**3GPP TSG-RAN WG3 Meeting #113-eR3-214198**

**Online, August 16th- 26th 2021**

Agenda Item: 15.3

Source: Ericsson (moderator)

Title: Summary of Offline Discussion on RAN-visible QoE

Document for: Approval

# Introduction

This is the SoD for the following comeback: **CB: # QoE5\_RANVisible**

The deadline for providing replies to Phase 1 is **Friday, August 20th at 23.59 UTC.**

Relevant papers:

1. R3-213320 RAN-visible QoE Metrics (Ericsson)
2. R3-213321 RAN-visible QoE Configuration and Reporting (Ericsson)
3. R3-213491 RAN visible QoE configuration and reporting (China Unicom, China Southern Power Grid)
4. R3-213656 Support for RAN Visible QoE (Qualcomm Incorporated)
5. R3-213685 Analysis of metrics for RAN visible QoE (Nokia, Nokia Shanghai Bell)
6. R3-213948 Discussion on RAN visible QoE configuration and reporting (CATT)
7. R3-213949 [Draft]LS on the configuration and report of the RAN-visible QoE (CATT)
8. R3-213967 Discussion on RAN visible QoE (Samsung)
9. R3-213968 (CR for TS38.473) Support of QoE information transfer (Samsung)
10. R3-214046 Further consideration on RAN visible QoE (ZTE, China Telecom)
11. R3-214047 [draft] LS on RAN visible QoE (ZTE, China Telecom)
12. R3-214075 Further discussions on RAN-visible QoE (Huawei)
13. R3-214076 Draft LS on RAN-visible QoE conclusions (Huawei)
14. R3-214109 Further discussions on RAN visible QoE (CMCC)

# For the Chairman’s Notes

**TBW**

# Discussion

**Disclaimer:** In each topic for which a WA exists, the starting point for the discussion is a potential proposal confirming the WA, provided that not much opposition is found in the submitted papers. To downscope the work, the issue of RVQoE values has been postponed.

## Issue 1: Metrics

The candidates for RVQoE metrics were discussed in papers [1, 4, 5, 8, 12]. Certain metrics received only positive, while certain received both positive and negative votes.

**Q1: For each metric listed below, please indicate whether the metric should be specified as RVQOE metric or not, and provide a short motivation (for both DASH streaming and VR, unless indicated otherwise):**

* **Buffer Level**
* **Average Throughput**
* **Playout Delay**
* **Play List (simplified version)**
* **Interaction latency (VR only)**
  + **Note: This is not a legacy QoE metric, it is a part of a TR 26.929.**

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| **Company** | **Answer** |
| **Ericsson** | Yes to all, **except**:   * Average Throughput – we are not sure how informative this is, given that the throughput can vary based on the media content as well, not only due to network conditions. Besides, the throughput is already measured in the MDT framework. * Interaction latency – in fact, this metric was captured in the TR 26.929, but did not make it into the spec TS 26.118. Perhaps the use case should be discussed first. |
| Huawei | Yes to Buffer level, Average Throughput could also be considered.  For the rest of the three, we are not sure what could bring to RAN. |
| CMCC | At least buffer level: most companies supported that it is beneficial to adopt Buffer Level, which is applicable to streaming services and AR services, for RAN awareness to help RAN adjust the resource allocation for the UE. For example, the base station will consider scheduling more radio resources to those streams which reports lower buffer level so that to guarantee the stream will be processing properly. |
| Qualcomm | Yes, to Buffer level and Playout Delay  Not to Average Throughput and Play List   * Reporting these QoE metrics by UE seems cumbersome as it includes a lot of information elements (seen from SA4 specs). Even a simplified version of Play List (e.g., an indication from the application to the AS whenever the video representation changes, or the video stalls) seems too much overhead and would be quite frequent |
| Verizon | Yes to Buffer level and Playout delay as these are critical metrics that capture use experience for streaming services.  Yes to Interaction latency for VR services only  Avg. throughput - no strong view as it is already measured in MDT framework. |
| Samsung | Yes, to Buffer level, Playout Delay, Play List (simplified version)  Yes to interaction latency for VR  Reply to E///, using the term “Interaction latency” described in TR 26.909 is for better understanding, and the interaction latency is very important and directly related to the User experience. The interaction latency has the same meaning as “Comparable quality viewport switching latency metric” in TS 26.118. |
| ZTE | Not sure for buffer level. We are not sure whether the introduction of buffer level will cause unfairness for users. The benefit of buffer level for RVQoE needs more evaluation.  For the rest of others, as discussed in our R3-214046, we say No. |
| TMUS | Yes: Buffer level, playout delay, interaction latency. No strong views on others. |
| Nokia | Buffer level or derived indicator (empty buffer alarm) may be considered. However the exact usage will depend on the information can be delivered using high-priority SRB, or carried over SRB4. In the latter case the RAN may perform corrections based on statistics (SON time scale). In both cases the RAN will have to compare the received information with own DL PDCP buffer status for the RB. Also the fairness aspect raised by ZTE should be checked.  The play-list may also serve a statistical purpose, redundant with buffer level information. If SRB4 is used, no strong view whether to use simplified play-list or buffer level.  Other metrics seem unsuitable for the RAN. |

