**Now it3GPP TSG-RAN WG3 Meeting #111-eR3-211015**

**Online, January 25th – February 4th 2021**

Agenda Item: 15.2

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: # NRQoE5-RAN\_visible**

The deadline for providing replies to Phase 1 is **Thursday, January 28th at 23.59 UTC.**

Relevant papers:

1. R3-210357 RAN visible QoE (Qualcomm Incorporated)
2. R3-210510 Discussion on RAN visible QoE and RAN triggered QMC (Samsung)
3. R3-210528 pCR for TR 38.890: QoE Visibility at the RAN (Ericsson)
4. R3-210772 Discussion on RAN visible QoE configuration and reporting (CATT)
5. R3-210773 TP for RAN visible QoE configuration and reporting (CATT)
6. R3-210900 Remaining issues on NR QoE management (CMCC)
7. R3-210821 Further discussions on the remaining open issues of QoE report visibility at RAN (Huawei)
8. R3-210660 (TP for TR 38.890) RAN awareness of QoE measurement reports (Nokia, Nokia Shanghai Bell)
9. R3-210848 Further consideration on NR QoE service and procedure (ZTE)

# For the Chairman’s Notes

**TBW**

# Phase 1: Reaching the essential agreements

At the RAN3#109-e and RAN3#110-e meetings the following was agreed:

**Take RAN visibility of some QoE information may be useful - to be confirmed in next meeting**

**Study the solution for QoE awareness:**

* **Type 1: gNB understands QoE report up to implementation**
  + **Opt. a) gNB directly understand UE QoE report up to implementation**
  + **Opt. d) gNB derives QoE score from UE QoE report by ML model**
* **Type 2: gNB receives RAN-visible QoE metrics from UE**
  + **Opt. b) UE reports generic QoE score to gNB**
  + **Opt. e) UE provide the report data as two parts, one for RAN with RAN designed format,**
* **Type 3: gNB receives RAN-visible QoE metrics from MCE. LTE as the baseline, the QoE configuration and QoE measurement results defined by SA4 are delivered as container.**

***What kinds of QoE metrics for RAN to understand, generic QoE score or some selected QoE parameters?***

***How to derive the RAN visible QoE metrics, from access stratum or application layer?***

***To be continued...***

## QoE visibility at the RAN

**NOTE: The objective of phase 1 is to reach the essential agreements, based on which a pCR for TR 38.890 is to be produced in Phase 2.**

Papers [1]-[8] state that QoE visibility at the RAN is useful and should be supported. Paper [7] is also in favour of QoE visibility at the RAN and provides an initial analysis of the relevance of the existing SA4-defined QoE metrics. Paper [8] states that the visibility can be supported via NR RRC is the normative phase, should the relevant use cases be identified. Meanwhile, paper [9] generally questions the benefits of the visibility, but, argues, that, in case RAN3 agrees on it, Opt1 of type a) should be selected.

Based on the above, the following proposals are derived:

**Proposal 1-1: QoE visibility at the RAN is supported.**

**Proposal 1-2: Remove the following Editor’s Note from the TR 38.890: “*Editor's NOTE: It is FFS whether RAN awareness of QoE information is useful, and whether UE reporting is needed.*”.**

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| **Company** | **Do you agree with Proposals 1-1 and 1-2?** |
| Ericsson | Yes, to both. |
| CATT | Yes, both |
| Samsung | Yes to both |
| Nokia | As per our discussion in [8] we can't agree on P1-1 as worded above but propose to reword as follows:  **Proposal 1-1: Future need for QoE visibility at the RAN is not excluded, and Rel-17 NR QoE signalling design should therefore be extendable to cover this case.**  For P1-2 we refer to our TP in [8] where we propose to remove the mentioned editor's note and also provide additional clarifications. |

## RAN-visible QoE reporting

Papers [3], [6] and [7] explicitly, and paper [8] implicitly propose that the UE should report the RAN-visible QoE, in an IE separate from the SA4-defined QoE report.

