3GPP TSG-RAN WG2 #112-e R2-2011039

Electronic, November 2nd – 13th, 2020

Agenda Item: 6.1.2

Source: Ericsson

Title: Summary on [AT112-e][046][NR16] Out-of-order CBG-based re-transmission

Document for: Discussion, Decision

# 1 Introduction

This document summarizes the following at-meeting email discussion after the 1st round online discussion:

**[AT112-e][046][NR16] Out-of-order CBG-based re-transmission (Ericsson)**

 Scope: Treat incoming LS (when it arrives), R2 input (R2-2010049), and make and agree on related Draft CRs.

 Intended outcome: Endorsed Draft CRs

 Deadline: by the Rapporteur (dep on R1).

R2-2010049 Out-of-order CBG-based re-transmission(s) with cancelled initial PUSCH transmission Ericsson discussion Rel-16

1st DISCUSSION

- Intel think that once we have info from R1, this will need significant discussion.

- Chair: We wait for R1. Separate email discussion on this topic (Ericsson), to be kicked-off as soon as LS from R1 is available. Rapporteur creates a draft for how to capture in R2 TSs.

To leave time for further discussion (if needed), the deadline for inputs is Wed Nov 11, 2000 UTC.

**Contact**

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| --- | --- | --- |
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# 2 Discussion

RAN1 has concluded the following, see the latest RAN1 chair notes [2]

|  |
| --- |
| **Agreements:*** When UE reports 5-25, the UE supports both in-order and out-of-order CBG-based retransmission(s) (not requiring 11-12 as prerequisite even for Rel-16 UE)
* For Rel-16, new FG for UE supporting only in-order CBG-based retransmission(s) (not requiring 5-25 as prerequisite) is introduced
	+ Whether/what TP for TS38.214 in Rel-16 is necessary should be discussed – Klaus (Nokia)
	+ Details of the new FG description should also be discussed
 |

The FG 5-25 [1] is the Rel-15 capability bit *cbg-TransIndication-UL*, see below in TS 38.306

| ***cbg-TransIndication-UL***Indicates whether the UE supports CBG-based (re)transmission for UL using CBG transmission information (CBGTI) as specified in TS 38.214 [12]. | UE | No | No | No |
| --- | --- | --- | --- | --- |

Subsequently, RAN1 agrees to introduce the new FG 11-12 with details shown below and the reference [3]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11. NR\_L1enh\_URLLC | 11-12 | CBG-based re-transmission for UL using CBGTI with only in-order CBG-based re-transmission(s) for cancelled initial PUSCH transmission | 1. Support of CBG-based PUSCH re-transmission(s) of a TB using CGBTI in case the initial PUSCH transmission was not cancelled due to gNB scheduling/indication/configuration. 2. Support of CBG-based PUSCH re-transmission(s) of a TB using CGBTI in case the initial PUSCH transmission was cancelled due to gNB scheduling/indication/configuration and the following condition is satisfied: the UE is scheduled for a re-transmission of a CBG #N in a given TB when CBG #N-1 has been transmitted before or is scheduled in the same UL grant that includes CBG#N. |  | Yes | N/A |   | Per UE | No | No |   |  | Optional with capability signaling  |

The above RAN1 agreement is in align with the principle of the approach 2 in the paper R2-2010049 (copied in Annex 5 for easy reference), in which a new “slimmed-down” version of the legacy bit is introduced. The RAN1 FG 11-12 is more precise in the sense that it also includes the case when there is no cancellation from the gNB. Per Ran1 feedback, due to NBC concern, Rel-15 *cbg-TransIndication-UL* cannot have new FG 11-12 as prerequisite and it is unnecessary to do something different in Rel-16. Additionally, with this approach, the only change is to add a new capability in Rel-16 38.306 which also simplifies a lot the RAN2 signalling discussion. From the rapporteur point of view, this seems to be one way forward.