## Issue 2: Configuration

The related topics covered in the contributions are:

* Activation/deactivation [14]
* Who generates the RVQoE configuration? [2, 3, 4, 6, 12]
* How to indicate from the OAM to the RAN which RVQoE metrics are available? [2, 3, 4, 12]
* Dependence on legacy QoE [2, 3, 4, 12]
* Configuration of multiple QoE measurements [2, 3, 4, 6, 12]
* Content of RVQoE configuration [6]
* The identifier of RVQoE [2, 4, 6, 12]

**Potential proposal 2-1: Upon:**

* **RAN visible QoE measurement activation, UE AS indicates to UE APP that RAN visible QoE measurement has been triggered, potentially with RAN visible QoE metrics needed to be collected at UE APP as requested by RAN.**
* **RAN visible QoE measurement deactivation, UE AS indicates to UE APP that RAN visible QoE measurement has been terminated, and then UE APP stops to provide RVQoE measurement results to UE AS.**

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| **Company** | **Answer** |
| **Ericsson** | **Agree.** This is needed for RVQoE to work. |
| Huawei | Agree with bullet 1.  For bullet 2, so we would like to introduce a deactivation mechanism? Do we also consider a pause/resume mechanism? |
| CMCC | Agree both. We can start with activation/deactivation case, and further to investigate the possibility to introduce pause/resume mechanism. We also support to introduce pause/resume mechanism for RVQoE. |
| Qualcomm | Agree to both. This means that RVQoE can be released/deactivated independent of legacy QoE. Pause/resume can be considered later if necessary. |
| China Unicom | RVQoE should be requested by RAN, both activation and deactivation. |
| Verizon | Agree to both. Pause/resume mechanisms can also considered. |
| Samsung | Agree to both. |
| CATT | Agree to both |
| ZTE | Agree. |
| TMUS | Agree to both |
| Nokia | Communication between UE AS and UE APP is not in RAN3 scope. RAN3 can assume that same procedures as normal QMC are used, unless CT1 or RAN2 decide differently. |

**Potential proposal 2-1: Turn into an agreement the WA that the RAN generates the RVQoE measurement configuration.**

**Potential proposal 2-2: The OAM indicates to the RAN, outside the QoE configuration container, which RVQoE metrics are available for the RAN to configure the UE to collect.**

**Q2-1: Please state your view on OAM generating the OAM configuration.**

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| **Company** | **Answer** |
| **Ericsson** | **Agree** to both proposals.  **Q2-1**: RAN is the consumer and RAN decides what it is interested in so we see no strong reasons why OAM would be generating the configuration. We also have concerns about having two different approaches standardized. |
| Huawei | Agree to both proposals. For proposal 2-2, we think the metrics to be collected should be part of what are configured inside the container.  For Q2-1, similar view as E///. |
| CMCC | Share view with E/// and HW. |
| Qualcomm | Agree to Proposal 2-1.  Regarding Proposal 2-2, why can’t RAN figure out by itself which RVQoE it can configure? RAN knows the UE capability for each RVQoE metric and should also know which service type is already configured at the UE via legacy QoE configuration. Don’t understand why OAM has to indicate to the RAN? |
| China Unicom | We are OK for both proposals. |
| Verizon | Agreeto proposal 2-1.  Share view with Qualcomm on Proposal 2-2. |
| Samsung | Agree with QC and Verizon |
| CATT | So far we RAN3 looks have some conflict understanding on who and how generate the configuration.  Firstly, RAN itself doesn’t have human interface. It should operate sth. via OAM. The QoE likes Trace, it should come from consumer request. If the RVQOE configuration will be configured by RAN itself, we should specify the when, why and how RAN itself configures the QoE in our spec.  In my understanding, the P2-2 aim to tell RAN what the metrics in the configured legacy QoE. So RAN may select from them. Because the legacy QOE configuration is transparent to RAN.  If we agree P2-2, we may simply agree the OAM configure the RVQOE |
| ZTE | Agree to proposal 2-1.  Share the view with QC. |
| TMUS | Agree to Proposal 2-1. |
| Nokia | Autonomous RVQOE configuration in the RAN depends on the capability signalling solution chosen, taking into account that capability both at application and AS level (+NAS?) is required. |

