

3GPP TSG RAN Rel-19 Workshop

15th – 16th June 2023

RWS-230459

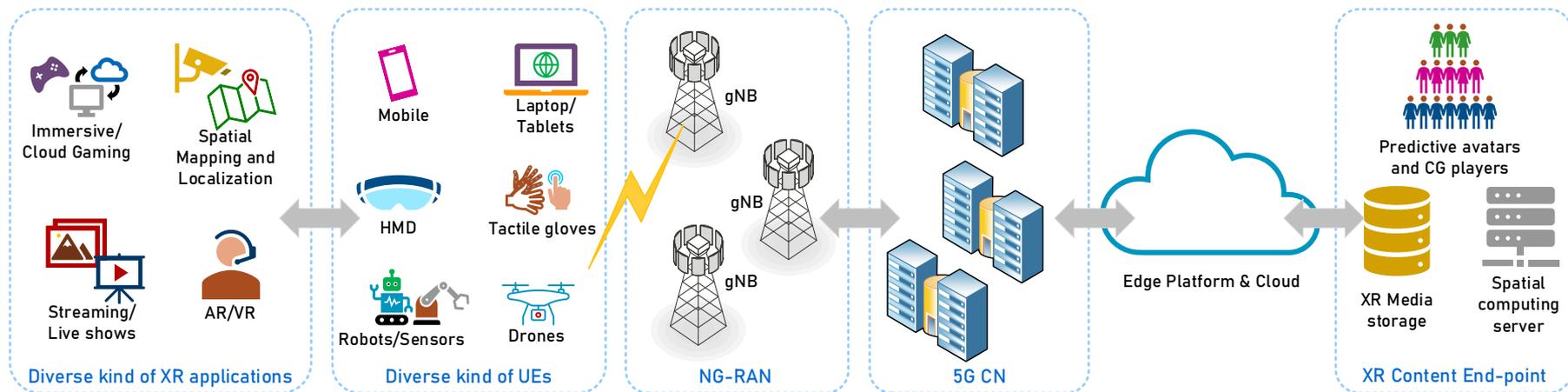
# XR Enhancements in Rel-19

Agenda Item:	5
Source:	Intel Corporation
Document for:	Discussion



# End-to-end 5G system for XR use cases in Rel-19

3GPP continues enhancements of 5G system (UE/NG-RAN & 5G-CN) considering XR-specific characteristics:



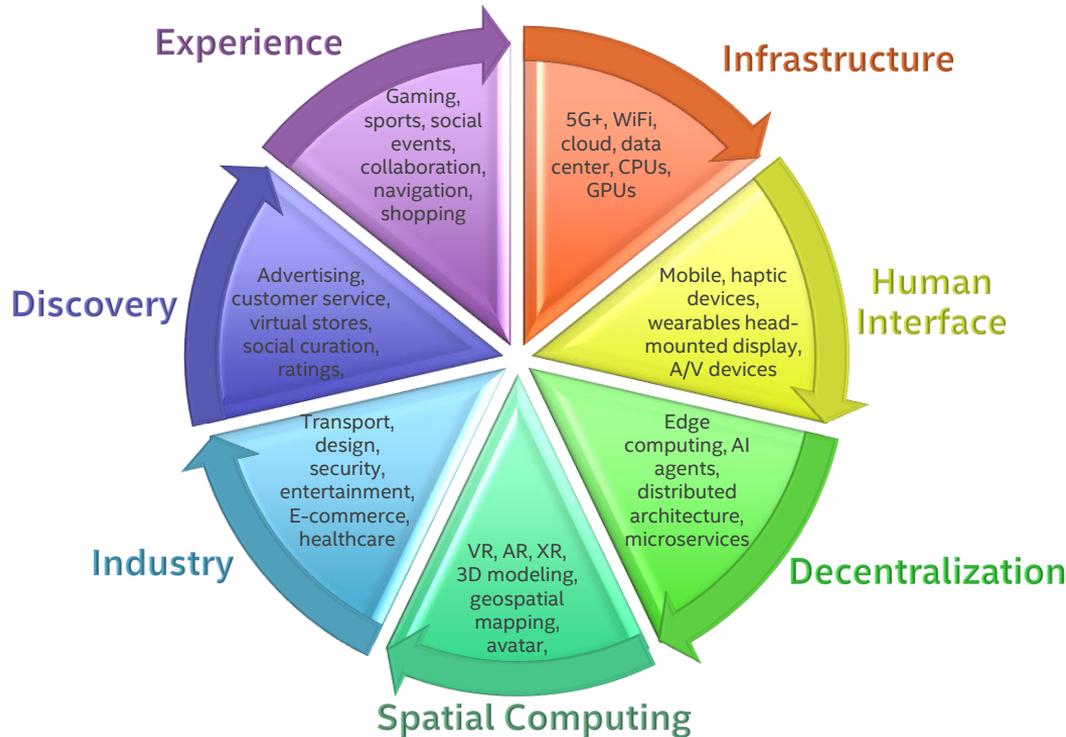
- ✓ XR specific traffic in DL and UL with 1 or more streams e.g.
  - I and P streams
  - Video and audio/data streams
  - FOV + omnidirectional view
  - Pose/control traffic

- ✓ Multiple devices associated to one or multiple user(s) in same or different locations
- ✓ Differentiation of XR packets or group of XR packets (i.e. "PDU set")

- ✓ Enhancements to NG-RAN and 5G CN to better support XR traffic characteristics not covered in Rel-18 XR e.g.
  - Multi-modality
  - Inter-PDU set dependency
- ✓ Enhance XR operation when operating with 5G features of interest, such as, URLLC, positioning, sidelink (as studied by SA1 in Rel-19 Metaverse)

