3GPP TSG-RAN WG3 #114-e R3-21586[9](https://ericsson-my.sharepoint.com/personal/filip_barac_ericsson_com/Documents/WORK/3GPP.exe/Meetings/RAN3%23113-e.exe/Meetings/RAN3%23113/chairnotes/Inbox/R3-214141.zip)

Online, 1st – 11th Oct 2021

Agenda Item: 15.3

Source: Qualcomm Incorporated (moderator)

Title: SoD on CB: # QoE5\_RAN Visible

Document for: Approval

# Introduction

**CB: # QoE5\_RANVisible**

**- Further discussion on RVQoE metrics and other open issues**

**- QoE value based solution?**

**- QoE information should be transmitted on F1 for scheduling purpose? F1 impact?**

**- TPs if agreeable**

**- Capture agreements and open issues**

**- LS to other groups?**

(Qualcomm - moderator)

Summary of offline disc [R3-215869](https://qualcomm-my.sharepoint.com/personal/shakrish_qti_qualcomm_com/Documents/Desktop/Dropbox/Pentari%20Systems/RAN3/114-e/CB/CB%20%23%20QoE5_RANVisible/Inbox/R3-215869.zip)

# For the Chair’s Notes

TBD

# Round-1 Discussion

## RVQoE metrics

The following RVQoE metrics were discussed in the contributions referenced within and support or not was mentioned.

|  |  |  |  |
| --- | --- | --- | --- |
| **RVQoE metric** | **Positive** | **Negative** | **FFS** |
| Buffer Level | [1], [3], [7] |  | [10] |
| Play List (simplified version) | [1], [7] | [3], [10] | [12] |
| Playout Delay for Media Startup | [1], [3] |  | [10], [12] |
| Buffer level alarm | [1] |  |  |
| Interaction latency or Comparable quality viewport switching latency metric | [7] | [1], [3] | [12] |

Also [6] proposed that further RAN3 discussion on RVQOE metric definition will need to wait for RAN2's reply. Further, buffer level alarm is considered as part of RVQoE values (see section 3.2.3).

Considering those metrics which received most positive and least negative votes during contribution, the following is proposed:

**Moderator Proposal 1:** Buffer level and Playout delay for Media startup is considered as RVQoE metric for DASH and VR service types

**Moderator Proposal 2:** Interaction latency or comparable quality viewport switching latency metric is not considered as RVQoE metric in Rel-17

**Companies are requested to provide their inputs on the following:**

**Q1: Whether Moderator proposal 1 and 2 are acceptable? If not, please provide your concerns**

**Q2: Whether a simplified version of playlist (e.g., when video representation changes or when stalling occurs) should be considered as RVQoE metric? If yes, please address concerns raised in [3] that this event might happen too often and might cause a lot of overhead**

|  |  |  |
| --- | --- | --- |
| **Company** | **Responses to Q1 and Q2** | **Comment** |
| Qualcomm | Q1 – Yes  Q2 - No | Q2 – Could be too frequent (e.g., wouldn’t video representation change quite often, say from 1080p to 720p) and might cause a lot of overhead |
| Huawei | Q1- In general yes, but,  Q2- not sure | Q1: Ok to Buffer level; not sure to Playout delay for Media startup, can companies further explain the benefits to RAN; According to the discussion in [3], the company think “RAN node can leverage this as a time budget to deliver the requested content without video stalling, while, at the same time, not over-allocating the precious radio resources to that service “. But in our understanding, this metric is used to indicate the playout delay for the previous media start-up. The RAN does not know when the next media start-up will happen and does not know when to use this metric. Not sure how the RAN use it.  Q2: not sure. We need to understand why this simplified version of playlist would helpful for RAN’s resource optimization…According to the discussion in [1], the company think “a simplified version of the playlist, e.g., an indication from the application to the access stratum whenever the video representation switched to a lower quality or the video stalls, would be suitable”. But we does not see how the RAN use it. According to the discussion in [7], the company think the simplified version of playlist is the non user actions such as rebuffering. In our understanding, the rebuffering can be indicated by the buffer level (i.e the buffer level is 0) |
| TMUS | Q1: Yes  Q2: No strong view |  |
| Samsung | Q1-yes.  Q2-yes | In [7], the intension is trying to use simplified version of playlist to calculate the stalling event, as the number of stalling occurrences may be calculated by counting how many times a stop reason is specified as "rebuffering", and we think the stalling is a very important metric directly reflects UE’s experience, if the gNB finds a very critical service has a lot of stallings recently, it can consider schedule the DRBs for this service with higher priority so that to improve UE experience. |
| ZTE | Q1:  Proposal 1,No, but;  Proposal2, yes.  Q2: No | Q1: for Proposal 1, we think the benefit of introducing Buffer level /Playout delay is not clear. As discuss in our R3-215644, introduction of buffer level may cause unfairness for users and using Initial Playout Delay as a time budget constraint for scheduling is not suitable and also of high risk due to various DASH client implementations. But in order to make progress, we can accept introduction of buffer level .  Q2: it is difficult for RAN to evaluate the user experience based on this play list, either the “full” version or the “simple” version. |
| CMCC | Q1: Yes  Q2: Yes but | Q1: We are supportive to introduce Buffer Level as RVQoE metric.  Q2: As commented by Samsung, such simplified version of playlist is mainly used for calculating stalling occurrence, then why not we could just make the calculation at UE APP, and send the stalling count result to NG-RAN directly, which may save overhead dramatically. |
| **Ericsson** | Q1: Yes  Q2: Yes | Regarding the **concerns on buffer level**: we think that its reporting **will not cause unfairness.** The reports will be analyzed by AI/ML algorithms, which are not naïve (so that they would cause unfairness) and will be used to optimize the experience, on both network and individual level.  Regarding the **concerns on startup delay for media playout:** in our view, **long delay for startup is one of the most irritating things** a user can experience. The RAN can use it to realize how to handle media start-up, e.g., whether to “reserve” some resources in advance for (a small number of) future sessions. Anyway, we should not discuss scheduler implementations.  Regarding the **concerns on simplified version of playlist:** are the opponents claiming that **stalling events are not of interest?** We think that stalling is also one of the most irritating events for the end user. Please note that streaming will constitute most of network traffic for a long time to come. If RAN understands that video stalled, it can change scheduling policy, set up CA/DC or even change the number of MIMO layers. Finally, **indicating presence of stalling can be made simple**, e.g., by a binary flag. |
| CATT | Q1:yes  Q2: not sure | We support Buffer level and Playout delay as the start of metrics analysis. |
| Nokia | Q1:  P1: no  P2: yes  Q2: No, offline measurement is sufficient | We are not convinced that AIML can magically solve the mentioned concerns related to unfairness… Some kind of standardized tests/certification of the reported information could be more helpful if we talk about applications deployed for the general public use. Playout delay is an E2E metric and we expect it will mainly reflect resource setup latency at the server side. Playout delay will also be reported as a non-real time metric, and it is not obvious to us how the RAN can identify the media start-up phase based on the received report. And anyway it will be too late - which means that the information could as well be collected by the MCE and sent back to RAN from OAM. Also, RAN-induced delays can be optimized by monitoring the DL PDCP buffer.  On Q2: We believe that stalling information can be used to fine-tune a mechanism for mitigation of high delays in the RAN (leading to stalling), but this sounds more like an activity to be done during feature deployment so offline measurement / OAM configuration seems OK. |

