3GPP TSG RAN Meeting #99

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Discussion on Rel-18 WI scope for XR Enhancements

Agenda Item: 9.3.2.9

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Introduction

- As RAN2 concluded XR study on XR awareness, the WID should be updated accordingly.
- Views on the updates needed to the following existing WI objectives based on the latest RAN2 discussions:
  - Provision of XR traffic assistance information for DL and UL (e.g. periodicity); (RAN2);
  - Discard operation of PDU Sets (RAN2);
  - BSR enhancements including at least new BS Table(s); (RAN2);
  - Delay reporting of buffered data in uplink; (RAN2)
- Minor clarification on the following objective:
  - Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE (RAN1);
- View on the following new topics that were discussed in the last RAN2 meeting:
  - No HARQ re-transmission for UL Pose/Control traffic
  - Tethering use case support

Update of the existing WI objectives (1/5)

XR awareness: PDU set details

- Conclusion on TR 38.825 within XR awareness:
  - *Provisioning by CN of semi-static information per QoS flow (e.g. PDU set QoS parameters), dynamic information per PDU set (PDU Set information and Identification) and End of Data Burst indication(as per TR 23.700-60 [9]);*
  - *Identifying by UE of PDU Sets, Data bursts and PSI;*
  - *Provisioning by UE of XR traffic assistance information e.g. periodicity, UL traffic arrival information (FFS).*
- RAN2 agreements
  - RAN2#119
    - *RAN2 assumes that PDU Set based parameters and PDU Set related information may be used for better support of XR services. RAN2 can consider both UL and DL directions.*
    - *RAN2 to adopt the current SA2 definition of PDU Set as an application media unit as working assumption, subjected to further guidance from SA2 and SA4.*
  - RAN2#119bis
    - *From RAN2 viewpoint, the following information would be useful for PDU set handling in UL and DL: Semi-static information (from CN to RAN): At least PSER and PSDB, as well as, Dynamic information: At least identifying which PDU belongs to which data burst/PDU set is also needed, including means to determine at least PDU set boundaries.*
  - RAN2#120
    - *Agree that UE identifies PDU Sets / Bursts. In-band marking not needed. Further information considered if BSR is not enough.*
  - RAN2#121
    - *Introduce UL PDU Set Importance. How UE derives this will be handled in UE implementation. Can indicate that in RAN2 considers PDU set concept applicable to both UL & DL in LS to SA2*
    - *Support of RLC bearer splitting should be limited to existing cases (e.g. PDCP duplication), no new XR-specific functionality*
    - *Since we already agreed to not support delay-aware LCP, RAN2 aims not to introduce changes to LCP due to PDU prioritization.*
- Proposed update to related WI objective
  - Provision of XR specific ~~traffic assistance~~ information for DL and UL ~~(e.g. periodicity)~~ from CN to RAN, including semi-static XR information provided per QoS flow and dynamic XR information provided per PDU based on SA2 PDU set design (RAN3);

Update of the existing WI objectives (2/5)

XR awareness: Discard

- Conclusion on TR 38.825 within capacity enhancements:
  - Discard operation of PDU Sets.
- RAN2 agreements
  - RAN2#119bis
    - *1. For UE transmitter, PDCP discard should be performed per PDU set basis.*
    - *2. For UE transmitter, PDCP discard is managed per SDU for PDU set, the PDCP entity discards all PDCP SDUs associated with the PDU set.*
    - *Keep discard description at XR awareness (we assume it may impact both capacity and power saving). Can re-consider based on SI progress. Discuss in the next meeting how we handle overlaps between XR awareness and capacity/power saving enhancements.*
  - RAN2#120
    - *RAN2 to support timer-based discarding of UL transmit side of PDCP PDU/SDUs of a PDU set. FFS how this is modelled in PDCP specification, can be discussed in WI phase*
  - RAN2#121
    - *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.
- Proposed update to related WI objective
  - Discard operation ~~of PDU Sets~~ for PDUs of a PDU set (including complete PDU Set) considering PDU Set Importance (PSI), and PDU Set Integrated Handling Indication (PSIHI) (RAN2);