**Question 1: Do you support adding a new capability bit for FG 11-12 and no other changes are needed?**

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| --- | --- | --- |
| **Company** | **Support (y/n)** | **Additional comments** |
| CATT | see comments | We may discuss whether the agreement 1 requires any clarification in current r2 spec.For example, it may be useful to clarify ***cbg-TransIndication-UL***Indicates whether the UE supports CBG-based (re)transmission for UL using CBG transmission information (CBGTI) with both in-order and out-of-order CBG-based retransmission(s) , as specified in TS 38.214 [12]. |
| Ericsson | Y | We do not prefer adding the above sentence. Technically, the Rel-16 capability supports 1. Both in-order and out-of-order, if not cancelled
2. Only in-order, if cancelled

Technically, the Rel-15 capability supports 1. Both in-order and out-of-order, if not cancelled
2. Both in-order and out-of-order, if cancelled

When (informally) talking about in-order and out-of-order support, it is restricted to that the initial PUSCH is cancelled. However, the capability (as seen by the Ran1 FG) also refers to the case when the initial PUSCH is not cancelled. To fully spell out these will be complicated and unnecessary, as this is clearly indicated in the field description.  |
| Intel | Yes, with comments | Agree with CATT. We also think that the Rel-15 capability field description may need to be updated to indicate that UE supports both in-order and out-of-order CBG-based retransmission(s) as in the RAN1 agreement. A more simplify suggestion:***cbg-TransIndication-UL***Indicates whether the UE supports both in-order and out-of-order CBG-based (re)transmission for UL using CBG transmission information (CBGTI) as specified in TS 38.214 [12]. |
| Apple | Yes with comments | Regarding Ericsson’s comments, our view is that we will not have out-of-order when initial is not cancelled, because the initial transmission always includes all the CBGs, which ensures in-order transmission already according to the definition. We also agree with CATT’s suggestion to change the description of R15 field. |

**Summary:** All companies are fine to introduce a new capability bit for FG 11-12. There is a majority view that the Rel-15 field should be clarified that it supports both in-order and out-of-order. After further clarification on the intention/meaning, rapporteur believe that it is acceptable for all and proposes that

**Proposal 1 Adds a new capability bit for in-order CBG-based retransmission (i.e., FG 11-12 in LS R2-2011120)**

**Proposal 2 Clarfiy in Rel-16 spec that the legacy *cbg-TransIndication-UL* bit indicate the support of both in-order and out-of-order CBG-based retransmissions.**

The TPs can be as below

#### 4.2.7.10 *Phy-Parameters*

| Definitions for parameters | Per | M | FDD-TDDDIFF | FR1-FR2DIFF |
| --- | --- | --- | --- | --- |
| ***cbg-TransCancelledPUSCH-UL-r16***Indicates whether the UE supports CBG-based re-transmission(s) of a TB using CBG transmission information (CBGTI) as specified in TS 38.214 [12] in the following two cases: 1. if the initial PUSCH transmission was not cancelled due to gNB scheduling/indication/configuration; and
2. if the initial PUSCH transmission was cancelled due to gNB scheduling/indication/configuration and the following condition is satisfied: the UE is scheduled for a re-transmission of a CBG #N in a given TB when CBG #N-1 has been transmitted before or is scheduled in the same UL grant that includes CBG#N.
 | UE | No | No | No |
| ***cbg-TransIndication-UL***Indicates whether the UE supports CBG-based (re)transmission for UL using CBG transmission information (CBGTI) as specified in TS 38.214 [12]. | UE | No | No | No |

The parameter is added in the RRC IE Phy-ParametersCommon

Phy-ParametersCommon ::= SEQUENCE {

 [[

 cbg-TransCancelledPUSCH-UL-r16 ENUMERATED {supported} OPTIONAL

 ]]

}

**Question 2: Do you agree with the above TP to capture the FG 11-12?**

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| **Company** | **Support (y/n)** | **Additional comments** |
| CATT | yes, but | we suggest a small update as the followingIndicates whether the UE supports CBG-based re-transmission(s) of a TB using CBG transmission information (CBGTI) with only in-order ‎CBG-based re-‎transmission(s) for ‎cancelled initial ‎PUSCH ‎transmission, as specified in TS 38.214 [12] in the following two cases: Thus it follows the R1 suggestion and is clearer.  |
| Ericsson | Yes | See above to address CATT’s comment for details. This capability also supports out-of-order when the initial PUSCH transmission is not cancelled. |
| Intel | Yes with comments | Our understanding from the RAN1 description is that UE can perform retransmission either if the initial PUSCH is cancelled or not. Hence maybe not to include ‘Cancelled’ in the field name? something like cbg-TransInitialPUSCH-UL-r16? |
| Apple | Yes with comments | We agree with Intel in not having ‘cancelled’ in the field name. |

**Summary:** Companies are various comments on the TP. Rapporteur suggest working directly on the draft CRs using FTP server.