## RVQoE values

**[10], Proposal 1**: To introduce RAN-visible QoE values to indicate the quality of the ongoing service, where QoE values could be a number range, e.g, 0 to10. where 10 represents excellent quality and 0 represents poor quality, or QoE values could be an enumerated type to indicate the quality, e.g, (poor, medium, good). RAN can receive RAN-visible QoE values for UE or QoE server.

**[3], Observation 1**: Defining a buffer level alarm indication instead of reporting an absolute buffer level seems to be under the scope of RVQoE values where UE can represent qualitative representation of RVQoE metrics.

**[3], Proposal 2:** The discussion on whether to define a buffer level alarm should happen under RVQoE values as this is a qualitative representation of a RVQoE metric and not an absolute value.

**[3], Observation 6:** Qualitative representation of QoE metrics in terms of a numerical value or an objective representation requires a model/function to be defined for each RAN visible QoE metric

### Whether to support RVQoE values

**Q3: Should RVQoE values be supported in addition in RVQoE metrics? If yes, which out of i) and ii) should be considered?**

1. **Qualitative representation of QoE metrics in terms of a numerical value e.g., 0 to 10**
2. **Objective representation of QoE metrics e.g., poor, medium, good**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No**  **(If yes, which out of i) and ii))** | **Comment** |
| Qualcomm | Depends on Q4 | We can first discuss Q4 i.e., who generates the RVQoE values (UE or NG-RAN). If NG-RAN generates the RVQoE value, we are OK to support both i) and ii) |
| Huawei | Yes | We think it was agreed to introduce values, while for concrete way of indicating values, we think either i) or ii) is fine, slightly prefer i). |
| TMUS | Yes | Prefer i) if it can provide more granularity |
| Samsung | Conditional yes | We only support QoE value that generated by NG-RAN,and i) is preferred |
| ZTE | Yes | Both options (i,ii) are ok for us, prefer i. |
| CMCC | Yes | i) is preferred. |
| **Ericsson** | Yes, but | We should discuss this **case-by-case**, we should not have a blank check in advance.  For now, we see two interesting candidates:   * Buffer level alarm * The number of stalling events   We are not sure that any of them fits in poor/medium/good or 0-10 dimensions. |
| CATT | No | Use the metrics SA4 defined |
| Nokia | Yes, but | Agree with Ericsson |

### Who should generate the RVQoE values (UE or NG-RAN)?

**[7], Observation 1:** UE performs the QoE value calculation is **not preferred** by SA4 as it has many limitations.

**[7], Observation 2:** **new mechanism is needed** if UE performs the QoE value calculation.

**[7], Observation 3:** RAN visible QoE value can be obtained by RAN visible QoE metrics **without extra specification impact.**

**[7], Proposal 2:** RAN visible QoE value should be **generated in gNB** based on the RAN visible QoE metrics and the existing models defined by SA4.

**[3], Proposal 16:** RAN3 to down select from the 3 options before deciding whether and how to support RVQoE values:

Option 1: Pre-defined formula in SA4 specs (**UE generated**)

Option 2: Configurable by NG-RAN (**UE generated**)

Option 3: Implementation specific to NG-RAN (**NG-RAN generated**)

**Q4: Who should generate the RVQoE values (UE or NG-RAN)? If UE generated, please provide comments to the concerns raised in [7].**