Paper [9] opts in favour of option a) of Type 1, i.e. that the visibility is enabled by implementation.

Paper [1] proposes that the RAN-visible QoE information is sent to the RAN by the RRC layer of the UE, as per input received from the APP layer by means of AT command.

Based on the above, the following proposals are derived:

**Proposal 2-1: The UE sends to the RAN the RAN-visible QoE report, in an IE separate and independent from the SA4-defined QoE report.**

**Proposal 2-2: RAN-visible QoE report is sent to the RAN by the RRC layer of the UE, as per input received from the APP layer by means of AT command.**

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| **Company** | **Do you agree with Proposals 2-1 and 2-2?** |
| Ericsson | Yes, to both. |
| CATT | **Yes** |
| Samsung | Both of the proposals depends on which RAN visible QoE solution is used.  In previous meeting, RAN3 agreed 3 types of RAN visible QoE solutions:   * For type 1, no impact on reporting. * For type 2, the RAN visible QoE report is independent from SA4-defined QoE report * For type 3, no impact on reporting   So P2-1 and P2-2, yes ONLY for type2. |
| Nokia | P2-1: We believe that SA4 involvement is needed also for the definition of any RAN-visible QoE report because the measurement has to be collected by the application. But agree on the principle to make the signaling extendable based on separate IE.  P2-2: Our current understanding is that AT commands terminate in the NAS layer and not in the AS. However we agree to the principle that any future RAN-visible QoE reports should be conveyed via RRC, letting the rest to RAN2. |

## RAN-visible QoE metrics

Paper [3] proposes that RAN-visible QoE metrics may include e.g. a numeric value on a scale from 0 to x, or an objective qualitative representation (“good QoE”, “moderate QoE”, “bad QoE”) per metric, or a binary flag.

Paper [7] analyses the existing SA4-defined QoE metrics and concludes that visibility of “buffer level” may be useful to the RAN. The same metric is also deemed useful by paper [6].

Paper [2] proposes that RAN-visible QoE metrics should be the Mean Opinion Score, derived from the SA4 QoE metrics.

Paper [1] proposes that simplified QoE information such as generic QoE value or combination of values should be derived from the SA4 defined QoE metrics by UE Application for RAN visible QoE.

The rapporteur notes that the companies identify certain SA4-defined QoE metrics that may be useful for RAN, but also argue that such metrics are not abundant. Hence, it seems that additional RAN-visible metrics may be necessary, with respect to those derived from the SA4-defined QoE metrics.

Based on the above, the following proposals are derived:

**Proposal 3-1: RAN-visible QoE metrics can be derived from individual SA4-defined QoE metrics deemed useful for the RAN, such as buffer level.**

**Proposal 3-2: RAN-visible QoE metrics can be simplified values derived from individual useful SA4-defined QoE metrics or combinations of these values in the form of e.g.:**

* **Numeric values on scale from 0 to x;**
* **Binary flags;**
* **Objective qualitative representations (“good QoE”, “moderate QoE”, “bad QoE”).**

**Proposal 3-3: Capture the initial analysis on RAN visible QoE metrics from [7] into the TR 38.890.**

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| **Company** | **Do you agree with Proposals 3-1, 3-2 and 3-3?** |
| Ericsson | We agree to the proposals.  We would prefer not to refer to the MOS in this context, as the term refers to a subjective framework and can thus not be used for the desired optimizations.  Regarding the analysis to be captured in the TP, we believe it is a good start, but probably requires some editing. |
| CATT | I would like to suggest we discuss these aspects in WI phase. We don’t need look so detail for the method in SI phase. We need more study on which parameter is needed for RAN visible QoE |
| Samsung | For proposal 3-1, agree, the detail metrics that can be used for RAN should be analysis service by service, as for streaming service, the buffer level, stallings and stalling duration will be useful for RAN; for voice service, the latency and packet loss will be useful for RAN. We prefer discuss the details in WI phase.  For proposal 3-2, in our understanding, the value derived from SA4-defined QoE metrics is kind of estimated MOS value, and the estimated MOS value is result stemming from an objective model. We think the estimated MOS values are beneficial for RAN, however, this value can also be derived from the metrics mentioned in proposal 3-1 according to the simplified MOS models defined by operators. So we think the metrics in proposal 3-1 are enough for RAN.  For proposal 3-3, it’s a good start, however the analysis in [7] are very one-sided, not sure we have time to check them one by one. |
| Nokia | A good starting point seems to be to capture the proposed clause 6.7.1 from [7]. For the buffer level (which we believe is UL buffer only?), it should be checked whether an alternative could be to use the UL D1 delay measurement already available via RRC today, or such measurement possibly improved e.g. by the gNB which can derive the delay of the QoS flow. The UL D1 delay measurement includes the UL PDCP buffering delay. |