*NOTE: Coordination expected with SA4, SA2, e.g., to identify additional XR traffic characteristics to consider and new target use cases/requirements of interest*

# Metaverse use cases and RAN impacts



- Some XR related use cases are described in TR 22.856 as part of Rel-19 SA1 Metaverse.
- On XR-specific topic, NR could be further enhanced to support multi-modal XR traffic in order to enable flexible coordination of services for one or multiple application(s) and/or UE(s)

# XR Traffic with Multi-modal Data

Rel-19 Proposal: For XR traffic with Multi-modal Data, RAN/UE enhancements targeting different/multiple data streams of one XR application

- Potential RAN/UE enhancements include:
  - Multiple active C-DRX configurations simultaneously
  - Synchronized or coordinated transmissions
  - Discard across streams
  - UE assistance/feedback information

## Background on Multi-modal Data

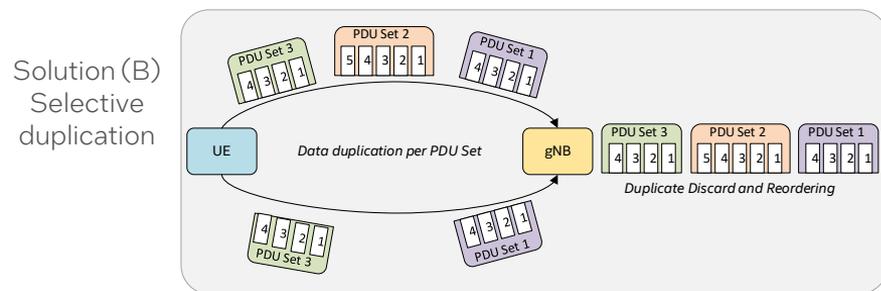
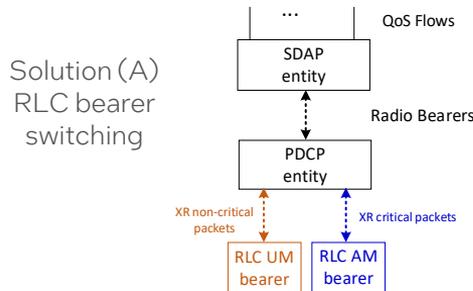
As defined by SA2, Multi-modal Data refers to data coming from different kinds of devices or sensors to one or different kinds of destinations (i.e., one or more UEs) that are required for the same task or application.

- Multi-modal data refers to data from some advanced XR applications which generates multiple types of traffic flows (e.g., video/audio stream, as well as sensor data for more immersive experience)

# Differentiated PDU Set Handling in a QoS Flow

Rel-19 Proposal: differentiated handling (including e.g., reliability, prioritization) of PDU set with different importance (i.e., PSI) in a given QoS flow

- Background: Rel-18 enhanced discard during congestion, however AS layer should not make differentiation on the reason why a packet fails (e.g., bad radio signal conditions, collision, congestion, exceeding the tolerable delay).
- Motivation: From system requirement perspective, RAN enhancements should focus on how a packet is delivered successfully to the receiver end point. E.g., for those PDUs identified as higher importance (i.e., PDUs belonging to a PDU set with higher PSI value), it is helpful if they could be provided with higher reliability or more robust mechanism over the radio. This could always be enabled or selectively when applicable (e.g., based on UE's radio conditions or when PSER/PER is below certain threshold).
- Potential solutions: (A) a single PDCP entity could be mapped to multiple RLC AM bearers and/or (B) multiple RLC UM bearers as required to support different handling of the PDUs with different PDU set importance.



# Enhancements associated to PDU Set Dependencies and Measurement Gaps for XR Traffic

## Rel-19 Proposal: PDU set discard enhancements for inter-PDU set dependencies

- Background: PSIH (PDU Set Integrated Handling Information) indicates whether all PDUs of the PDU Set are needed by the application layer in the receiver side but in Release 18, a PDU Set is considered as successfully delivered only when all PDUs of a PDU Set are delivered successfully.
- Motivation for inter-PDU Set Dependencies: for some XR applications, a PDU Set can be required a successful delivery of other related PDU Set (here referred as inter-PDU Set).

## Rel-19 Proposal: Measurement gap enhancements to mitigate the impact on the XR traffic

- Motivation: to minimize impact of measurements to XR traffic while also reducing the scheduling restrictions (e.g., to reduce delay and discard of packets), as initially discussed in Rel-18 XR.
- NOTE-1: This area of enhancement is not XR specific.
- NOTE-2: RAN4 Rel-19 material (RWS-230460) also includes measurement gap related enhancement for time-sensitive or reliability-sensitive types of services which could apply to XR.

# Summary on enhancements to XR operation

In Rel-18, RAN and UE are enhanced to consider XR specific information although some topics of interest were not pursued due to lack of time/interest or foreseen impacts. SA1 Rel-19 TR 22.856 captures Metaverse use cases (which are a super set of XR).

## Rel-18

Discard operation for intra-PDU set

BSR enhancements considering XR characteristics and including delay reporting of UL buffered data

C-DRX support of XR traffic with non-integer periodicities

Multiple CG PUSCH transmission occasions in a period of a CG PUSCH configuration

Retransmission-less CG enhancement for XR

## Rel-19

Differentiated handling (e.g., reliability, prioritization) of different PDU set importance in a given QoS flow

Support of Multi-Modal XR data (i.e., different streams of an application) e.g., synchronization of related streams, multiple C-DRX active simultaneously

PDU set discard enhancements due to inter-PDU set dependencies

Measurement gap enhancements to mitigate the impact on the XR traffic

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