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Enhancements for XR over NR support

RAN Rel-18 Workshop

28th June – 2nd July 2021

RWS-210070

Nokia, Nokia Shanghai Bell

Motivation

- Extended Reality (XR), including Augmented Reality (AR) and Virtual Reality (VR), as well as Cloud Gaming (CG), present a new promising category of connected devices, applications and services.
  - Market of XR and CG devices and services is rapidly growing every year

- These XR and CG devices are typically featured by:
  1. Predictable semi-periodic traffic (e.g., AR glasses orientation updates every 4 ms)
  2. High-rate data flows (e.g., FullHD/4K video to VR glasses)
  3. Stringent latency and reliability requirements (e.g., XR gaming and CG)
  4. Strong weight, size, performance, and power consumption constraints (as many XR devices are wearables)
- Hence, **supporting XR services as regular eMBB service in NR may be not optimal**
  - There is an ongoing SI in Rel 17 on ”XR for NR”, where several important XR features have been identified:
- This work item aims to enhance XR support for NR in Rel-18. **The following should be studied:**
  1. Radio resource allocation & RRM enhancements [RAN1/RAN2/RAN4]
  2. Mobility and beam management enhancements [RAN2/RAN4]
  3. UE power saving enhancements for XR use cases [RAN2/RAN3]
  4. Higher layer QoE enhancements, including SA aspects [RAN2/RAN3/SA2]

Objectives

1. Radio resource allocation & RRM enhancements [RAN1/RAN2/RAN4]
2. Mobility and beam management enhancements [RAN2/RAN4]
3. UE power saving enhancements for XR use cases [RAN2/RAN3]
4. Higher layer QoE enhancements, including SA aspects [RAN2/RAN3/SA2]

Enhancements for XR (1): Radio Resource Allocation & RRM

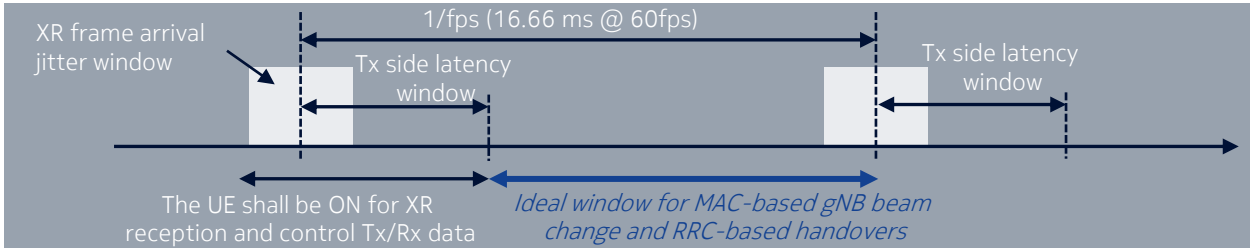
Radio resource allocation & RRM enhancements [RAN1/RAN2/RAN4]

- Enhanced semi-persistent scheduling (eSPS) and Configured Grant [RAN1/RAN2]
  - *(i) periodicities that match XR traffic characteristics, (ii) multiple TBs per periodicity, (iii) dynamic on-the-fly change of eSPS and Configured Grant configuration.*
- FR2 prioritized decoding during SSB based measurement timing configuration (SMTC) [RAN2/RAN4]
  - *To ensure decoding of XR transmissions for FR2. Configuration of UE to prioritize decoding of potentially critical PDCCH/PDSCH transmissions from its serving cell, even if colliding with SMTC windows where the UE may perform RSRP measurements.*
- FR2 intra-frequency RRM measurement awareness [RAN2/RAN4]
  - *To improve the scheduling algorithm, UE informs gNB when it is performing and not performing intra-frequency measurements. This increases the amount of scheduling opportunities in case UE is not performing intra-frequency measurements (or applies the scheduling restrictions in case UE is performing intra-frequency measurements).*