|  |  |  |
| --- | --- | --- |
| **Company** | **UE or NG-RAN** | **Comment** |
| Qualcomm | NG-RAN | If UE has to generate RVQoE value, there will be the following spec impacts:   1. **CT1 impact**: Enhancements to AT commands needed to support RVQoE value 2. **SA4 impact**: The application has to compute the RVQoE value based on the instantaneous/average QoE in the measurement period. Also pre-defined formula in SA4 specs might be needed if there is no configurable RVQoE target 3. **RAN2 impact:** In case we decide to have a configurable RVQoE target, this needs to be configured over Uu   Alternatively, gNB can simply compute the RVQoE value based on the received RVQoE metric and its own QoE target. E.g., if buffer level sent by UE is less than 10 ms, gNB can classify this as “good” or have a RVQoE value as “10/10” etc. We don’t see the need to impact UE and different WGs when this can be easily done by implementation at gNB |
| Huawei | UE | It is preferred that UE should generate the values, since UE is the consumer of radio resource and customer who expresses their experience, while from RAN side, of course gNB should be able to evaluate and judge with the reported value as important reference.  As to the model to calculate the QoE value, it is decided by the SA4. |
| TMUS | No strong view |  |
| Samsung | NG-RAN | Same view as QC.  As we commented many times, SA4 had already studied whether UE can generate QoE value by the model, and the conclusion is that UE generate QoE value is not recommend. We don’t think we have enough time to coordinate with SA4 and RAN2 to define a new mechanism to support generate QoE value by UE. |
| ZTE | UE | UE can calculate the QoE value based on measurements of multiple metrics, the calculated QoE value is used to indicate the level of user satisfaction of the service, but not to indicate scores of some type of metric. Since the QoE value is affected by many factors, and RVQoE is only a small part of the QoE measurement, so only UE can generate such QoE value. (but it is also possible that the QoE server can generate such value and send to RAN?).  The evaluation model of QoE value is up to SA4, if SA4 agrees to provide QoE value (of course, the specific model may be FFS), RAN3 only needs to consider the signaling impact. An AI based RAN can train QoS/QoE correlation by implementation, and use these for network optimization.  In the SI phase, we think it is a common understanding that the design of RVQoE values would need cooperation with SA4. As in 38.890, the definition of RVQoE values is “A set of values derived from QoE metrics data through a model/function defined in collaboration with SA4.” We all know that QoE metrics are measured by App layer in UE, so SA4 would have the most suitable way to calculate the values. This work cannot be taken by RAN, in our understanding. |
| CMCC | UE | UE is the better place to generate such value since UE is the end consumer. And we also acknowledge that such mechanism may involve in many WGs, so we’d better liaise to other WGs as soon as possible if UE method is agreeable. |
| **Ericsson** | UE | We think that the following potential RVQoE values **do not need any formula or new mechanism:**   * The number of stalling events. * The buffer level alarm.   Regarding QC’s concerns:   * Seems no SA4 impact for now, if the above two values are considered. * We have already generated quite some CT1 impact in the agreements so far, so this addition should not be a problem. * RAN2 impact is straightforward to specify. |
| CATT | UE | See my answer in Q3, I don’t think the value is useful. If we should support the value, the UE may generate the value. |
| Nokia | UE or MCE | From an architectural perspective generation of RVQOE values should be done at the application layer which is aware of SA4's XML definition, which means either the UE or the MCE. And for the use cases mentioned so far, it seems that offline generation in the MCE would be the simplest and actually sufficient. |

### Configurability in case of UE generated RVQoE values

[1], Proposal 5: A RAN node can configure the UE to either report the Buffer Level or to report a Buffer Level Alarm based on a **configurable** threshold.

[3], Proposal 16: RAN3 to down select from the 3 options before deciding whether and how to support RVQoE values:

**Option 1: Pre-defined formula in SA4 specs**

**Option 2: Configurable by NG-RAN**

Option 3: Implementation specific to NG-RAN

[10], Proposal 2: To introduce **RAN-visible QoE value target** at RAN side. This RVQoE value target indicates the QoE value that needs to be guaranteed by RAN for UE.

[10], Proposal 3: For Signalling-based QoE, the CN signals the RVQoE value target to NG-RAN together with the QoE configuration. For Management-based QoE, the OAM configures the RVQoE value target to NG-RAN together with the QoE configuration.

An example could be Buffer level alarm e.g., if buffer level is greater or less than a threshold “X”

**Q5: If UE generates the RVQoE value (based on your answer to Q4), whether it should be a pre-defined formula in SA4 specs or configurable by NG-RAN?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Pre-defined formula or Configurable by NG-RAN** | | **Comment** |
| Qualcomm | No need | | UE should not generate RVQoE values (see comments to Q4) |
| Huawei | Pre-defined | We think it is better to ask SA4 to investigate this, since RAN is not fully aware of the media transmission which is an E2E process. | |
| TMUS | NG-RAN | | RAN should be in control of the performance target |
| Samsung | No need | | If we agree UE generates QoE value, image the work we have to do next, coordinate with SA4 and RAN2 on the UE capability issue and new mechanism. We don’t think we have enough time. |
| ZTE | Pre-defined | | The RVQoE should be calculated by a pre-defined formula in SA4, not configurable by NG-RAN. |
| CMCC | Pre-defined | |  |
| **Ericsson** | No need for SA4 to do anything | | Configurable by the RAN. Why do we need SA4 to define how to count stalling events or to determine that buffer level is under a certain level? |
| CATT | Pre-defined | |  |
| Nokia | Pre-defined | | Unfortunately we need some work to be done in SA4, because it is not within RAN3's terms of reference to create requirements on the application layer. |

## RVQoE configuration

### Basic principles

[9], Proposal 4: In split scenarios, CU should generate the RVQoE configurations.

