**3GPP TSG-RAN WG3 Meeting #110-eR3-206398**

**Online, November 2nd – 12th 2020**

Agenda Item: 15.2

Source: Ericsson

Title: pCR for TR 38.890: Mobility Support for NR QoE Management

Document for: Agreement

# 1 Introduction

At the RAN3#109-e meeting the following has been agreed:

**Mobility support is specified for both signaling- and management-based NR QoE management.**

In this paper, we discuss different solutions for supporting QoE measurements in mobility scenarios, considering the requirements defined by SA4.

# 2 Mobility support for QoE

Providing seamless mobility for different service types has been a fundamental requirement in NR development, and in order to verify the impact of the mobility on QoE, QoE measurements support in mobility scenarios shall be considered.

**Observation 1: Seamless mobility is a key functionality in NR and its impacts should be measurable at application layer.**

The following agreement in RAN3#109-e effectively means that a UE should be able to determine whether an ongoing QoE measurement at application layer should continue after being handed over to another cell.

Agreement in 3GPP RAN WG3 meeting # 109e

* + Mobility support is specified for both signaling- and management-based NR QoE management.

To enable QoE measurement support in mobility scenarios, it is required to develop a solution enabling the network to control the QoE measurements upon UE mobility in RRC\_CONNECTED mode. The solution should be viable in both signalling- and management-based QoE measurements. In management based QoE an area is defined as part of configuration, but in our understanding, in signalling based QoE, management system may need to be capable to define an area as an optional feature.

In LTE system to support the QoE measurement in mobility scenario the QoE configuration is forwarded from the source eNB to the target eNB as part of Trace Activation IE over X2 interface. Same IE is sent over S1 interface for mobility scenarios when Xn interface does not exist. In our view, same solution should be applied to the NR inter-RAN node interfaces i.e., Xn and NG interfaces, to support QoE measurement in mobility scenarios in NR.

**Observation 2: To enable measuring the impact of the mobility on application and users’ QoE it is required to support QoE measurements in mobility scenarios for both signalling and management based QoE.**

**Proposal 1: RAN3 agree to transfer QoE configuration over Xn and NG interface as part of Trace Activation IE.**

Concerning QoE support in mobility scenario, SA4 has specified requirements for QoE measurements, so that the UE shall check the QoE configuration only when the respective session starts [1], [2]. This means that any potential changes in QoE configuration would not be effective for an ongoing session. See the SA4 requirements in Figure 1.

26.247, clause 10.1: 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.

26.114, clause 16.3: 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.

**Figure 1: SA4 requirements about checking QoE configuration only upon starting a session; changes in QoE configuration would not be effective for an ongoing session.**

One motivation for this requirement is that measurements pertaining to parts of sessions, rather than entire sessions, are not interesting cases. UEs at the cell (or area) borders might move in and out of the area scope intermittently during the session, and these entries/exits are of high interest, as they might involve different kind of handovers as well as mobility failures and failure recovery. Therefore, ending an ongoing session measurement as soon as UE moves out of the area may compromise the QoE measurements by excluding perhaps the interesting part of the measurements. Moreover, for very small areas (say area scope consisting of a single cell) it may not be possible, in practice, to get any measurements at all, since most UEs would move away from the cell at some time during the session.

The SA4 requirements mean that the UE should check the area scope when starting the measurements, but if the UE moves out of the area during the ongoing session, the QoE measurements should not be stopped. After the ongoing session is completed, no new measurements should be started if the UE is outside the area.

**Observation 3: The SA4 requirements for QoE measurements stipulate that the client shall check the QoE configuration when each session starts. This means that the client shall continue the QoE measurements for an ongoing session even if the UE moves out of the configured area.**

The above-mentioned requirements are associated to the services and are hence RAT-independent. Therefore, it is obvious that the same requirements should be considered when specifying mobility support for NR QoE measurements.

