3GPP TSG SA WG4#112-e meeting TDoc S4-210075

E-meeting, 1st – 10th February 2021

**Title: [Draft] Reply LS on New Standardized 5QIs for 5G-AIS (Advanced Interactive Services)**

**Response to: S2-2009227**

**Release: Release 17**

**Work Item: FS\_5GXR, FS\_XRTraffic, 5G\_AIS**

**Source: 3GPP TSG SA WG4**

**To: 3GPP TSG SA WG2**

**Cc: 3GPP TSG RAN WG1, 3GPP TSG RAN WG2**

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**Attachments:**

* tbd

# 1 Overall description

3GPP TSG SA WG4 (SA4) would like to thank 3GPP TSG SA WG2 (SA2) on the LS on New Standardized 5QIs for 5G-AIS (Advanced Interactive Services).

On your question

*Q2): SA2 kindly asks SA4 to provide feedback on whether they agree 10E-3 PER for downlink traffic for cloud/edge/spit rendering for cloud gaming and XR or whether they have suggestions for exact values based on SA4 outcome, i.e. after SA1 NCIS work item completion to further align stage-1 requirements and additional requirements for QoS enhancement that may come from SA4’s ongoing work on 5G XR. Considering the Rel-17 5G\_AIS work item timeline, SA2 aims at moving forward according to TS 22.261 KPIs if any other feedback is not received on time (e.g. before SA2 2021 April meeting).*

SA4 would like to respond as follows.

We believe it is appropriate to provide new Standardized 5QIs for Advanced Interactive Services based on our work in Rel-16 in TR 26.928.

We would like to provide the following comments. In TR 26.928, clause 4.2, Quality-of-Experience for XR Services is introduced. A crucial fact is the round-trip interaction delay according to clause 4.2.2 of TR 26.928 for Interactive, XR and Gaming split rendering services. For highly complex games, roundtrip interaction delays in the range of 50 to at most 100ms are crucial.

Secondly, for such split rendering-based services, clause 6.2.5 of TR 26.928 provides QoE parameters and it is stated:

*“5QI values exist that may address the use case, such 5QI value number 80 with 10ms, however this is part of the non-GBR bearers […]. In addition, it is unclear whether the 10ms with such high bitrates and low required error rates may be too stringent and resource consuming. Hence, for simple split rendering in the context of the requirements in this clause, suitable 5QIs may have to be defined addressing the latency requirements in the range of 10-20ms and bitrate guarantees to be able to stream 50 to 100 Mbps consistently.”*

This is further summarized in Table 6.3-1 of TR 26.928.

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| **Architecture** | **DL Rate range** | **UL Rate range** | **DL PDB** | **UL PDB** | **RTT** | **DL PER range** | **UL PER range** | **Traffic periodicity range** | **Traffic file size distribution** |
| Raster-based Split Rendering with Pose Correction | 100 Mbit/s | 500 kbit/s | 20ms | 10ms | 50ms | FFS | FFS | Almost constant | FFS |

Thirdly, it is relevant to understand that in the downlink highly-compressed video data is sent at several 10 Mbit/s (typically between 10 and up 100 Mbit/s), for which any error results not only in a glitch in one picture, but also results in error propagation. While such effects may be mitigated by error-robust video encoding, such encoding significantly harms compression efficiency (as an example, intra-coded information typically requires 3 to 6 times the amount of data compared to inter-coded information, so should be used with care). In the uplink, less loss-sensitive XR Pose and controller actions are sent (data is not predictively coded) at lower data rates (several 100 kbit/s) as seen in the table above. Assuming similar packet sizes in uplink and downlink, an error in the downlink would happen about 10 to 100 times more frequently in time than in uplink. As an example, assuming 1500 byte packets, loss rate 10-3, and 50 Mbit/s, a packet error impacting the video quality would occur roughly every 250 ms, whereas in the uplink at 500 kbit/s it would be every 25 seconds.

Finally, it is relevant to understand that due to the periodic nature of the video traffic based on video frames with frame rates of for example 60 fps or 90 fps (i.e. every 17ms or 11ms) and certain video rate control mechanisms, the size of one frame is restricted. Frame sizes are typically up to 30 kB, with exceptions up to 100 kB. This implies that the peak throughput requirement can be higher than the average throughput requirement for this traffic. This information may be useful for appropriate QoS settings, for example in order to define peak throughputs, and decisions on admitting this traffic.