Update of the existing WI objectives (3/5)

Power saving enhancements specific to XR

- Conclusion on TR 38.825 on power saving:
  - *DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling).*
- RAN2 agreements
  - RAN2#119bis
    - *1: At least RRC pre-configuration and switching of configurations of DRX could be considered for enhancements of XR power saving. Other solutions are not precluded and can be further discussed*
  - RAN2#120
    - *RAN2 aims to allow XR frame rates that correspond to non-integer periodicities in at least semi-static manner (e.g. RRC). Details can be left to WI phase*
- No proposed update to related WI objective
  - DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling) (RAN2).

Update of the existing WI objectives (4/5)

Capacity enhancements specific to XR: BSR

- Conclusion on TR 38.825 within capacity enhancements:
  - *BSR enhancements including at least new BS Table(s);*
  - *Delay reporting of buffered data in uplink;*
- RAN2 agreements
  - RAN2#119bis
    - *1: introduce new BS table(s) to reduce the quantisation errors (e.g. for high bit rates). FFS how new BSR tables are created and how they impact BSR formats (can be discussed in WI phase).*
    - *Delay information consists of at least "remaining time".*
      - *2: RAN2 considers a delay information is useful for XR. FFS if dynamic reporting from UE to network (e.g. via BSR) is needed, or whether PSDB is sufficient. If we have delay information, it needs to distinguish how much data is buffered for which delay value. Stage-3 details (e.g. what's contained, how the triggering is done) can be discussed in the WI phase. If we have delay information reporting, RAN2 aims to define how the UE determines the "remaining time" in the delay information*
  - RAN2#120
    - *RAN2 thinks we need one or more additional BSR table(s) for XR. FFS whether these are static (=specified) or dynamic (e.g. generated, differs according to some RRC parameter), can be discussed in WI phase.*
    - *RAN2 will introduce data volume information associated with delay information (e.g. remaining time) in a MAC CE. FFS if this is extension of BSR or new format. FFS how to do that (e.g. what exactly is reported) and how to ensure this information is up-to-date e.g. considering UL scheduling delay.*
    - *RAN2 needs to discuss additional BSR triggering conditions to allow timely availability of buffer status information at gNB. This can be discussed in WI phase.*
  - RAN2#121
    - *New BSR tables are fixed (=specified) or semi-static (RRC-based). FFS how many BSR tables are defined.*
- Proposed update to related WI objective
  - BSR enhancements including at least new BS Table(s), defined in a non-dynamic manner, new trigger(s) and delay budget usage/reporting of buffered data in uplink (RAN2);

Update of the existing WI objectives (5/5)

Capacity enhancements specific to XR: CG

- Conclusion on TR 38.825 within capacity enhancements:
  - *Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration;*
  - *Dynamic indication of unused CG PUSCH occasion(s) based on UCI by the UE;*
- Motivation of the update
  - RAN1 understanding supported at least by majority view during SI phase and RAN1 #112 was that the second objective focus in a CG period, i.e. dynamic indication of unused CG PUSCH occasions does not target to be across multiple periods. UE cannot get the accurate resource usage information in multiple CG periods, thus UCI cannot indicate the unused resource in this case, note the traffic size in later CG periods may not be known from UE side when the UCI is transmitted. Moreover, there is concern on the overhead of UCI in this case. A UCI indication for a CG period should be the most essential use case.
- Propose update to related WI objective
  - Dynamic indication of unused CG PUSCH occasion(s) in a period based on UCI by the UE (RAN1);

Potential new topics (1/2)

No HARQ re-transmission for UL Pose/Control traffic

- RAN2 deferred this discussion to RAN plenary:
  - Whether the issue of retransmission-less CG for UL pose transmission is addressed in the WI needs to be discussed in RAN
- There is broad agreement that avoid HARQ re-tx for UL Pose could be helpful
  - But there are different opinions on how to specify it
  - RAN2 has not studied the different solutions in detail
- Proposal:
  - Rel-18 XR WI re-uses the solution that were introduced for NTN for re-transmission-less HARQ
  - Introduce a new objective:
    - Enable Retransmission-less CG for UL pose/control transmission using NTN HARQ less operation as baseline (RAN2).