Enhancements for XR (2): Mobility and Beam Management

Mobility and beam management enhancements [RAN2/RAN4]

- Synchronous MAC-based gNB beam switching [RAN2/RAN4]
  - *To ensure time-synchronized beam switching between UE and gNB. It enables gNB to control that the time of gNB beam switching happens outside the window of the critical XR transmission.*
- Enhanced conditional handover (eCHO) [RAN2/RAN4]
  - *To ensure proper timing of HO execution to minimized impact latency impact on XR frame transmission to increasing the probability that the XR QoS requirements are fulfilled during such handovers.*
- Enhanced Dual-Active Protocol Stack (DAPS) [RAN2/RAN3/RAN4]
  - *To reduce handover interruption time close to 0 ms in both DL and UL for intra-frequency FR2-FR2 scenario, DAPS enhancements are proposed. This includes specification of DAPS for FR2-FR2 case, as Rel. 16 DAPS handover is not specified for intra-frequency FR2-FR2 handover. Details are in "Mobility Enhancements for Rel-18 " [RWS-210078].*



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Enhancements for XR (3): UE Power Saving

UE power saving enhancements for XR use cases [RAN1/RAN2/RAN3]

- Adaptive discontinuous reception (aDRX) [RAN1/RAN2/RAN3]
  - *The current DRX configurations do not fit well for (i) the non-integer XR traffic periodicity, (ii) variable XR data rate and (iii) quasi-periodic XR periodicity. Define support for: (i) adaptive configuration of DRX parameters, (ii) dynamic on-the-fly change of aDRX configuration, (iii) resynchronization of DRX cycle and XR periodicity due to periodicity mismatch.*
- Dynamic configuration of DRX [RAN1/RAN2/RAN3]
  - *To reduce the UE power consumption while meeting maximum latency budget, enable dynamic scale up/down of DRX cycle and ON duration. New assistance information of e.g., current frame rate (frames per second, such as 30 fps, 60 fps, or 120 fps) helps gNB to improve UE power and satisfaction models.*

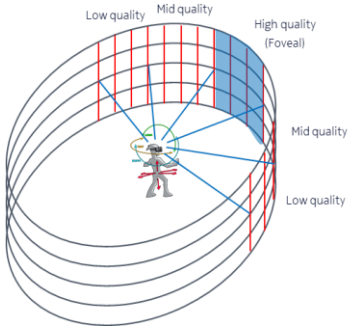
It is desirable to consider DRX enhancements that enable the (semi-)dynamic reconfiguration of DRX parameters, without having to fully release an existing DRX configuration and setup a new one.

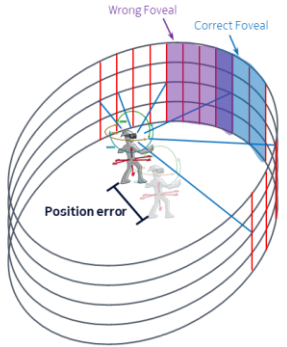
Enhancements for XR (4): Higher Layer QoE

Higher layer QoE enhancements, including SA aspects [RAN2/RAN3/SA2]

- VR traffic prioritization and differentiation [RAN2/SA2]
  - *To enable scheduling prioritization and improved resource allocation for on-demand VR streaming, e.g., based on Dynamic Adaptive Streaming over HTTP (DASH), extension of Time Sensitive Communications Assistance Information (TSCAI) is needed. There is a benefit in e.g., defining a maximum presentation latency (MPL: the time between the first HTTP request and the last HTTP response for a burst of data). A VR scene cannot be fully rendered without the last HTTP response, hence MPL determines the QoS for XR UEs.*

- View port identifier (VPI) and pose information accuracy [RAN2/RAN3/SA2]
  - *VPI enables QoS differentiation of the multiple streams that compose different portions of the user view (e.g., far, mid, near field of view). To support VPI, multiple 5QIs per QoS flow are needed. New assistance information related to pose information accuracy would help in improving resource reservation and management.*





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