3GPP TSG-RAN WG2 Meeting #115 R2-21xxxxx

Online, 09 – 27 August 2021

**Agenda item: 8.14.2.1**

**Source: Huawei, HiSilicon**

**Title: Summary of QoE mobility papers**

**WID/SID: NR\_QoE-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This document summarizes observations and proposals related to QoE handling during inter-cell UE mobility, including handling of state transitioning from RRC INACTIVE to RRC CONNECTED, from the following Tdocs:

1. R2-2107513 QoE handling in RAN Nokia, Nokia Shanghai Bell
2. R2-2108110 Mobility Support for NR QoE Management Ericsson
3. R2-2108111 [Draft] Support for Session Start and Session End Indication Ericsson
4. R2-2108207 QoE handling during UE mobility Huawei, HiSilicon
5. R2-2108228 Discussion on NR QoEcontinuity in handover ZTE Corporation, Sanechips
6. R2-2108595 Discussion on QoE continuity during mobility vivo
7. R2-2108514 More considerations on configuration and reporting CMCC
8. R2-2107817 Left issues for QoE pause and resume procedure Qualcomm Incorporated
9. R2-2107381 Activation and deactivation for QoE collection CATT

Based on the summarized views, a set of proposals for the discussion and agreement by RAN2 is provided as well.

# 2 Discussion

## 2.1 Management based and signalling based QoE

In [1], it is proposed to clarify that the QoE configuration propagates during the handover only for signalling-based QoE activation, while it does not propagate for management-based QoE. Similarly, [5] assumes that QOE continuity is only applicable to signalling-based QoE. In [2] on the other hand, there is a view that all mobility related procedures should be applicable to both signalling-0based and management-based QoE. The rapporteur would like to note that RAN3 is already discussing this topic and made the following agreement:

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| Include signaling based QoE measurement configuration in handover preparation messages i.e. in XnAP: HANDOVER REQUEST, NGAP: HANDOVER REQUEST. FFS on NGAP HANDOVER REQUIRED |

Furthermore, it is already noted in WID (RP-210913) that for mobility handling for management based QoE activation, SA5 input is required:

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| * Specify the support for QoE measurement collection and reporting continuity in intra-system intra-RAT mobility scenario for signaling based QoE. Mobility support for management based QoE measurements is pending input from SA5. [RAN3, RAN2] |

It seems that for now RAN2 can assume that a discussion and agreements related to mobility are applicable to signalling-based QoE and whether they are applicable to management-based QoE depends on further discussions in RAN3 based on input from SA5.

**Proposal 1: RAN2 assumes that all QoE mobility related agreements made by RAN2 are applicable at least to signalling based QoE. Whether the same applies to management-based QoE is pending further input from SA5 and RAN3.**

## 2.2 Area handling for QoE during handover

RAN2 received an LS from RAN3 in R3-212976 with the following conclusion with respect to area handling for QoE during mobility:

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| RAN3 discussed further the following three options captured in TR 38.890 regarding the area handling for QoE during mobility.  - Option 1, where the network is responsible for keeping track of whether the UE is inside or outside the area and configures / releases configuration accordingly.  - Option 2, where the network is responsible for keeping track of whether the UE is inside or outside the area, and the UE responsible to manage start/stop of QoE accordingly.  - Option 3, where the UE is responsible for area checking (UE has the area configuration) and to manage start/stop of QoE accordingly.  RAN3 agreed to support Option 1. |

Based on this agreement, several contribution discuss the details of option 1 selected by RAN3, e.g. [1], [2], [4], [5], [6], [9].

In [4], [5] and [6], network side behaviour is clarified for QoE configurations handling upon handover based on the relevant area scope. It is clarified that area scope of each QoE configuration will be known at the target gNB based on the Xn signalling, at least for signalling based QoE activation. Based on this information, the target gNB can decide which QoE configurations to keep and which QoE configurations to release by taking into consideration the relevant area scope of each of QoE configuration. Similarly, [1] discusses *areaScope* parameter, which was previously described by SA5 in an LS in R2-1900096 for LTE QoE and it is also clarified that gNB itself can determine whether the UE is in the measurement area or not and can either keep or release the QoE configuration based on this. Based on the views expressed in these papers, the following can be proposed:

**Proposal 2: Area scope parameter is not introduced in RRC procedures supporting QoE.**

**Proposal 3: The target gNB decides which QoE configurations to keep and which to release during a handover, e.g. based on QoE configuration information received from the source gNB in Xn signalling and/or UE’s current RRC configuration of QoE.**

With respect to QoE handling upon mobility, in [2] and [4], the following SA4 requirement is recalled:

