

3GPP TSG RAN Rel-19 workshop
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RWS-230410

Support for XR enhancement in Rel-19

Huawei, HiSilicon

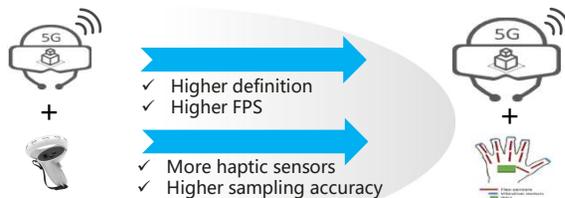
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Trends of XR evolution

• XR evolution

- **Higher data rate:** Future XR service is supposed to provide better visual quality (e.g. higher definition and higher FPS)
- **Multi-modality:** More types of devices can bring various sensation to improve the user immersive experience
 - Haptic sensors have been deployed in the current commercialized XR service (e.g. joypad) and are supposed to be wildly used in the future (e.g. tactile gloves and tactile suits)



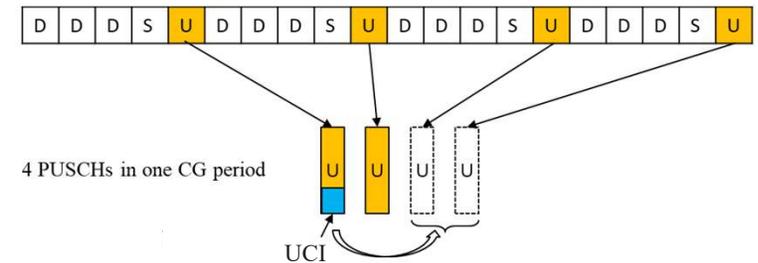
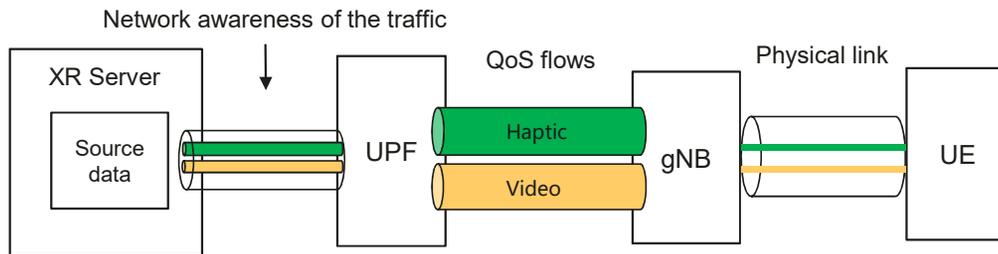
• Latest survey on XR use cases

- VR/AR/MR
 - Annual shipments of XR device is about 15 million in 2022 and will go to 26 million in 2023 [* From Omdia]
- Cloud gaming
 - In 2022, the average monthly users approaches 343 million globally and is foreseen to grow up 50% in 2023 [*From IDC China]
- Glass-free 3D
 - 2~3x data volume than conventional 2D video



Solutions in Rel-18 for XR

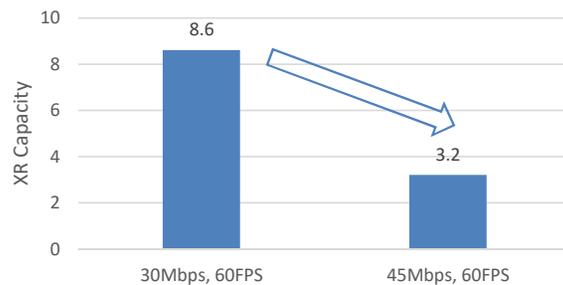
- SA: identify data flows which belong to one application service but with different transmission requirements
 - Delay budget and error rate for PDU sets (PSDB, PSER), differentiation of importance for PDU sets in one QoS flow (PSIHI)
- RAN2: XR awareness, capacity enhancement, power saving
 - New BSR tables, buffering delay report, multiple CG PUSCH occasions, C-DRX enhancement
- RAN1: CG enhancement
 - Multiple CG PUSCH occasions, indication of unused CG occasions (UTO-UCI)



Challenges for XR evolution

- **Challenges to guarantee latency requirement**

- Higher data rate raises new challenge for transmission to guarantee latency requirements

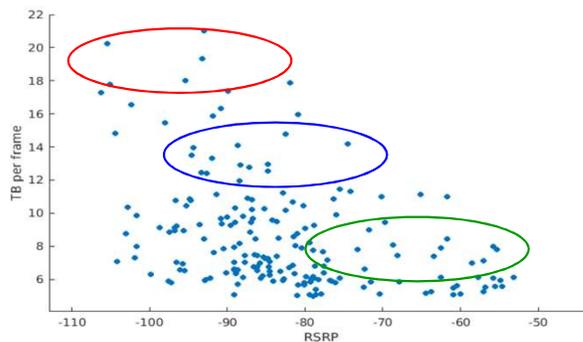


XR capacity is defined as the maximum number of users per cell with at least 90 % of UEs meeting latency requirement.