Based on these assumptions, we kindly suggest the following modifications to the table:

* Relax the latency targets (potentially increasing the radio capacity) in the downlink but support lower loss rates from 5ms and 10ms to 10ms and 20ms, respectively.
* Invert the loss rate requirements for uplink and downlink based on the considerations above to provide lower loss rates in downlink and accept higher ones in the uplink.
* Consider adding delay Critical GBR type to downlink with associated default MDBV values in the order of 50-100kB to support sufficiently high peak-to-average throughputs.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| New Value#1 |  | 25 | 10~~5~~ms | 10-4~~3~~ | N/A | 2000 ms | Interactive Service - visual content for cloud/edge/split rendering, (see TS 22.261 [2]) | |
| New Value#2 | 25 | 20~~10~~ms | 10-4~~3~~ | N/A | 2000 ms | Interactive Service - visual content for cloud/edge/split rendering, (see TS 22.261 [2]) | |
| New Value#3 | 25 | 5ms  (NOTE 17) | 10-3~~4~~ | 300 bytes  (NOTE 19) | 2000 ms | Interactive Service -Motion tracking data, (see TS 22.261 [2]) | |
| New  Value#4 | 25 | 10ms  (NOTE 18) | 10-3~~4~~ | 600 bytes  (NOTE 19) | 2000 ms | Interactive Service -Motion tracking data, (see TS 22.261 [2]) | |
| NOTE 17: For interactive service with cloud/edge/split rendering, this 5QI is defined for motion tracking and sensor data. New value#3 can be together with New value#1 to support total UL+DL latency to be sufficiently low to support roundtrip interaction delays (see TR26.928 [X], clause 4.2 and 6.2.5) within 50ms. A static value for the CN PDB of 1 ms for the delay between a UPF terminating N6 and a 5G-AN should be subtracted from a given PDB to derive the packet delay budget that applies to the radio interface. When a dynamic CN PDB is used, see clause 5.7.3.4.  NOTE 18: For interactive service with cloud/edge/split rendering, this 5QI is defined for motion tracking and sensor data. New value#4 can be together with New value#2 to support total UL+DL latency to be sufficiently low to support roundtrip interaction delays (see TR26.928 [X], clause 4.2 and 6.2.5) 100ms. A static value for the CN PDB of 1 ms for the delay between a UPF terminating N6 and a 5G-AN should be subtracted from a given PDB to derive the packet delay budget that applies to the radio interface. When a dynamic CN PDB is used, see clause 5.7.3.4.  NOTE 19: MDBV is calculated with 0.6Mbps service bit rate and corresponding 5G-AN PDB for motion tracking data as default values for New value#3 and #4 . MDBV value for interactive services may be a range and other values can be signaled to the RAN according to service bit rate needed. | | | | | | | | |

In the context of the above discussion, we would like to highlight that the above assumptions are built on packet sizes of typical 1500 bytes. In the context of Rel-17 FS\_XRTraffic, it has been considered to also permit IP packet sizes that carry an entire video slice/frame, which may as an example be as large as 30 kB, with exceptions potentially even 100 kB (see above). In this case, it is obvious that a 10-4 packet/frame loss in the downlink may be over-dimensioned (resulting in a loss on average every 100-200 seconds). Such larger packets may provide "awareness" of video data structures to the 5G System (which better reflects the requirements from the XR application) and may hence provide additional benefits when setting QoS parameters for video-centric XR traffic. We suggest that SA2 takes into considerations and provides feedback, if needed.

We are in the process of confirming some of the above initial Rel-16 assumptions as part of our Rel-17 FS\_XRTraffic work by more sophisticated simulation models, including different configurations of IP packet sizes and slice awareness. Attached to this document is the latest agreed permanent document [add during SA4#112-e].

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We look forward to the continuous exchange of XR media centric aspects between SA2 and SA4.

# 2 Actions

**To SA2**

**ACTION:**

1. To take the above information into account
2. To provide any comments or questions as feedback on the assumptions

# 3 Dates of next TSG SA WG 4 meetings

3GPP SA4#113-e 6 – 14 April 2021, e-meeting

3GPP SA4#114-e 19 – 28 May 2021, e-meeting