## RAN interaction with the SA4-defined QMC and reporting

Paper [3] argues that RAN should not be allowed to change the existing configuration of legacy QoE metrics specified by SA4 (i.e. the metrics not visible at the RAN).

Meanwhile, paper [2] proposes that both RAN-visible QoE and the “underlying raw metrics generated in application layer” should be visible and used for RAN.

Based on the above, the following proposals are derived:

**Proposal 4-1: RAN should not be allowed to change the existing configuration of legacy QoE metrics specified by SA4 (i.e. the metrics not visible at the RAN).**

**Proposal 4-2: Both RAN-visible QoE and the “underlying raw metrics generated in application layer” should be visible and used for RAN.**

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| **Company** | **Do you agree with Proposals 4-1 and 4-2?** |
| Ericsson | **4-1:** we agree, RAN should not tamper with legacy QoE configuration.  **4-2:** disagree, RAN should not be required to read the legacy QoE reports, that defeats the whole purpose of introducing RAN-visible QoE. Moreover, the legacy QoE metrics are reported in a zipped XML file, where each change in the report XML structure would require changes to the gNB functionality. |
| CATT | 4-1 agree. 4-2 disagree.  We need get the clear understanding about how the RAN use the underlying raw metrics generated in application layer. In the legacy LTE QoE, whether MCE server sends to RAN any information which is derived from QoE report. if any redundancy define between them. |
| Samsung | There are some misunderstandings on proposal 4-2.  Proposal 4-2 is not trying to change the SA4 defined structure.  What paper [2] tries to point out is that both QoE value (i.e. score) and QoE metrics (maybe some key metrics, the same as p3-1) defined by SA4 are useful for RAN. The QoE value can reflect the whole situation of user experience, but the QoE metrics can reflect the details, and the QoE metrics (i.e. the underlying raw metrics) can be obtained by the following ways (which have been agreed in previous meeting):   * **Type 1: gNB understands QoE report up to implementation**   + **Opt. a) gNB directly understand UE QoE report up to implementation** * **Type 2: gNB receives RAN-visible QoE metrics from UE**   + **Opt. e) UE provide the report data as two parts, one for RAN with RAN designed format,**   For type 1, RAN can read the XML report up to implementation. the XML is a standardized format, and RAN also generates some XML files itself (e.g. logs, traces), so in our understanding, RAN is capable to read XML file. Here we only talk about reading, there will have no any change on the structure of the xml file.  For type 2, UE can provide the QoE metrics with RAN designed format to RAN, those QoE metrics may be some key metrics are useful for RAN, just the same as proposal 3-1.  So we think both approaches (type 1 and type 2) are feasible, which should be captured in the TR. |
| Nokia | P4-1: agree that QoE configuration received from OAM/MCE etc should be transparent to the RAN  P4-2: RAN implementations could read XML QoE reports, and forward without modification |

## Configuration of RAN-visible QoE measurement and reporting

Paper [3] proposes that RAN supports QoE measurement configuration and activation of Lightweight QoE, for all services.

Paper [4] proposes that RAN visible QoE configuration can be sent to the UE (resulting in measurement start) directly from the RAN or indirectly from RAN via OAM/CN, where RAN assembles the RAN-visible QoE configuration.