[3], Proposal 5: RVQoE and legacy QoE can be configured independently i.e., RVQoE can be configured at a later time after configuring legacy QoE by using the same measConfigAppLayerID

**Q6: Do companies agree on the above two proposals on RVQoE configuration?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes to P4, not sure to P5 | P4: We agree that the CU should generate the RAN visible QoE metric configurations.  P5: We think RAN visible QoE metric should be configured only when QoE measurement is configured, and configured together or after configuring legacy QoE to UE; since RAN needs to understand what kind of metrics could be visible and if those visible metrics were configured in the QoE measurement. |
| TMUS | Yes to P4 |  |
| Samsung | P4: yes  P5: yes |  |
| ZTE | Yes |  |
| CMCC | Yes |  |
| China Unicom | Yes | P5: We think RVQoE and legacy QoE can be configured together or configured separately. But RVQoE should be configured together or after configuring legacy QoE to UE. |
| **Ericsson** | Yes, to both |  |
| CATT | Yes |  |
| Nokia | Not sure | For the described use of RVQOE, it seems that offline measurements would be sufficient in which case the configuration doesn't need to be generated in the NG-RAN but in the application layer (application server). If it is concluded that the NG-RAN generates the configuration, P4 and P5 look reasonable from RAN point of view, leading to RAN2/CT1/SA4 impact. |

### RVQoE release

**[3], Proposal 6:** NG-RAN can release a list of RVQOE configurations while not releasing corresponding legacy QoE configurations

**[3], Proposal 7:** If the legacy QoE configuration is released, the corresponding RVQOE configuration is released as well

**Q7: Do companies agree on the above two proposals on RVQoE release ?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/no | Comment |
| **Qualcomm** | **Yes** |  |
| Huawei | Yes | Not sure the difference between P6 and P7, P7 is saying the releasing is triggered from OAM, so corresponding visible metrics should also be released; otherwise, if triggered by RAN, the two releasing behavior could be independent? Anyway, if QoE measurement configuration is released, how could RAN expect the measurement will continue?  P6: The RVQoE is configured by the RAN. Therefore RAN can release the RVQoE while keep the legacy QoE configuration.  P7: RAN3 has agreed that the RAN visible QoE metric should be configured only when QoE measurement is configured. Therefore we think the corresponding RVQoE configuration should be released if the legacy QoE configuration is released. |
| TMUS | yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| CMCC | Yes |  |
| China Unicom | Yes | RVQoE configurations can be released separate with legacy QoE. |
| **Ericsson** | OK |  |
| CATT | Yes |  |
| Nokia | Yes |  |

### RVQoE configuration IE details

RVQoE configuration can include the following (the ones in red indicate no support, ones in green indicate support)

1. Metrics to be reported [3]
2. Service Type [4]
3. QoE measurement ID [4], [9]
4. Start Time [2], [3], [12]
5. Duration [2], [3], [12]
6. Reporting Interval for periodic case [2], [7], [3], [12]
7. Triggering Event [2], [7], [12], [3]
8. Indication to report QoE value [9]
9. Sample Percentage (**FFS by [2]),** [3], [12]

**Moderator Proposal 3:** RVQoE configuration can include the RVQoE metrics to be reported, service type and a measurement ID for the RVQoE. Whether existing IEs can be reused for service type and measurement ID and the signaling design is up to RAN2

Considering the limited interest and more negative votes towards Start Time, Duration and Sample Percentage, it is also proposed the following:

**Moderator Proposal 4:** There is no need to consider Start Time, Duration and Sample Percentage in the RVQoE configuration in Rel-17

**Moderator Proposal 5:** Whether to include Triggering Event (e.g., an indication when video representation changes or stalling occurs or when a QoE metric e.g., buffer level, changes beyond a threshold) in RVQoE configuration depends on the final list of RVQoE metrics and whether RVQoE values are supported and should be discussed post agreements on those topics.

**Q8: Do companies agree with Moderator proposals 3-5?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | In general yes, but | But we think we should not make things complicated, why is “the configuration of visible metrics being coupled with corresponding QoE measurement” not acceptable, this should be the straight forward way, we could discuss further enhancements in R18 if there is consensus. |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes | For P5, how to trigger the RVQoE can be done by implementation |
| CMCC | Yes |  |
| China Unicom | 3)4) OK  5) not sure | For proposal 5), it is need to clarify if the trigger event is based on RVQoE metrics. |
| **Ericsson** | Look right | **MP3: agree**  **MP4: disagree,** we do not understand the motivation from [3] and [12] not to report start/stop time and interval.  **MP5: disagree in this form.** We support triggering events, and we think that some interesting triggering events have nothing to do with metric values. For example, RAN may want to observe the HO performance, and it needs to be able to trigger the measurement regardless the prior measurement result.  So, in addition to defining triggers that are based on measurements/reporting, one may also consider **the events** that are not measurement-based (e.g., a handover). |
| CATT | Yes |  |
| Nokia | Yes |  |

Regarding whether to support Reporting Interval, it is moderator’s understanding that this is closely related to whether RVQoE and legacy QoE can be reported separately or should be reported together (we can discuss this in section 3.4.1) and RAN2 pending reply on whether a high priority SRB can be used for RVQoE report.

Meanwhile, we could discuss the use case of RVQoE and its priority w.r.t legacy QoE to achieve some common understanding.

[3], Proposal 4: RVQOE has the same priority as legacy QoE. The main purpose of RVQOE is to expose QoE metrics to RAN and not for enabling QoE aware real-time use cases