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| The QoE configuration shall only be checked by the client when each session starts, and thus all logging and reporting criterias for an ongoing session shall be unaffected by any QoE configuration changes received during that session. This also includes evaluation of any filtering criterias, such as geographical filtering, which shall only be done when the session starts. Thus changes to the QoE configuration will only affect sessions started after these configuration changes have been received. |

According to the contributions, this requirement means that the gNB should not release a QoE configuration for which the QoE session is ongoing, even when the UE moves outside of the QoE area. This in turn requires the gNB to be aware of when the session is ongoing. Furthermore, in [9] it is indicated that session start/end indications from the UE are required for the QoE related procedures in the network, especially for activation and deactivation procedures, e.g. for the network to know when the QoE configurations may be released from the UE once the deactivation command is received by the gNB. Based on [2], [4] and [9] the following proposals are then made:

**Proposal 4: The UE informs the gNB when the QoE measurement session starts or when the session ends, e.g. to enable QoE configuration handling upon mobility or for QoE activation/deactivation procedures.**

In [4], it is also indicated that CT1 may need to be involved to specify the relevant indication from application to AS layer:

**Proposal 5: RAN2 sends an LS to CT1 group to specify session start and session end indications from application to AS layer.**

In [2], the network side behaviour is also further clarified for the case where the UE moves out of the QoE measurement area, but the related QoE measurement session is ongoing when the handover occurs:

**Proposal 6: If SA4 confirms that the requirement for configuration changes of ongoing QMC sessions is applicable also for NR QMC: In case the UE moves out of the measurement area during a handover, the target gNB should release the QoE configuration of the UE if the related QoE measurement session is not ongoing and should keep the QoE configurations for which the QoE measurements are ongoing (regardless of whether the UE stays within the associated QoE area or not).**

Furthermore, in [1] and [4], the aspects related to SRB4 release are discussed. In [1], it is indicated that, e.g. upon moving to RRC IDLE state, the UE will release SRB4 and that it should be clarified in the specifications that releasing SRB4 is equivalent to releasing all QoE configurations. Similarly, in [4], it is noted that a UE may move into the coverage of the gNB which does not support QoE and such gNB will not support SRB4. Without being configured with SRB4, the UE will not be able to send the QoE measurement reports to the network. Hence, it is proposed to clarify that the UE should discard the reports received from application layer in case it has no associated QoE configuration / SRB4 established. Based on the discussion in these papers, the following proposals are made:

**Proposal 7: When the UE moves to RRC IDLE state, it releases SRB4, releases all QoE configurations and discards any pending or not reported QoE data.**

**Proposal 8: The UE discards the reports received from application layer in case it has no associated QoE configuration configured.**

## 2.3 QoE handling upon receiving Full configuration

In [2], it is proposed that upon receiving full configuration during a handover, a UE shall check if otherConfig includes the QoE configuration or not. If the same QoE configuration exists, the UE shall continue the QoE measurements and otherwise, the UE should release QoE configuration. Repeating the configuration will also make the UE to release an old QoE configuration and treat the repeated as the new one, since the UE is not able to really tell whether the configuration is the same or not. Therefore, it is proposed:

**Proposal 9: Upon FullConfig, the gNB can indicate to the UE the identifiers of QoE configurations which should be kept by the UE and the UE shall continue the QoE measurements for the indicated QoE configurations.**

## 2.4 QoE handling during mobility in RRC INACTIVE

In [7], it is proposed to discuss whether the UE should always store and recover all of its QoE configurations when transitioning between RRC INACTIVE and RRC CONNECTED states, or whether there should be a possibility for the network to decide which QoE configurations are stored/recovered, e.g. via RRCRelease or RRCResume message.

In [8], it is proposed to discuss how to restore QoE configurations stored in the UE context in three scenarios:

1. UE resumes the connection in the gNB supporting QoE with no overload/congestion.
2. UE resumes the connection in the gNB supporting QoE in an overload/congestion situation.
3. UE resumes the connection in the gNB not supporting QoE feature.

Furthermore, it is proposed in [8] that:

* When the UE resumes RRC connection in a gNB not supporting QoE, UE restores QoE context and performs QoE measurements but pauses QoE reporting. UE recognizes gNB not supporting QoE by the lack of indication to restore QoE in RRCResume message.
* When UE resumes RRC connection in a gNB supporting QoE, UE restores QoE reporting only after receiving explicit indication in RRCResume message.
* The gNB supporting QoE can release or pause all or part of QoE configurations during RRC resume.

Similar topic is discussed in [4]. It is indicated that the overall principle should be the same as for UE mobility in RRC CONNECTED state, i.e. it is the target gNB (new serving gNB), which should decide which QoE configurations to keep and which to release, e.g. based on area information received from the source node (anchor gNB). According to [4], this can be achieved by gNB sending an indication to the UE in RRCResume message about which QoE configurations should be kept at the UE and when there is no indication to restore the QoE configurations, the UE should release all of its QoE configurations. This way, it is possible to release all QoE configurations from the UE (e.g. when the connection is resumed in a gNB not supporting QoE) or some of the configurations (e.g. those which are not in relevant in the area where the UE resumes the connection).

