the secondary RLC entity as well. The detailed TP has been proposed in the Second changes (Page 6) in Annex A of R2-2313421. | This issue has not been discussed before, and cannot be implemented at this moment. You may need to bring up the issue at the next meeting. |
| ASUS01 | The timer *discardTimerForLowImportance* is per DRB. Since QoS flow remapping may cause PDUs of a PDU Set being delivered into different DRBs, expiry of *discardTimerForLowImportance* may just discard partial PDUs of the PDU Set on the corresponding DRB. | There is a need for clarification on SDU discard. Here is a text proposal in clause 5.3:  - discard all PDCP SDUs (including both already stored PDCP SDUs and newly received PDCP SDUs in the same or different DRBs) belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs; | This issue has not been discussed before, and cannot be implemented at this moment. You may need to bring up the issue at the next meeting. |
| FW006 | 5.X Data volume calculation for delay status reporting | The following differences from the legacy cases are missing (our bad for not catching them in the first round):  - for AM DRBs, the delay-critical PDCP SDUs to be retransmitted according to clause 5.1.2 and clause 5.13;  - for AM DRBs, the PDCP Data PDUs containing the delay-critical PDCP SDUs and to be retransmitted according to clause 5.5. | The suggestion is not correct, because all PDCP SDUs or PDCP Data PDUs to be retransmitted are prioritized. This is agreement in R2#124  The PDCP SDUs and PDCP Data PDUs to be retransmitted for AM DRBs should be considered as the delay-critical PDCP data volume. |
| FW007 | 3.1 Definition of delay-critical PDCP SDU in r1 version | We think “(including both already received PDCP SDU and not yet received PDCP SDU)” in the definition is unnecessary. As Nokia had commented in their reply in N003, including “not yet received PDCP SDU” in the delay-critical data volume calculation would require the UE to know the PDU Set size at the beginning of the PDU Set. We think the UE reports DSR using only PDCP SDUs received up to the time that the DSR is generated. So, we prefer the following:  **Delay-critical PDCP SDU**: if *pdu-SetDiscard* is not configured, a PDCP SDU for which the remaining time till *discardTimer* expiry is less than the *remainingTimeThreshold*; if *pdu-SetDiscard* is configured, a PDCP SDU belonging to a PDU Set of which at least one PDCP SDU has the remaining time till *discardTimer* expiry less than the *remainingTimeThreshold*. | As many companies expressed concerns, the text in the bracket is removed in r2.  Editorial changes are not adopted because current text is aligned with other text in the specification. |
| FW008 | 5.3 SDU discard - NOTE 1 in r1 version | Replace “newly” with “subsequently” in NOTE 1, because “subsequently” better describes the timing relationship of the additional receiving and discarding, which occurs after the initial discarding. | In r2, “newly” is changed to “subsequently”. |
| S001 | Psi-BasedDiscard (5.2.1) | Please edit as below to reflect text better in section 5.2.1. If discardTimerforLowImportance is not configured, then the execution should go to ‘else’ case  - if *~~psi-BasedDiscard~~ discardTimerForLowImportance* is configured and PSI based SDU discard is activated, and the PDCP SDU belongs to a low importance PDU Set:  - start the *discardTimerForLowImportance* associated with this PDCP SDU ~~(if configured)~~; | The suggestion is adopted in r2 |
| S002 | 5.3 SDU discard - NOTE 1 in r1 version | We share the view with Futurewei to use ‘subsequently’ instead of ‘newly’ for more accurate description (same was also proposed in [Post123bis][026] by Samsung] | In r2, “newly” is changed to “subsequently”. |
| S003 | 3.1 Definition of delay-critical PDCP SDU in r1 version | We agree with the consideration for both ‘already received’ and ‘not yet received’ PDCP SDU, as accurate and reliable UE behaviour should be to account the entire PDU set size towards delay critical PDCP volume for DSR. If this is not considered, network scheduling may not be proper and adequate. However, it may also be noted that this delay critical PDCP volume calculation considering not yet received PDCP SDU, will be based on UE implementation. Therefore, we prefer the relevant text can be better placed in the new section 5.X, instead of the definition. The new section can describe what PDCP SDU is considered as delay critical PDCP SDU by the UE and how UE calculates the critical PDCP data volume for DSR | As many companies expressed concerns, the text in the bracket is removed in r2. |