**Q9: Does RVQoE have the same priority or higher priority than legacy QoE and why? If higher priority, is it necessary to have i) separate reporting periodicities and ii) a higher priority SRB (or can SRB4 still work)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Same or Higher priority** | **Comment** |
| Qualcomm | Same priority  Reporting Interval – Not needed  SRB4 for RVQoE report | To keep it simple, we think RVQoE can have the **same priority** as legacy QoE in Rel-17 at least till we identify RVQoE metrics which are absolutely needed with a higher frequency to enable real-time use cases.  Enabling separate reporting periodicities for RVQoE will add to the processing complexities and increase storage requirements at UE Application to handle RVQoE and legacy QoE independently. We therefore propose to not define a **Reporting Interval** for RVQoE configuration.  Also, if RVQoE has same priority as legacy QoE, **SRB4 can be reused** for RVQoE reporting and we won’t need to define a higher priority SRB (e.g., SRB1/SRB2) for RVQoE reporting. |
| Huawei | Not sure | We think visible metric report is just a by-product of QoE measurement report.  As to whether the RAN visible QoE use the same SRB with the legacy QoE, it is up to RAN2 to decide. |
| TMUS | Higher priority for RVQoE | Prefer to have the flexibility to set different priority and reporting frequency for RVQoE |
| Samsung | Higher priority for RVQoE | Agree with TMUS |
| ZTE | Same priority  Reporting Interval – Not needed  SRB4 for RVQoE report | We think RVQoE can be reported together with legacy QoE report through SRB4, which means they are of the same priority in our mind. In this way, there is no need to define a report interval for the reporting of RVQoE. |
| CMCC | Higher priority for RVQoE | And the reporting interval could be made shorter than legacy QoE. Since we’ve considered the overhead issue for the selected reporting metrics, the RVQoE report will not be large in size, so the extra overhead over Uu could be marginal. |
| China Unicom | At least RVQoE needs separate Reporting Interval  If RVQoE should have high priority need to wait RAN2 LS feedback. | Whether the RVQoE use the same SRB with the legacy QoE is up to RAN2.  Anyway, we think the separate reporting periodicities should be configured for RVQoE. |
| **Ericsson** | RVQoE has higher prio | It should be possible to report RVQoE more often because it may be used for more frequent optimization than legacy QoE. The reporting interval should be up to the RAN.  Higher priority SRB would be suitable for RVQoE, but even if SRB4 is used, the reporting intervals should be different. |
| CATT | Tend to agree Higher priority for RVQoE.  Reporting Interval is needed | If RAN 2 agrees to use SRB2 for the RVQoE report, we can set RVQOE as higher priority. Otherwise, same priority as legacy QoE  For RVQoE, RAN may want to have more just-in-time by RVQoE report, so more frequent report may be needed. The reporting interval define is needed |
| Nokia | Not sure | It seems from the described use cases that real-time interaction is not expected (e.g. analysis via statistics / AIML mechanism). RAN3 already asked RAN2 to answer this question. |

## RVQoE report

### Relation with legacy QoE report

[2], Proposal 4: The RAN visible QoE reports and legacy QoE reports may be delivered in separate messages.

[3], Observation 3: If RVQoE and legacy QoE are to be reported separately, it might increase the processing complexity and storage requirements at UE Application to handle RVQoE and legacy QoE independently

[3], Proposal 10: RVQOE and legacy QoE should be reported together

[4], Proposal 2: RVQoE and legacy QOE can be reported separately or together

[9], Proposal 5: RVQoE and legacy QoE should be reported together.

[12], Proposal 3: The RAN visible QoE metrics are reported together with the QoE report container in the interface between the application layer and the AS

**Summary from contributions:**

RVQoE and legacy QoE can be reported separately [2], [4]

RVQoE and legacy QoE should be reported together [3], [9], [12]

**Q10: Whether RVQoE and legacy QoE can be reported separately or should be reported together. If can be reported separately, please provide justifications in the potential increase in processing complexity and storage requirements at UE APP as highlighted by [3]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Together or Separate** | **Comment** |
| Qualcomm | Together | Justifications provided in Q9. |
| Huawei | Together | We think this question is about the reporting between AS and APP. As to the Uu, it is up to RAN2 to decide. |
| TMUS | No Strong view | However, Separate would provide more flexibility. For example, operator can decide to disable the legacy QoE and only enable RVQoE, or give low priority to legacy QoE reporting |
| Samsung | Both are possible | We think it depends on the configuration of report interval and trigger event, if the report interval of legacy QoE report is quite long (e.g. report at the end of the session), RVQoE can be reported more frequent than legacy QoE report; if the report interval of legacy QoE report is short enough, RVQoE can be reported together with the legacy QoE report.  There’s no need to restrict whether report them together or separately, it depends on the configuration. |
| ZTE | Together | This would make it easier for the configuration and reporting of RVQoE. |
| CMCC | Both are possible |  |
| China Unicom | Separately | We think RVQoE is used for RAN optimization, it should have separate interval with legacy QoE and should be reported separately. |
| **Ericsson** | Both separately and together | Tying legacy QoE reports and RVQoE reports can significantly limit the usefulness of RVQoE.  Regarding QC’s concern about storage, we are not sure why more storage is needed, given that RVQoE reports are to be sent more often than legacy ones. The processing price is, in our opinion, not drastic and definitely worth it, given the purpose of RVQoE. |
| CATT | separately or together | We cannot restrict the report of RVQoE and legacy QoE report separately or together. These two scenario should be all supported |
| Nokia | probably together | We can't see any described use case justifying a requirement from RAN3 point of view in the direction of separate reporting. |

### PDU session information

[2], Proposal 5: RAN3 to discuss the feasibility of including PDU session information into the RVQoE report.

[3], Observation 4: QoE support for MR-DC is not supported in Rel-17 i.e., QoE is always configured and reported over MN in Rel-17

[3], Proposal 11: There is no need to include PDU session information (e.g., DRB ID, PDU session ID, QoS Flow ID) in the RVQoE report

[6], Proposal 2: The gNB should be able to identify the DRB concerned by RVQOE reports, which will require reporting of PDU session and QoS flow information from the UE to the gNB.

[7], Proposal 4: The DRB information (or QoS flow information) should be included in the QoE report for QoS aware scheduling.

[12], Proposal 6: The PDU session information and QoS flow information are reported together with the RAN visible QoE.