**Potential proposal 2-3: Turn into an agreement the WA that the ID used to identify QoE measurements is reused for identifying the RVQoE measurements.**

**Potential proposal 2-4: Turn into an agreement the WA stating that RVQoE collection can be configured only if QoE measurements are configured for the same service type.**

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| **Company** | **Answer** |
| **Ericsson** | **Agree** to both |
| Huawei | **Agree** to both |
| CMCC | Agree both. |
| Qualcomm | Agree to both. |
| China Unicom | Agree to both |
| Verizon | Agree to both. |
| Samsung | Agree to both |
| CATT | Agree to both |
| ZTE | Agree to both. |
| TMUS | Agree to both |
| Nokia | Agree to both. |

**Potential proposal 2-5: Turn into an agreement the WA stating that multiple simultaneous RVQoE measurements are supported.**

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| **Company** | **Answer** |
| **Ericsson** | **Agree,** just as for the legacy metrics. |
| Huawei | Agree. |
| CMCC | Agree |
| Qualcomm | Agree |
| China Unicom | Agree, align with the legacy QoE configuration. |
| Verizon | Agree |
| Samsung | Agree |
| CATT | Agree |
| ZTE | Agree. Just as legacy QoE. |
| TMUS | Agree |
| Nokia | Agree to align with the legacy QoE configuration, pending RAN2 and CT1 confirmation. |

**Q2-2: Should the RAN-visible QoE configuration be fixed?**

**Q2-3: Which of the below items need to be included in a RVQoE configuration sent to UE:**

* **Service type**
* **QoE measurement ID (QoE reference may be used)**
* **Metrics to be reported**
* **Sample percentage**
* **Location/Area scope**
* **Start Time**
* **Duration**
* **Reporting Interval for periodic case**

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| **Company** | **Answer** |
| **Ericsson** | **Q2-2: No,** RAN should decide about what it is interested in.  **Q2-3:** Several of the parameters are **redundant**, as they are already present in the configuration container, e.g.: Service Type, QoE measurement ID, Location/Area scope. Other points should be discussed.  We would like to add two additional points:   * **Triggering Event.** One example: “video stalling”, or “buffer alarm threshold”, as proposed by [5]. * **DRB information (or QoS flow information), to be reported,** as an optional parameter as proposed by [8]. |
| Huawei | Q2-2: not needed. RAN knows which metric(s) it is interested in.  Q2-3: Only Metrics to be reported. In general, we think measurement configuration for QoE should be applied to visible QoE metric collection (e.g. Start Time, Duration Reporting Interval for periodic case). In addition, we are not sure about Sample percentage. |
| CMCC | Q2-2: No need to be fixed. Flexible configuration will also save the reporting overhead.  Q2-3: At least QoE measurement ID, metrics to be reported and time info (FFS on details for time info) are needed. Our understanding is that the above three parameters are basis for QoE reporting. |
| Qualcomm | Q2-2: Can be flexible; RAN can request each metric  Q2-3: Metrics to be reported. If RVQoE is configured later than legacy QoE, we might also need the QoE reference (reuse) if multiple simultaneous RVQoE are to configured (e.g. we might want to configure a RVQoE metric only for QoERef = 1 but not for QoERef = 2)  Also, we don’t want to end up defining a different periodicity or event trigger for RVQoE – it is simple if RVQoE and legacy QoE are reported together. |
| China Unicom | Q2-2: No, it can be requested according to RAN requirements. |
| Verizon | Q 2-2: No, RAN should have the flexibility to configure as per its requirements  Q 2-3: All in the list are needed. Additional info as in Ericsson’s comment can also be considered |
| Samsung | Agree with E/// and Verizon, **triggering event** and **DRB information (or QoS flow information)** should also be considered for better RAN optimization. |
| CATT | Q2-2, if not fixed, we need to consider whether the configured up to product implemented or specified  Q2-3, we should consider all the information which the legacy QoE configuration included. We may reuse the value from container or separately defined for RVQOE. Anyway, this information is needed for RVQOE. For detail explanation, you may see R3-213948 |
| ZTE | Q2-2: RAN can configure the RVQoE configuration flexibly.  Q2-3: same as HW. Only metrics to be reported. |
| TMUS | Q2-2: NO. RAN to decide  Q2-3: Agree with Ericsson |
| Nokia | Q2-2: flexibility  Q2-3: limit to basic reporting |

## Issue 3: Reporting

The questions and proposals are derived based on proposals in papers [2, 3, 4, 6, 8, 12].