| C001 | 3.1 Delay Critical | 1) We remember there was an unresolved FFS from Xiamen regarding the reported data volume: “FFS what to report for the case of not PDU set discard configured”. We don’t remember we formally discussed this. So we believe the same holds true for the definition of delay critical SDUs. In the current CR, a different definition is captured depending on whether PDU set discard is configured or not. However, we understand the DSR feature and the discarding of PDCP SDUs are independent features serving different purposes. Indeed, the former assists the gNB scheduler in assessing the UL resources needed by the UE, while the latter aims at getting rid of outdated data in the transmit queue. So, in our view, even when *pdu-SetDiscard* is not configured (for example networks still prefers to deliver late PDUs of a PDU Set), gNB scheduler should target scheduling and processing SDUs of a PDU Set altogether. Hence we think, to be useful for XR, Delay critical definition should always consider PDU Sets, independently of *pdu-SetDiscard* configuration. What should only matter is if the UE is able to identify PDU Sets for the QoS flow(s) mapped onto this DRB.  So in short, we suggest replacing the condition “if *pdu-SetDiscard* is not configured” with “if the UE reported that it is able to identify PDU Sets for the QoS flow(s) mapped onto this DRB”.  2) Note that even with the current definition, *pdu-SetDiscard* is configured per DRB, so it should be added “for this DRB”.  3) We agree with other companies that “not yet received PDCP SDU” cannot be part of the reported data volume in DSR. This is only about the discarding, which is taken care of by the Note in clause 5.3. | 1) There was an agreement in R2#123bis.  The data volume calculation to be reported in the DSR will consider the at size of the full remaining PDUs in the PDU set (if any PDU within the PDU set is with remaining time below the threshold), if the PDU set discard is configured. FFS what to report for the case of not PDU set discard configured  For the FFS part, though there was no clear agreement, majority think that it applies to the PDCP SDU.  2) PDCP specification is always specified from a PDCP entity point of view. It is clear that the text is applied for this DRB.  3) As many companies expressed concerns, the text in the bracket is removed in r2. |
| C002 | 5.2.1 Transmit | No discard timer should be started for an SDU which is discarded immediately upon being received per Note 1 of clause 5.3. | I think it can be handled by UE implementation. But, if more concerns are raised, we may add “without starting the discardTimer or discardTimerForLowImportance at the end of the NOTE 1”. |
| HW001 | Clause 5.2.1 Note Reordering | We still think it would be better not to reorder the notes. Perhaps it is not common, but they can be referred from other specs or other documents. We can start from “Note 0” instead. | NOTE is not referred to by the other specification, and there is no problem to change the NOTE number.  For example, check the note numbers in following sections. (Rel15 vs Rel17)  38.331 s5.3.8.3  38.321 s5.1.1 |
| HW002 | Clause 7.3 clarify that the legacy timer and newly defined timer will not start simultaneously. | under *a) discardTimer,* we need to add the text “if the PSI based SDU discard is not activated” after the current text “a new timer is started upon reception of an SDU from upper layer.”  Otherwise, it seems that legacy *discardTimer* will be always started for each newly arrived SDU, and the SDU may further start with the *discardTimerForLowImportance* in some cases. | The suggestion is adopted in r2. However, if other companies have concerns, it can be removed because it is clear from the procedure in 5.2.1. |
| O001 | [Question] Clause 5.3 | It was agreed #124 that the PSI based SDU discard and the PDU set discard should be independent features in XR. In our view, it implies the case exists that the PSI-based discard is configured/activated but the PDU set discard is not configured. If the case is there, what is the UE’s behaviour on SDU discard if *discardTimerForLowImportance* expires and *pdu-SetDiscard* is not configured? The UE shall “discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs” (due to the agreement below) or just “discard the PDCP SDU”? Try to confirm that the common understanding is the latter one, right?   * RAN2 thinks PSI can be useful for PDU set-based discard. RAN2 aims to introduce a mechanism to allow UE to handle discarding of packets with different PSI in case of congestion. FFS for other cases.   BTW: We share a similar view as Huawei (on HW002). The related suggestion captured in r2 can avoid the misleading that discardTime and discardTimerForLowImportance are started simultaneously. | My understanding (and I believe common understanding) is the latter one. |
| Xiaomi-001 | Clause 7.3 | a) *discardTimer*  This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3]. In the transmitter, a new timer is started upon reception of an SDU from upper layer if PSI based SDU discard is not activated.  We do not need to add this for legacy timer since in context 5.2.1, the legacy timer will only be started when PSI based SDU discard is not activated.  That is already clear. | I also think it is clear from 5.2.1, but Huawei and Oppo support this clarification.  Let’s keep it for now unless more objections are raised. |
| Xiaomi-002 | Clause 5.1.5 PDCP entity reconfiguration | Currently, there is a not in 5.1.5:  NOTE 1: The state variables which control the transmission and reception operation should not be reset, and the timers including *t-Reordering* and *discardTimer* keep running during PDCP entity reconfiguration procedure.  Similarly, *discardTimerForLowImportance* keep running during PDCP entity reconfiguration procedure.  Further more, we need to discuss that whether the shorter timer for low importance PDU sets keeps running when NW disables PSI based discarding by RRC reconfiguration. | In r3, changes in section 5.1.5 is added.  For the discard timer handling at PSI based discard disabling, there is no issue because discard timers are never stopped. |