**Q11: Whether PDU/DRB/QoS flow information should be included in RVQoE report? Should this be deferred to Rel-18 as QoE for MR-DC is not supported in Rel-17?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | No | Can be discussed in Rel-18 |
| Huawei | Yes to PDU/QoS | We think application layer understands the corresponding PDU/QoS info of the concerned service type, which could be convey to UE AS layer, for UE to report.  It is not the QoE for MR-DC. The motivation of RAN visible QoE is to optimize the radio resource allocation. In NR, the radio resource are configured per DRB. Therefore we think the RAN need to know the corresponding DRB of the QoE reporting. But the APP does not know the DRB information. Therefore the APP should report the PDU/QoS flow information. |
| TMUS | Yes |  |
| Samsung | Yes | The PDU/DRB/QoS flow information is needed, which ID is used can be FFS. |
| ZTE | Yes | We think PDU/QoS flow information should be included in RVQoE. |
| CMCC | Yes | PDU/DRB/QoS flow info is needed. And we can decide which granularities could be reported as a starting point in R17. |
| China Unicom | Yes to PDU | We think PDU session ID (list) can be visible for RAN. RAN can know the correlation for DRB and PDU session.  It is not for MR-DC, it is RVQoE for RAN optimization, and should be supported in R17. |
| **Ericsson** | No | We think that the feasibility i.e., whether the Application layer has access to this information, needs to be studied. For example, for the DRB/PDU session ID/QoS flow information to be included in the RVQoE report, either the Application layer needs to be aware of this information or the UE AS needs to be aware of the mapping between an application session pertaining to the QoE reference, and a DRB/PDU session.  Given the amount of work we have left, it is better to consider this in Rel18. |
| CATT |  | Can be discuss it in R18 |
| Nokia | Yes to PDU/QoS | Without mapping to a DRB (based on PDU/QoS flow), the RVQOE information can't be used in the RAN. |

## Mobility Support for RVQoE

[2], Proposal 6: RAN3 to agree that the RAN visible QoE configuration can be propagated via Xn from the source to target node upon mobility in RRC\_CONNECTED and during context retrieval upon resumption from RRC\_INACTIVE. The target/new RAN node may assemble a different RAN visible QoE configuration.

[3], Proposal 12: RVQoE configuration can be propagated from the source to target node upon mobility in RRC\_CONNECTED and during context retrieval upon resumption from RRC\_INACTIVE. The target/new RAN node may assemble a different RVQoE configuration

[4], Proposal 3: RVQoE configuration **will not be transferred** to target node during mobility or resumption

**Q12: Whether RVQoE configuration can be propagated from the source to target node upon mobility and during context retrieval? If not, please provide justifications.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes, but | Since visible metrics are mainly for the RAN node to check and evaluate the resource usage, we are not sure if this target RAN node is happy to do that or not, if target RAN is willing to do that, it could configure by itself, according to the received QoE measurement configuration.  In our understanding, the RAN visible QoE configuration is included in the RRCReconfiguration message. And the source RAN will transfer the RRCReconfiguration to the target RAN in the handoverPreparationInformation during the mobility and context retrieval. Therefore the target node can know the RAN visible QoE configuration from the source node. It does not have any impact on RAN3. |
| TMUS | Yes |  |
| Samsung | No | In our understanding, RVQoE is for node internal optimization, RVQoE configuration should be kept within the gNB that initiates RVQoE collection. If the UE is handed over to a new gNB, if RVQoE is needed in the new gNB, the new gNB will send the new RVQoE configuration according to its own optimization needs.  So there’s no need to transfer the RVQoE configuration 1 of gNB1 to gNB2 which may have RVQoE configuration 2 itself.  If this RVQoE configuration propagation is supported, there will be an issue that we should decide what type of RVQoE is (s-based or m-based) as the assembly of RVQoE is according to the QoE configuration from OAM (both s-based and m-based are possible), it will also make the overriding mechanism complicated.  And of course, there’s no need to kept RVQoE configuration when UE enters into RRC\_INACTIVE state. |
| ZTE | No | We think the RVQoE configuration is only used for the RAN node itself. If the UE handovers to another RAN node, we are not sure whether the RVQoE configuration counts for the target node. if the target RAN node feels necessary to perform RVQoE, it can generate the RVQoE configuration for itself, instead of taking the configuration from source node. |
| CMCC | Yes | The target could refer to config at source, and reconfigure if needed. |
| China Unicom | Yes |  |
| **Ericsson** | Yes |  |
| CATT | No | The RVQoE is RAN locally requirement and generated by the RAN node. After handover, the target node may initial the RVQoE configuration by their requirement. Follow the same principle, the RVQoE configuration also is not need to be transferred when the UE is in RRC\_inactive. |
| Nokia | No | This seems to be an enhancement that can come later if needed. |

Further, the following proposals were made on propagation of RVQoE report:

[2], Proposal 7: The RAN visible QoE report can be signalled from the target to the source node after a successful handover.

[4], Proposal 4: RVQoE report can be signalled from the target to the source node after a successful handover

[7], Proposal 5: RAN visible QoE report should be transmitted on Xn for scheduling optimization or handover optimization.

[3], Proposal 13: RVQoE report can be signaled from the target to the source node after a successful handover

[12], Proposal 9: Sending the RAN visible QoE report from the target node to the source node can be discussed in SON/MDT WID.

Since companies have consensus, the following is proposed.

**Moderator Proposal 6:** The RAN visible QoE report can be signalled from the target to the source node after a successful handover.

**Q13: Whether Moderator Proposal 6 is agreeable?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Not sure | As suggested, we think this could be discussed in SON/MDT WI. |
| TMUS | Yes |  |
| Samsung | Yes | We should discuss how to deliver the RVQoE report to the right place, just the same as we discuss how to deliver QoE report to MCE in legacy QoE reporting.  This topic is definitely in the QoE WI scope. |
| ZTE | No | see Q12 comments. |
| CMCC | Yes |  |
| China Unicom | Yes |  |
| **Ericsson** | Yes | Yes, this is needed to monitor the impact of HO on QoE. |
| CATT | Yes |  |
| Nokia | No | This seems to be an enhancement that can come later if needed. |

## Which RVQoE metrics can NG-RAN configure?

[2], Observation 1: The OAM can configure the UE to collect a subset of the QoE metrics and not necessarily all the supported QoE metrics, meaning that the set of RVQoE metrics that are allowed to be collected is a subset of the legacy and RVQoE metrics that the UE is capable of collecting for the given service type.