**Potential proposal 3: Turn into an agreement the WA stating that the RVQoE report is provided inside a dedicated IE, outside the QoE report container.**

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| **Company** | **Answer** |
| **Ericsson** | Agree – RAN visible QoE |
| Huawei | Agree |
| CMCC | Agree |
| Qualcomm | Agree |
| China Unicom | Agree |
| Verizon | Agree |
| Samsung | Agree |
| CATT | Agree |
| ZTE | Agree |
| TMUS | Agree |
| Nokia | This will be CT1's and RAN2's decision, but OK from RAN3 point of view. |

**Q3-1: Should the FFS stating that RVQoE reporting is upon RAN request be turned into an agreement?**

**Q3-2: Should RVQoE and legacy QOE *always* be reported together, or can they be reported separately?**

**Q3-3: Can the RVQoE report can be signalled from the target to the source node post a successful handover?**

**Q3-4: Should the DRB information (or QoS flow information) be included in the QoE report for QoS aware scheduling?**

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| **Company** | **Answer** |
| **Ericsson** | **Q3-1: Yes**  **Q3-2: Separately,** given that the consumers of RVQoE and QoE reports are different, we see no reason not to allow separate reporting.  **Q3-3: Yes,** we think this is quite useful for HO performance evaluation.  **Q3-4:** This could be considered as an **optional** parameter. |
| Huawei | Q3-1: yes  Q3-2: we think they should be reported together, since they are configured together; if separately, RAN may need to remember all the configured QoE measurement and visible metric measurements. And if the two are reported separately, it may increase the complexity of APP.  Q3-3: not needed, we are not sure what this could bring any benefits, since target is not the consumer.  Q3-4: no strong opinion, seems to us DRB info and service type/slice may not be one to one mapping, also the APP does not know the DRB info. Therefore if RAN3 think some information is useful for QoS aware scheduling, we think the PDU session and QoS flow information can be reported. |
| CMCC | Q3-1: Yes.  Q3-2: It seems to be more beneficial for RAN optimization if RVQoE report can be reported separately.  Q3-3: Yes. Note that the intention of this question has indicated the source is the consumer.  Q3-4: Yes. Reporting DRB info/QoS flow info enables RAN to optimize parameters configured for a radio bearer, Qos flow to DRB mapping, etc. |
| Qualcomm | Q3-1: Whether RVQoE reporting is upon RAN request depends on the RVQoE configuration (i.e Q2-2). If we don’t end up agreeing to a different periodicity or event trigger to RVQoE, then RVQoE can’t be reported upon RAN request and simply will be reported when legacy QoE is reported as well  Q3-2: NO. RVQoE and legacy QoE should be reported together. In our view, the RVQoE is being introduced to expose QoE metrics to RAN and not to report it with a higher periodicity to do any sort of real-time optimization. We therefore propose to keep it simple and have the reporting together.  Q3-3: Yes; to report it back to the source in case of handover  Q3-4: This can be FFS; pending per-slice QoE. UE can just report either one among PDU session or DRB or S-NSSAI. |
| China Unicom | **Q3-1: Yes**  **Q3-2: Separately**  **Q3-3: Yes**  **Q3-4:** We are fine with the proposal. |
| Verizon | Q 3-1: Yes  Q3-2: RVQoE reported separately  Q3-3: Yes RVQoE report can be signalled post successful handover  Q3-4: Yes |
| Samsung | Q 3-1: Yes  Q3-2: RVQoE reported separately  Q3-3: Yes, reply to HW, the benefit is to evaluate handover performance, and it’s also beneficial for the case when the QoE report for the source is sent after handover, and the QoE report can be used for the source node to optimize the network configuration.  Q3-4: Yes, whether it’s DRB or PDU session ID or QoS flow is FFS. At least DRB related information can be agreed, FFS on the details. |
| CATT | Q3-1: Yes  Q3-2: Separately  Q3-3: Yes  Q3-4: I don’t think UE can map the DRB/QoS flow to the service type . |
| ZTE | 3-1: Yes  3-2: Together  3-3: Wait for progress in legacy QoE mobility  3-4: Yes |
| TMUS | 3-1: Yes  3-2: Separately  3-3: Yes  3-4: Yes |
| Nokia | 3-1: We can reword into "RVQOE shall only be reported if requested by the RAN".  3-2: Depends on RAN2 decision e.g. on SRB to carry the RVQOE info.  3-3: Not in Rel-17 (we have to keep it simple)  3-4: Depends on feasibility |

## Issue 4: Mobility support

The question is derived based on proposals in papers [3, 4].

