3GPP TSG SA WG4 Meeting #121 TDoc S4-221288

E-Meeting, 17th – 26th August 2022

**Title: Draft Reply LS to RAN3 on RAN visible QoE value**

**Response to: LS S4-221234 (R3-226014**

**Release: Rel-18**

**Work Item: NR\_QoE\_enh-Core**

**Source:** **3GPP SA4**

**To:** **3GPP RAN3, ITU-T SG12**

**Cc: 3GPP RAN2, 3GPP SA5**

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**Attachments: none**

# 1 Overall description

SA4 thanks RAN3 for your LS on RAN visible QoE value, and wishes to respond to the two questions from RAN3 regarding QoE metrics in SA4’s Rel-18 specifications on AR, MR and MBS.

**Question 1:**

**Can a RAN visible QoE value be defined that reflects the overall QoE of an ongoing service, assuming multiple QoE metrics taken into account, like MOS value for audio? In that respect, RAN3 notices that the TR 26.909 states:**

***"While MOS calculation in the client is possible, it severely limits the use of advanced network optimization, use of flexible MOS windowing, and also introduces problems when the MOS model calculation needs to be updated. A better solution is to make sure that the raw reported QoE metrics are enough to be able to calculate the final MOS value in the QoE server."***

**RAN3 wonders whether the above conclusion about MOS in TR 26.909 still holds.**

**SA4 reply**:

In general, SA4 believes that while in principle it is possible to define a RAN visible QoE value as described above by RAN3, the absence of the necessary standards makes it not feasible in practice. We are also unclear of the practical benefit for producing such MOS value representation given a number of reasons. The above conclusion in TR 26.909 as cited by RAN3 still holds, and furthermore, additional factors for consideration are described below.

As background, please note that TR 26.909 containing the aforementioned statement was outcome of SA4’s Rel-14 IQoE work item based on analysis done in 2015-2016 of MOS-based QoE assessment work by ITU-T SG12’s (then) “Parametric non-intrusive assessment of TCP-based multimedia streaming quality” work item, a.k.a *P.NATS*. That ITU-T activity later became P.1203, “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport”.

Without going into excessive detail, SA4 wishes to point out some issues and concerns we have identified with ITU-T P.1203 with regards to SA4’s current thinking on potentially pursuing follow-up activity related to that ITU-T work item.

1. A measure of the overall QoE for an ongoing service must in principle estimate the experience of the human user of the service, on a ***subjective*** basis. For multimedia services this inherently means that the overall service QoE cannot be evaluated “instantly”, but rather must be based on data covering longer periods of time, i.e., at a “human (hence subjective) time-scale”. The lower end of this time-scale is about ten seconds, corresponding to the typical length of individual subjective multimedia tests samples (such as audio-only or video-only tests). But for multimedia services with potentially multiple types of quality-degrading effects (encoding distortions, bitrate adaptation fluctuations, rebufferings etc.) the lowest relevant time-scale is much larger, as the combined effects of these distortions need to be taken into account. This is the reason that P.1203 specifies 30 seconds as the shortest session duration for which the ITU-T standard is applicable.
2. ITU-T P.1203, while addressing both individual short-term (e.g., at the seconds level) video and audio MOS estimation, as well as longer-term A/V MOS integration (minutes or longer, e.g., for the entire media session), its algorithms are somewhat outdated, and only cover H.264 up to HD quality.
3. There is related follow-up ITU-T work to P.1203 in P.1204. For example, the latter addresses MOS estimation for other, more modern codecs including H.265 and VP9, and up to 4K/UHD resolution. However, the required specification of individual quality assessment modules in P.1204 has not concluded for the low-complexity modes (corresponding to P.1204 Modes 0 and 1), and furthermore, is limited to video quality assessment. Although in principle the audio and A/V integration methodologies from P.1203 might be reused, there has not been agreement/decision in ITU-T to incorporate that in P.1204.
4. Although the P.1203 and P.1204 architectures depict per-one second MOS outputs from the video quality estimation module, these are calculated based on input data from up to a 20-sec sliding window. In other words, the provided MOS information would likely not support real-time RAN resource allocation.
5. The downside of a simple MOS value for QoE is the inherent absence of granular information regarding the contributing components in the transmission chain. Besides quality degradation effects that occur in the device and network as mentioned in a), there could be other contributing factors to overall service quality – content offered only in low-resolution on the server, user subscription restrictions on allowed bitrates, etc. Therefore, given simply the MOS value, SA4 would ask RAN3 to explain the assumptions or other factors that might prove useful in the determination of which network “knobs and dials” to adjust to dynamically and practically improve subjective QoE.
6. Overall, the MOS-based QoE assessment method of ITU-T, when applied to 3GPP, may incur significant increase in processing overhead of the UE, especially on the application layer in executing the associated algorithms, depending on the complexity of algorithm design.
7. As a general principle, MOS-based QoE characterization must be performed according to standardized algorithms. From SA4’s perspective, such is the scope of ITU-T (e.g., in P.1203/P.1204). Therefore, SA4 believes that its primary objective and task regarding QoE is to define the relevant raw QoE metrics for the application services in our scope.

Due to the RAN3 interest as indicated in your LS being tied to related ITU-T activity in P.1204, SA4 also copies this LS reply to ITU-T SG12, with inquiry on their plans for further work/completion of that work item.

**Question 2: If the above conclusion about MOS from TR 26.909 does not hold, is it feasible to define such a RAN visible QoE value that would be useful at the gNB?**

**SA4 reply**: As cited in the SA4 reply to Q1, especially points a) and d), the support for real-time RAN optimization via computation of RAN-visible QoE value (as MOS value) is most likely unachievable in practice. Although not explicitly mentioned in the RAN3 LS, SA4 understands that another potential motivation of RAN groups for MOS-based QoE estimation by the UE is to reduce uplink RRC signaling traffic attributed to application layer measurement reporting. On the other hand, given the simplistic/one-dimensional nature of MOS, SA4 would like to ask RAN3 to explain how such information might be relevant for use. Also, as indicated in point g), SA4 believes that the standardization of media QoE models should be the responsibility of ITU-T SG12.

Overall, SA4 wishes to defer a specific answer to this question at this time, and instead would ask ITU SG12 to provide their overall comments.

# 2 Actions

**To RAN3**

**ACTION:** SA4 kindly asks RAN3 to take the above information into account, and provide feedback to SA4 if necessary. In addition, SA4 asks RAN3 to provide reply to the question we pose on the envisioned practical usage of RAN visible QoE given the identified limitations.

**To ITU-T SG12**

**ACTION:** SA4 kindly requests ITU-T SG12 to check the above responses provided by SA4 to RAN3 and provide your comments and suggestions, along with any corrections. In addition, SA4 requests ITU-T SG12 to inform 3GPP (esp. SA4, RAN3 and RAN2) about your plans regarding the P.1204 work item.

# 3 Dates of next TSG SA WG 4 meetings

SA4#122 20th – 24th February 2023 EU

SA4#123 17th – 21st April 2023 TBD