In rapporteur’s understanding, paper [2] proposes that RAN should be able to trigger the QoE measurement when it deems it necessary, where the measurements triggered include both SA4-defined QoE measurements and RAN-visible measurements, where RAN can read both types of reports.

Papers [1] and [7] propose that RAN-visible configuration should be assembled by the OAM/CN.

Paper [2] also proposes that, for real-time use cases, QoE value (the rapporteur understands this as RAN-visible QoE) should be generated by gNB or UE; for non-real time use cases, QoE value should be generated by QoE server and transmitted to gNB.

From the above, the following questions can be derived:

**Q5-1: Which node should assemble the RAN-visible QoE configuration?**

**Q5-2: Which node should trigger (= activate) RAN-visible QoE measurements?**

**Q5-3: Where should the RAN-visible QoE values be generated?**

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| **Company** | **Please provide your answers to questions 5-1, 5-2 and 5-3** |
| Ericsson | **Q5-1: RAN** should be responsible for assembling the RAN-visible measurement configuration, because RAN is the end user of RAN-visible QoE measurements, and it knows what it is interested in. This should hold for all services.  **Q5-2: RAN** should be responsible for activating the RAN-visible measurement. Again, as the end-user of RAN-visible QoE reports, RAN should be able to activate the RAN-visible QoE measurements. This should hold for all services.  **Q5-3:** These values should be generated **at the UE**. Otherwise, things become complicated:   * The solution where the OAM server generates RAN-visible QoE values introduces huge latency – note that one of the main use cases of RAN QoE awareness are time-critical applications, enabling the RAN to make timely adjustments. * RAN generating the RAN-visible QoE values means that RAN should be able to read the legacy QoE reports, which is not preferred and defeats the purpose of RAN QoE awareness. * Having different types of handling for different applications (time-critical vs. non-time-critical), increases the complexity. |
| CATT | Q5-1: RAN should assemble the RAN-visible QoE configuration. But the OAM/CN may need to aware the RAN-visible configuration to avoid the configuration and report redundancy. For example, MCE get some issue from the QoE report and then require RAN to do sth. Meanwhile the RAN gets the same problem form visible report and plan to do sth. The requirement may be redundancy  Q5-2: RAN should trigger RAN-visible measurement. Also the RAN can stop/release the measurements at any time. We need study how to support the mobility about the RAN-visible QoE  Q5-3: UE generates the value. We need have the whole picture how the MCE QoE and RAN visible QoE work together. The coordination of the configuration and correlation the report may be needed. We should work with SA4 for this structure design if we agree to support RAN visible QoE |
| Samsung | Q5-1, RAN should assemble the RAN visible QoE configuration **(including proposal 3-1 or proposal 3-2)**.  Q5-2,RAN should trigger RAN-visible QoE measurements **(including proposal 3-1 or proposal 3-2)**  Q5-3: **Where should the RAN-visible QoE values be generated? (For proposal 3-2),** before we discuss where to generate, we should firstly think about how this value is generated, in our view, it can be generated from the QoE metrics through the MOS model defined by operators. So it is possible that **UE, RAN and QoE server** can generate this value  In our analysis:   * If UE generates the QoE value, the question is how to make different UEs and applications follow the same rule to generate this value? We think it’s possible but hard to implement, and also not flexible. * If gNB generates the QoE value, it can use the key QoE metrics from the UE (proposal 3-1) according to the operator defined MOS model, thus, gNB will have both QoE metrics (i.e. detail view) and QoE value (high level view), it’s beneficial for RAN functions and features. * If QoE server generates QoE value, it’s easy to implement, but it cannot be used for time critical services.   We think all of the options (generated by UE, gNB or QoE server) should be studied in the TR. |
| Nokia | Agree with CATT and Samsung that different options need study e.g. to avoid excessive or redundant reporting burden for the application client in the UE. But we would further add that it is also important to define a clear use case (problem to solve) in order to guide the direction of such study. |

# Phase 2: Production of a pCR for TR 38.890