*Dense Urban, MU-MIMO, GOP-based I/P multi-stream model [TR 38.838]

- The channel of the mobile network is time-varying

- Mid-to-far-range users needs more TB number for frame delivery and more retransmission leads to uncertain latency



Far users: 18 ~ 22 TBs

Mid users: 12 ~ 15 TBs

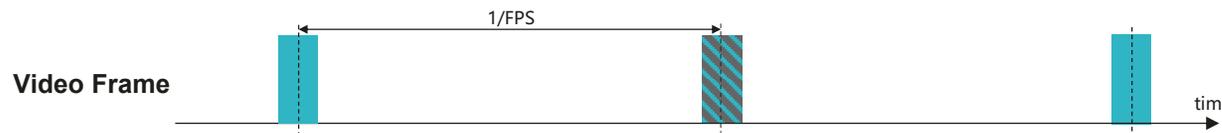
Near users: 5 ~ 9 TBs

*Dense Urban, MU-MIMO, 60Mbps@60FPS, 21 cells, 9 UEs per cell

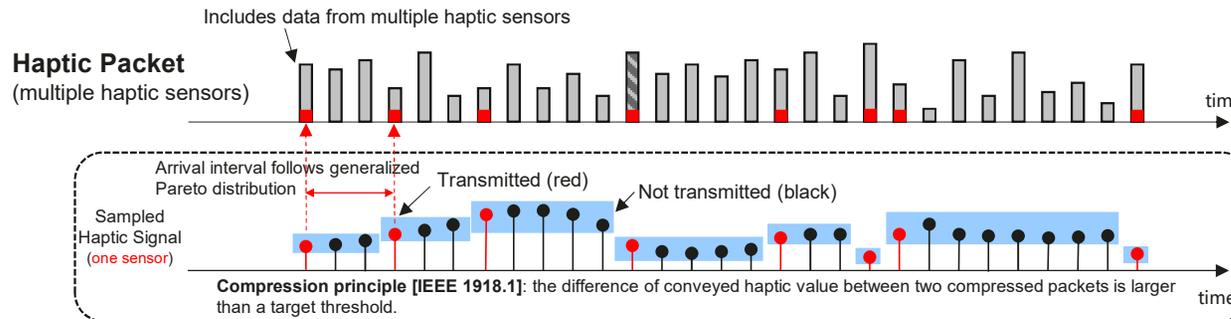
Challenges for XR evolution

• Challenges to support multi-modal XR

- Two modals have **different traffic characteristics** (video: periodic arrival with large burst; Haptic: frequent arrival with variable burst), **different KPIs** (99%@10ms and 99.999%@5ms) and **additional sync requirement** between them

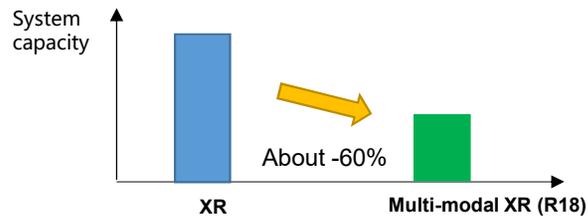


Traffic model: 30Mbps@60FPS, mean frame size 500KBytes [TR 38.838]
KPI: 99%@10ms [TS 22.261]



Traffic Model: 0.8k~200k bps for each sensor, up to 60 sensors (up to 12Mbps=200kbps*60) [TR 22.847 & TR 22.856]
KPI: 99.999%@5ms, Sync Error<15ms [TS 22.261]

➤ System capacity of multi-modal XR via R18



- Additional haptic data occupies more resources
- Sync requirement is not considered
- Lower spectrum efficiency for video frame due to combined transmission with haptic data (high reliability)
- UL CG wastes resource for irregular haptic burst and DG introduces large latency

* Assume that the multi-modal devices are connected (e.g. Bluetooth) and perform as a single UE

Overall work/study item proposal

Proposal 1: SI+WI for further XR enhancement in Rel-19

Proposal 2: The objectives of SI include:

Enhancements on general XR

- Latency
 - An E2E mechanism to enable dynamic QoS adaptation to varying radio conditions [RAN2/RAN3] ^{Note}
 - Enhancement of SR to reduce scheduling latency [RAN1/RAN2]
- Resource efficiency
 - RLC ARQ enhancement to avoid the out-of-PDB RLC retransmission [RAN2]

Enhancements on multi-modal XR

- Synchronization
 - Study enhancements to ensure sync requirement between different XR modal traffic (e.g. video and haptic) [RAN2/RAN3] ^{Note}
- Reliability
 - Achieve distinct reliability requirements of different traffic (e.g. video and haptic) when transmitting them in a single slot [RAN1]
- Resource efficiency
 - Resource-efficiency enhancements to dynamic scheduling and/or configured grants to support variable packet sizes [RAN1/RAN2]
 - PDCP concatenation for small haptic packets [RAN2]

- Note: coordination with SA2 is needed