**Lastly**, please fill in the below table if there are any other issues that need to be discussed in the email.

|  |  |
| --- | --- |
| **Company** | **Additional issues** |
| Apple | We will have issues if the R16 UE with the R16 field set enters R15 NW unless the R16 UE does not set the R15 field. In other words, if the UE sets R16 field, R15 field should be set to not supported. We are wondering is this needs to be captured in field description or leave it to UE implementation to make sure their config will not cause issues to the UE. |
|  |  |

**Summary:** Rapporteur understands that if a Rel-16 UE indicates it support both the Rel-15 field and the Rel-16 field, then there is no issue for the UE to operate with the Rel-15 gNB, since Rel-15 gNB understands the UE supports Rel-15 field. UE is allowed to set Rel-16 field but not Rel-15 field, but there is no issue if UE can indicate the support of both. Rapporteur’s suggestion is that this can be left for UE implementation.

# 3 Conclusion

TBC

4. References

1. TR 38.822, User Equipment (UE) feature list, Rel-15
2. Session Notes for NR UE Features, AI 7.2.11, 3GPP TSG RAN WG1 #103-e, October 26th – November 13th, 2020, NTT DoCoMo, Inc.

 <https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_103-e/Inbox/Hiroki_sessions/Session%20Notes_Hiroki_NR_UEFeatures_v009.zip>

1. R2-2011120, LS on updated Rel-16 RAN1 UE features lists for NR (R1-2009586; contact: NTT DOCOMO, AT&T).

5. Annex - Approach 2 of paper R2-2010049

**Approach 2 for Rel-15:**

No change to Rel-15. Rel-15 FG would hence only have the legacy bit with the legacy meaning, i.e. it would indicate that the UE supports both in-order and out-of-order CBG retransmissions.

| ***cbg-TransIndication-UL***Indicates whether the UE supports CBG-based (re)transmission for UL using CBG transmission information (CBGTI) as specified in TS 38.214 [12]. | UE | No | No | No |
| --- | --- | --- | --- | --- |

**Approach 2 for Rel-16:**

Add a new bit for the in-order scheduling alternative. Basically a slimmed down version of the legacy bit.

| ***cbg-TransCancelledPUSCH-UL-r16***Indicates whether the UE supports CBG-based retransmission for UL using CBG transmission information (CBGTI) in case the initial PUSCH transmission was cancelled and the following condition is satisfied: the UE is scheduled for a re-transmission of a CBG #N in a given TB when CBG #(N-1) has been scheduled before or CBG #(N-1) is scheduled in the same UL grant that includes CBG#N.The UE indicating support of cbg-TransIndication-UL also supports this feature.  | UE | No | No | No |
| --- | --- | --- | --- | --- |
| ***cbg-TransIndication-UL***Indicates whether the UE supports CBG-based (re)transmission for UL using CBG transmission information (CBGTI) as specified in TS 38.214 [12]. | UE | No | No | No |

UE signalling:

* A Rel-15 UE can indicate that it supports CBG retransmission by indicating that it supports *cbg-TransIndication-UL*. Both in-order and out-of-order CBG retransmission are supported.
* A Rel-16 can indicate that
	+ it supports in-order CBG retransmission, and does not support out-of-order CBG retransmission, when initial PUSCH transmission is cancelled, by indicating that it does not support *cbg-TransIndication-UL* and support *cbg-TransCancelledPUSCH-UL*.
	+ it supports both in-order and out-of-order CBG retransmission regardless of cancellation of initial PUSCH transmission, by indicating that it supports *cbg-TransIndication-UL*. In this case, the UE has to indicate support of *cbg-TransCancelledPUSCH-UL*.

This approach has the advantage that it is backwards compatible.

A drawback is a Rel-15 UE cannot indicate that it supports only in-order CBG retransmission. Since the understanding is that out-of-order is more difficult to implement, the entire feature of CBG-based retransmissions has a risk of not being implementable as there is no Rel-15 UE reporting the support of both out-of-order and in-order.