| Xiaomi-003 | 5.X Data volume calculation for delay status reporting | Agree with FW006：  :  - for AM DRBs, the PDCP SDUs to be retransmitted according to clause 5.1.2 and clause 5.13;  - for AM DRBs, the PDCP Data PDUs to be retransmitted according to clause 5.5.  The PDCP SDUs and PDCP Data PDUs whose remaining time is small enough to be retransmitted for AM DRBs should definitely be considered as the delay-critical PDCP data volume. We are not sure whether a PDCP SDUs or PDCP Data PDUs which are to be retransmitted should also be counted as not delay critical even though their remaining time is still large enough.  Should put a FFS here. | Same comment as in FW006. The agreement is:  The PDCP SDUs and PDCP Data PDUs to be retransmitted for AM DRBs should be considered as the delay-critical PDCP data volume.  Moreover, there should be no FFS in the CR finalizing the WI. |
| V001 | 5.2.1 Transmit5.3 SDU discard | There are two cases which doesn’t need to start discardTimerForLowImportance:   1. In case discardTimerForLowImportance is configured with the value of zero 2. Subsequently received SDU belong to the PDU set if pdu-SetDiscard is configured.   Fort these two cases, no discard timer should be started for an SDU. We think it is better to clarify it, or some note should be added. | 1. Timer value 0 means the timer expires immediately after starts. This is same for other timers, e.g. t-Reordering, drx-InactivityTimer (MAC). No need for further clarification.  2. As CATT (C002) and Vivo support it, I added in r3 “without starting the discardTimer or discardTimerForLowImportance“ in the NOTE. |
| V002 | 5.3 : “stored” | During online discussion, some companies think the current specification does not state anything about what happens with its associated discardTimer when the corresponding PDU SDU is discarded due to ACK confirmation by PDCP SR. Then, if the discardTimer expires for the successful delivery of a PDCP SDU, it could trigger the discard of the other PDUs belonging to the same PDU Set.  We think it is better to add “stored” to make it clearer. | As Nokia opposed (N004), and there is not much support, it is not possible to include this change. |
| E001 | 5.2.1 Transmit | Agrees with the first part of Vivo V001 comment, i.e. if discardTimer is configured to 0 the SDU should be **immediately** discarded and no discard timer should be started. No further procedures for that SDU should take place, i.e. no COUNT association etc. This would benefit to be clarified as 0 value was previously not an allowed discard timer value. | See my comments to V001. Note that no further procedure is performed upon reception of a PDCP SDU except the start of the discard timer. |
| I001 | 7.3 Timers | Legacy discardTimer is still applicable when PSI based SDU discard is activated for those PDU Set which are not low importance PDU Sets (as it is currently captured in procedural text in section 5.2.1). We suggest updating the definition adding the text in highlighted red e.g., as follows  "a) discardTimer  This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3]. In the transmitter, a new timer is started upon reception of an SDU from upper layer if PSI based SDU discard is not activated or when PSI based SDU discard is activated if the SDU does not belong to low importance PDU Set." |  |
| I002 | (De)activated of PSI based SDU discard | The TP of sections 5.2.1 and 7.3 captures statements in relation to whether “**if PSI based SDU discard is (or not) activated**” however it is unclear which activation this refers to. We suggest adding that this comes from lower layer indication (as this behaviour is currently captured in TS 38.321 as part of the new section 5.18.X Activation/ deactivation of PSI-based SDU discard). On summary, suggest adding the following e.g., “if PSI based SDU discard is activated by lower layers” |  |
| I003 | Discard behaviour of PSI based SDU discard | From UE capability point of view, PDU Set based discard and PSI based discard are independent features (as agreed by RAN2, i.e. “*The PSI based SDU discard and the PDU set discard should be independent features in XR*”).  XR agreed CR to TS 38.300 explains that PSI based discard performs discard at the PDU Set level (based on the text “*In case of congestion, the gNB may use the PSI for PDU set discarding. For uplink, dedicated downlink signalling is used to request the UE to apply a shorter discard timer to low importance SDUs in PDCP.*”)  Section 5.3 allows that PSI based discard could be performed at SDU level when discardTimerForLowImportance expires and pdu-SetDiscard is configured, as shown in below reference:  “When the *discardTimer* or *discardTimerForLowImportance* expires for a PDCP SDU, the transmitting PDCP entity shall:  -    if *pdu-SetDiscard* is configured:  -    discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;  NOTE 1: PDCP SDUs subsequently received from upper layers are also discarded without starting the discardTimer or discardTimerForLowImportance if they belong to the PDU Set.  -    else:  -    discard the PDCP SDU along with the corresponding PDCP Data PDU.”  We wonder whether the functional behaviour of PSI based discard should be updated in the CR to 38.300 (or alternatively the PSI based discard procedure in section 5.3 should be updated to apply at PDU Set level). |  |

# Conclusion

TBD