[2], Proposal 1: The OAM sends a list of the available RVQoE metrics to the RAN node, outside the legacy QoE configuration container.

[12], proposal 2: For the RAN visible metrics, it should explicitly indicate to RAN the metrics which could be visible in RAN and are also configured in the container.

[3], Proposal 14: NG-RAN can conclude which RVQoE metrics are available to be collected from the UE via UE capability signaling and the service type configured for the UE (no need for OAM to configure this explicitly in the QoE configuration container)

[4], Proposal 1: RAN can conclude the metrics from the UE capability indication and the service type configured for the UE

**Q14: Which option do you prefer?**

**Option 1: NG-RAN configures RVQoE for only those metrics which are configured as part of legacy QoE configuration (needs OAM indication to NG-RAN)**

**Option 2: NG-RAN can configure any RVQoE metric without the knowledge of legacy QoE metrics configured**

An example is provided below:

* Suppose UE indicates capability to collect RVQoE metrics 1, 2 and 3 for service Type A.
* OAM configures legacy QoE metrics 1, 2 for service Type A
* Can NG-RAN configure UE to provide RVQoE metric 3 or only should be a subset of legacy QoE metrics 1 and 2?

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1 or 2** | **Comment** |
| Qualcomm | See comments | Option 1 is probably better in that it doesn’t introduce new requirements at UE to measure a QoE metric just for RVQoE (e.g., RVQoE metric 3 in the above example), but reduces flexibility at NG-RAN (i.e., it can’t configure RVQoE metric 3 in the above example).  We seek some clarifications on Option 1 as well:   1. Is there a security issue as NG-RAN is informed which legacy QoE metrics were configured by the OAM inside the QoE configuration container? (e.g., that OAM configured QoE metrics 1 and 2 in the above example) 2. This list of RVQoE metrics will need to be sent with each QoE configuration, right? So, some signalling impact is foreseen. |
| Huawei | The former | We think visible metrics should be explicitly indicated to RAN the metrics which could be visible in RAN and are also configured in the container, otherwise RAN intervenes UE application layer behaviour.  The UE capability for the collecting of each metric does not mean the OAM will configure to report this metric. Also we are still not sure how the capabilities for RAN visible QoE are designed by RAN2. |
| TMUS | Prefer option 1 |  |
| Samsung | Option 1 |  |
| ZTE | Prefer Option 1 | Prefer Option 1. By Option 2, if RAN selects a metric not configured in legacy QoE, the UE app layer would be pushed to start new measurement only for RVQoE, which is not preferred. |
| CMCC |  | Depends on what metrics we can report in RVQoE report. |
| China Unicom | Option1 | RVQoE should be a subset of legacy QoE metrics that configured by OAM. |
| **Ericsson** | Option 1 | We should liaise RAN2 to include the support for UE RVQoE capability indication. |
| CATT | Option2  Option 1also can be accepted | this solution2 is simple for the implementation. We don’t think we have agreements on the RVQoE metrics should be subset of the legacy QoE. So no harmful in RVQoE have one metric which is not in the legacy QoE  For the option1, the OAM also does not know which metrics is configured because it will not decode the XML file. We should check with SA5 whether the OAM can provide this metrics information |
| Nokia | Option 1 |  |

## Misc topics

### RVQoE handling at RAN overload

[3], Proposal 7: If the legacy QoE configuration is paused/resumed, the corresponding RVQOE configuration is paused/resumed as well

[3], Proposal 8: A common indicator is used to pause/resume both legacy QoE and RVQoE configurations i.e., there is no support to pause/resume a list of RVQoE configurations while not pausing/resuming corresponding legacy QoE configurations

**Q15: Do companies agree on the above two proposals on RVQoE handling at RAN overload?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes |  |
| Huawei | Yes | This is a simpler way. Also as we known, RAN2 are still discussing whether to support the pause at RAN overload and how to store the QoE results generated during the pause phase. Maybe we need to wait the progress of RAN2. |
| TMUS | Yes |  |
| Samsung | Depends on Q9 and Q10 | If SRB4 is used for RVQoE and RVQoE report together with legacy QoE report, the P7 and P8 can be agreed.  If RVQoE report has higher priority or report separately from legacy QoE report, we need further discuss. |
| ZTE | FFS | Maybe the above two proposals can be FFS, suggest to discuss these as enhancements in R18. |
| CMCC |  | We can accept to agree on these to make progress. |
| China Unicom | Yes |  |
| **Ericsson** | No | Pausing RAN visible QoE is not needed. QoE measurement is performed during the pause and RVQoE report can be provided to RAN to monitor the user experience during overload. Given the limited size of RVQoE and its values, pausing the RVQoE may not be required. |
| CATT |  | We can make it simple in R17. But it is better to separate |
| Nokia | Yes to P7 | We can make it simple in R17. |

### Other topics

[2], Proposal 2: The alignment between radio-related measurements and RVQoE measurements is supported.

[2], Proposal 3: RAN3 to discuss the support for per-slice RVQoE and RVQoE handling at RAN overload once the basic solution (for QoE measurements) has been defined.

[3], Proposal 17: Per-slice RVQOE and alignment of RVQOE with radio-related measurements can be discussed post progress on the corresponding topics for the legacy QoE

**Moderator Proposal 7:** Alignment between radio-related measurements and RVQoE measurements and Per-slice RVQoE can be discussed post progress on the corresponding topics for the legacy QoE.