Potential new topics (2/2)

Tethering use case support

- RAN2 Agreements:
  - *RAN2 thinks UL jitter may be present for XR (e.g. for tethering use cases). It is unclear how network would use UL jitter information (depends on what would be signalled, and would anyway be up to network implementation).*
  - *RAN2 intends to support tethering use case for XR. This may require signalling of some UL traffic arrival information from UE to network*
- While RAN2 agreed to support tethering, there was no consensus on jitter information should be signalled from UE to network
  - How jitter information is used by the network
  - How jitter information is signalled to the network
  - How UE can reliably determine jitter information or whether it is consistent
- Two options to consider
  - **Option 1:** Study further during the WI whether any additional enhancement is needed for tethering use case e.g. defining signaling of some UL jitter or traffic arrival kind of information from UE to network). Or
  - **Option 2:** Not specify signalling enhancements to improve tethering use case in Rel-18
- Proposal:
  - Not to specify any signalling enhancements to improve tethering use case in Rel-18

Conclusion

Proposal 1: Adopt the following updated objectives in Rel-18 XR WID

- XR awareness enhancements
  - Provision of XR specific information for DL and UL from CN to RAN, including semi-static XR information provided per QoS flow and dynamic XR information provided per PDU based on SA2 PDU set design (RAN3);
  - Discard operation for PDUs of a PDU set (including complete PDU Set) considering PDU Set Importance (PSI), and PDU Set Integrated Handling Indication (PSIHI) (RAN2);
- Capacity enhancements
  - BSR enhancements including at least new BS Table(s), defined in a non-dynamic manner, new trigger(s) and delay budget usage/reporting of buffered data in uplink (RAN2);
  - Dynamic indication of unused CG PUSCH occasion(s) in a period based on UCI by the UE (RAN1);

Proposal 2: Adopt the following new objectives in Rel-18 XR WID

- Enable Retransmission-less CG for UL pose/control transmission using NTN HARQ less operation as baseline (RAN2);

Example of proposed changes to WID objectives

Specify the enhancements related to power saving:

- DRX support of XR frame rates corresponding to non-integer periodicities (through at least semi-static mechanisms e.g. RRC signalling) (RAN2).

Specify the enhancements related to capacity:

- Multiple CG PUSCH transmission occasions in a period of a single CG PUSCH configuration (RAN1, RAN2);
- Dynamic indication of unused CG PUSCH occasion(s) in a period based on UCI by the UE (RAN1);
- BSR enhancements including at least new BS Table(s), defined in a non-dynamic manner, new trigger(s)~~; (RAN2);~~
- ~~D~~ and delay budget usage/reporting of buffered data in uplink; (RAN2);
- Enable Retransmission-less CG for UL pose/control transmission using NTN HARQ less operation as baseline (RAN2);

Specify the enhancements for XR Awareness

- Provision of XR specific ~~traffic assistance~~ information for DL and UL ~~(e.g. periodicity);~~ from CN to RAN, including semi-static XR information provided per QoS flow and dynamic XR information provided per PDU based on SA2 PDU set design ~~(RAN2)~~ (RAN3);
- Discard operation ~~of PDU Sets~~ for PDUs of a PDU set (including complete PDU Set) considering PDU Set Importance (PSI), and PDU set Integrated Handling Indication (PSIHI) (RAN2);

~~Specify the enhancements for XR Awareness (RAN2, RAN3): TBD (detailed objectives will be further clarified at RAN#99 based on the conclusions of TR38.835, and work to be started only after RAN#99)~~

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