Based on the above, it seems that an explicit indication in RRCResume to restore QoE configurations is required/beneficial to support at least the case where the UE resumes the connection in a gNB not supporting QoE as well as to release the QoE configurations which are not valid in the new gNB. Since an explicit indication is proposed in both [4] and [8] while [7] seems to be neutral on this topic, RAN2 is requested to discuss and agree the following proposal:

**Proposal 11: When the UE resumes the connection in a gNB supporting QoE, the target gNB should explicitly indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure, e.g. in RRCResume message. The UE shall release all QoE measurement configurations not indicated by the gNB for restoration.**

There are different views on what should happen in case the UE resumes in the gNB not supporting QoE (e.g. in [4] and [8]), so it is further proposed to discuss the following proposal:

**Proposal 12: RAN2 is requested to discuss handling of QoE configurations when resuming the connection in a gNB not supporting QoE (recognized, e.g. by the lack of QoE indication in RRCResume):**

1. **The UE shall release all QoE measurement configurations.**
2. **The UE restores QoE context and performs QoE measurements but pausing QoE reporting.**

It is also proposed to discuss further whether it is required to allow a possibility for a target gNB to pause QoE measurement reporting during RRC Resume procedure, as proposed in [8]:

**Proposal 13: RAN2 is requested to discuss whether it should be possible for the gNB to restore and pause QoE measurement reporting for some/all QoE configurations during RRC Resume procedure.**

# 3 Conclusions

Based on the summary of the documents submitted by various companies related to QoE handling during UE mobility, the following is proposed:

Signalling-based and management-based QoE activation:

**Proposal 1: RAN2 assumes that all QoE mobility related agreements are applicable at least to signalling based QoE. Whether the same applies to management-based QoE is pending further input from SA5 and RAN3.**

Mobility in RRC CONNECTED state:

**Proposal 2: Area scope parameter is not introduced in RRC procedures supporting QoE.**

**Proposal 3: The target gNB decides which QoE configurations to keep and which to release during a handover, e.g. based on QoE configuration information received from the source gNB in Xn signalling and/or UE’s current RRC configuration of QoE.**

**Proposal 4: To enable QoE configuration handling upon mobility, the UE informs the gNB when the QoE measurement session starts or when the session ends.**

**Proposal 5: RAN2 sends an LS to CT1 group to specify session start and session end indications from application to AS layer.**

**Proposal 6: In case the UE moves out of the measurement area during a handover, the target gNB should release the QoE configuration of the UE if the related QoE measurement session is not ongoing and should keep the QoE configurations for which the QoE measurements are ongoing (regardless of whether the UE stays within the associated QoE area or not).**

SRB4 handling:

**Proposal 7:** **SRB4 release implies QoE configuration release, notifying upper layer about the release, discarding any pending or not reported QoE data.**

**Proposal 8: The UE discards the reports received from application layer in case it has no associated QoE configuration / SRB4 established.**

Mobility with Full configuration

**Proposal 9: RAN2 agree that UE shall continue the QoE measurements if the otherConfig includes the same QoE configuration upon receiving FullConfig. Otherwise, i.e. QoE configuration is not included in otherConfig, the UE shall release the QoE configuration.**

**Proposal 10:** **The QoE configuration container is optionally included in the RRCReconfiguration, i.e. the QoE configurations which should be kept upon full configuration, are indicated with QoE configuration identifier only.**

Mobility in RRC INACTIVE state:

**Proposal 11: When the UE resumes the connection in a gNB supporting QoE, the target gNB should explicitly indicate which QoE measurement configurations should be kept by the UE during RRC resume procedure, e.g. in RRCResume message. The UE shall release all QoE measurement configurations not indicated by the gNB for restoration.**

**Proposal 12: RAN2 is requested to discuss handling of QoE configurations when resuming the connection in a gNB not supporting QoE (recognized, e.g. by the lack of QoE indication in RRCResume):**

1. **The UE shall release all QoE measurement configurations.**
2. **The UE restores QoE context and performs QoE measurements but pausing QoE reporting.**

**Proposal 13: RAN2 is requested to discuss whether it should be possible for the gNB to restore and pause QoE measurement reporting for some/all QoE configurations during RRC Resume procedure.**

# References

1. R2-2107513 QoE handling in RAN Nokia, Nokia Shanghai Bell
2. R2-2108110 Mobility Support for NR QoE Management Ericsson
3. R2-2108111 [Draft] Support for Session Start and Session End Indication Ericsson
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