**Q16: Do companies agree on Moderator Proposal 7?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Postpone | Can be discussed in the next meeting |
| Huawei | Yes | Let’s try to agree a baseline approach, then we could continue to discuss possible enhancements |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE | Postpone |  |
| CMCC | Yes |  |
| China Unicom | Yes | Agree with Huawei |
| **Ericsson** | Yes | We need to do this at the next meeting. |
| CATT | Yes |  |
| Nokia | Postpone |  |

### Stage-3

QoE information transfer over F1 was already agreed last meeting. We can discuss the draft CR this meeting.

[7], Proposal 6: QoE information should be transmitted on F1 for scheduling purpose.

[7], Proposal 7: RAN3 agree the CR for TS 38.473 in [8] to support QoE information transfer.

**Q17: Any comments on the draft CR for TS 38.473?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/no** | **Comment** |
| Qualcomm | Yes | OK in general to introduce a class-2 message QOE INFORMATION TRANSFER over F1. IE details (whether to include RVQoE values, DRB ID) can be FFS and based on agreements this meeting. |
| Huawei | Yes | This could be considered |
| TMUS | Yes |  |
| Samsung | Yes |  |
| ZTE |  | OK for P6, the detail of stage3 is FFS. |
| CMCC | Yes |  |
| China Unicom | Yes |  |
| **Ericsson** | OK, in general, but… | We need to refine the content, based on pending agreements. |
| CATT | Yes |  |
| Nokia |  | we need to check stage 3 in light of agreements taken |

## LSs to other groups

The following LSs to other groups have been proposed. In the 1st round, we can confirm which of the following LSs are needed and **can work on the draft LSs in the 2nd round** based on agreements achieved this meeting.

**Q18: Which of the following LSs are needed to be sent?**

1. **LS to CT1 requesting to provide the AT commands for RVQoE configuration and report between the UE Application layer and UE AS**
2. **LS to SA4 to check if any spec impact is needed to support RVQoE**
3. **LS to RAN2 on further agreements on RVQoE configuration and RVQoE metrics and RVQoE values (if agreed)**
4. **LS to SA4/CT1 to check whether the application layer can know the QoS flows of the service [13]**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No on LSs i)-iv)** | **Comment** |
| Qualcomm | Except iv) | OK on LS i)-iii). Details can be decided in Phase-II.  **Not clear on LS iv)** which states the following:  *The motivation of RAN visible QoE is to optimize the radio resource allocation. In NR, the radio resource are configured per DRB. The packets belonging to different PDU sessions are mapped to different DRBs by the RAN, and the packets from different QoS flows belonging to the same PDU session can be mapped to different DRBs. According to the last reply LS from SA4, RAN3’s understanding is that the UE APP can know the PDU session information of the concerned service type, but RAN3 are not sure whether the APP can know the QoS flow information belonging to each PDU session.*  **Question to SA4**: T*herefore, RAN3 would like to check with SA4 if the APP can also know the QoS flows of the concerned service, so that RAN is able to know the correspondence between the service type with the reported visible metrics and the PDU session/QoS flows, and take potential optimizations of radio resource usage for corresponding DRB.*  Is this related to section 3.4.2 on PDU session information? If so, this can be postponed to Rel-18 as commented before. |
| Huawei | iii&iv. | We think we could a common LS to e.g. CT1/SA4, informing agreements and asking questions; another LS to RAN2 informing agreements and asking questions (if needed) |
| TMUS | i, ii and iii |  |
| Samsung | Yes to all | Agree with HW about we can have a common LS |
| ZTE | Yes on i) ii) | We submitted a draft LS to SA4 this time and we are glad to provide a draft LS for ii) in phase II if needed, based on the progress at this meeting. |
| CMCC | Yes to all |  |
| China Unicom | ii and iii |  |
| **Ericsson** | Yes to all except iv), and… | We should also liaise RAN2 to include the support for UE RVQoE capability indication.  Let us leave iv) for Rel18. |
| CATT | iii | For others, I don’t think these are needed. The i) should be in the RAN2 scope, RAN2 send the LS to CT1 with their design |
| Nokia | iv  maybe iii | iv is needed, because this information is essential for RVQOE. i: to be done by RAN2; ii: LS not needed at this meeting, but it is clear from WG ToR's that there is SA4 impact. iii: this may be needed, depending on meeting outcome |

# Conclusion, Recommendations [if needed]

If needed

# References

|  |  |  |
| --- | --- | --- |
|  |  |  |
| [1] | [R3-214730](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214730.zip) | RAN Visible QoE Metrics (Ericsson) |
| [2] | [R3-214731](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214731.zip) | Configuration and Reporting of RAN Visible QoE (Ericsson) |
| [3] | [R3-214911](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-214911.zip) | RAN Visible QoE (Qualcomm Incorporated) |
| [4] | [R3-215119](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215119.zip) | Discussion on RAN visible QoE configuration and reporting (CATT) |
| [5] | [R3-215120](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215120.zip) | TP for 38.423 on RAN visible QoE configuration and reporting (CATT) |
| [6] | [R3-215312](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215312.zip) | Handling of open points for RAN visible QoE (Nokia, Nokia Shanghai Bell) |
| [7] | [R3-215546](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215546.zip) | RAN visible QoE (Samsung) |
| [8] | [R3-215547](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215547.zip) | (CR for TS38.473) Support of QoE information transfer (Samsung) |
| [9] | [R3-215641](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215641.zip) | Discussion on configuration and reporting of RVQoE (ZTE, China Telecom) |
| [10] | [R3-215644](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215644.zip) | Consideration on RAN visible QoE (ZTE, China Telecom) |
| [11] | [R3-215647](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215647.zip) | [draft] LS on the support for RAN visible QoE (ZTE, China Telecom) |
| [12] | [R3-215659](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215659.zip) | Further discussions on RAN visible QoE metrics (Huawei) |
| [13] | [R3-215660](https://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_114-e/Docs/R3-215660.zip) | Draft LS on RAN visible QoE conclusions (Huawei) |