**Q4: Should the RVQoE configuration be propagated from the source to target node upon mobility in RRC\_CONNECTED and during context retrieval upon resumption from RRC\_INACTIVE?**

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| **Company** | **Answer** |
| **Ericsson** | **Yes,** in both. |
| Huawei | We think the current mechanism already allows such behaviour. The target node can know the RVQoE configuration based on the RRC context in the handover request message. |
| CMCC | OK to agree it as a basic principle, and we can further look into details when we prepare stg3 TPs and check RAN2 RRC running CR. |
| Qualcomm | Agree. Similar to Pause status, RVQoE configuration (which is transparent to AMF) should be sent in the Source to Target Transparent Container. |
| China Unicom | Yes for both |
| Verizon | Yes to both |
| Samsung | Yes to both |
| CATT | I am wondering why RVQOE support mobility. As most companies would like RAN generate the configuration. The consumer is the source RAN node , the target node may not be interesting in the RVQOE |
| ZTE | It should be the same as mobility support in legacy QoE. |
| TMUS | Yes to both |
| Nokia | Not if it is configured autonomously by the source gNB. Flexibility should also apply for the target gNB. |

## Issue 5: UE capability indication

The question is derived based on proposals in papers [2, 14].

**Q5: Should RAN3 send an LS asking RAN2 to define in the RRC specification a UE capability indication of RVQoE support?**

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| **Company** | **Answer** |
| **Ericsson** | **Yes,** this is necessary, since not every UE may support RVQoE collection. |
| Huawei | UE capability indication is needed. We think RAN2 can discuss it directly. RAN3 does not need to send an LS. |
| CMCC | Yes. Since RVQoE is led by RAN3, we need to inform RAN2 to implement the requirement identified by RAN3. |
| Qualcomm | OK. We can send this along with list of other agreements. |
| China Unicom | Yes |
| Verizon | Yes |
| Samsung | Yes |
| CATT | Yes |
| ZTE | Yes |
| TMUS | Yes |
| Nokia | OK, but coordination between RAN2, CT1 (and possibly SA4 for APP level capability?) should be left to RAN2. |

## Issue 6: Sending the RVQoE report over F1

The proposal is derived based on papers [2, 4, 8, 12].

**Potential proposal 6: Turn into an agreement the WA stating that the gNB-CU may signal RVQoE report to gNB-DU over F1.**

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| **Company** | **Answer** |
| **Ericsson** | **Agree,** the scheduler may benefit from this info. |
| Huawei | Agree. |
| CMCC | Agree |
| Qualcomm | Agree |
| China Unicom | Agree |
| Verizon | Agree |
| Samsung | Yes |
| CATT | NO strong view, what does DU do when get the report |
| ZTE | Agree. |
| TMUS | Agree |
| Nokia | We believe this depends on whether the RVQOE report is delivered by high-priority SRB, and hence suitable for scheduling? |

## Issue 7: LSs to other groups

This issue depends on the outcome of Issues 1-6.

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| **Company** | **Answer** |
| Huawei | Yes, we think LS to SA4 is needed to inform the conclusions of this meeting and last meeting, for SA4 to take into account. |
| Qualcomm | LS to RAN2 and SA4. |
| Verizon | LS to RAN2 and SA4 would be useful |
| Samsung | Agree with the above. |
| CATT | We should inform RAN2 about the RVQOE status, so they can start their job. |
| ZTE | LS to SA4, cc RAN2 .  In addition, in our R3-214046, we proposed to introduce simple RAN-visible QoE values to indicate the quality of the ongoing service. Unfortunately, as disclaimer of moderator, the issue of RVQoE values has been postponed. To state here, we want to include the issue on whether RVQoE values is feasible in LS. |
| Nokia | We expect RVQOE metric has to be defined in SA4 specification because the measurements are generated by the application. However SA4 will need to know whether delivery of the measurements are done in real-time (high-priority SRB) or not. So both SA4 and RAN2 should be included. |
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