**Observation 4: The SA4 requirements are RAT-independent and shall therefore be applied to the mobility solution for QoE measurement in NR.**

Fulfilling these SA4 requirements is not straightforward, since only the application layer in the UE knows when the session is ongoing or not, while the network layer has no information about that. The UE may not be aware of exiting the area if that information only resides in the network.

In general, we think there might be three different approaches to solve this problem during CONNECTED mode mobility. These three approaches are:

1. The network sends the entire area scope configuration to the UE;
2. The network sends the release command to the UE, upon the UE moving outside the area;
3. Using a *WithinArea* flag to indicate whether the target cell is in the area or not upon handover.

Among the above-mentioned solutions, the solution (i) is logged MDT-like solution in which the UE receives the entire area configuration and checks if it is inside or outside the area. However, in MDT the measurements are performed when the UE moves to IDLE/INACTIVE mode and that is why the entire area configuration is sent to the UE as UE is not accessible, compared to CONNECTED mode. Hence, this solution may not be required for QoE measurements which are performed in CONNECTED mode and not in IDLE/INACTIVE mode. In addition, it may still need some additional work by the UE so that the SA4 requirements are fulfilled. In fact, the area configuration should not be effective when UE moves out of the area with an ongoing session and ongoing QoE measurements.

Solution (ii) is to use the ASN.1 *release* command to instruct the UE to release the existing QoE configuration. However, this approach needs to be incorporated with feedback indication specified by SA5 [3] that is sent from the application to the UE and to the gNB, since otherwise the gNB will not know when there is a session ongoing. The feedback indication gives additional information on the state of the services/applications and whether there is an ongoing session or not. This indication can be potentially used by network to take a proper action fulfilling the SA4 requirements. If there is an ongoing session at UE, gNB will not release the QoE configuration upon handover toward outside the configured area.

Another approach (i.e., solution (iii)) is to implement a *WithinArea* indication. Upon moving from one cell to another, this indication informs the UE about whether the target cell is within the configured area scope or not. The UE can then finalize the ongoing session in the new cell, but it cannot start any new measurements if the new cell is outside the area. Hence this approach is compliant with the SA4 requirements. Moreover, in this approach, the UE does not need to release the entire configuration for the ongoing sessions and corresponding ongoing QoE measurements when it moves outside the area. This is very beneficial for the scenario where the UE moves continuously in and out of the area, as the QoE configuration does not need to be sent again every time the UE re-enters the area. The pros and cons of the above-mentioned solutions are discussed in the Table 1.

**Table 1: Pros and cons of different solutions for enabling mobility support for QoE measurement**

|  |  |  |
| --- | --- | --- |
| Method | Advantages | Disadvantages |
| #1: Sending the entire area configuration to the UE | * Simplicity - the network sends the configuration to the UE only once, and the UE has the sufficient information to decide when starting a session
 | * Causes more control traffic as the entire area configuration list should be sent to the UE
* It is used in MDT, but in MDT UE performs logged MDT in IDLE/INACTIVE mode, but in QoE UE performs QoE measurements in CONNECTED mode.
 |
| #2: Sending release command to UE upon moving outside of the area  | * Reusing the existing *release* command in LTE for NR case
 | * Needs to be incorporated with feedback indication from the UE to fulfill the SA4 requirements.
 |
| #3: Sending *WithinArea* indication to the UE upon mobility | * Efficient in terms of traffic (only one bit per handover)
* SA4 requirements on continuation of QoE measurements after moving out of the area will be met
 | * Requires area check for every handover, while the UE only uses it when QoE session has ended.
 |

**Observation 5: QoE measurement in CONNECTED mode mobility can be supported based on one of the following options:**

1. **Sending the entire area configuration list to the UE;**
2. **Sending release command to UE upon moving outside the area;**
3. **Sending *WithinArea* indication to UE upon handover.**

Based on the above, we propose to consider the SA4 requirements in designing the solution for mobility support for QoE measurements, enabling the UE to check the QoE configuration only when a new session starts.

**Proposal 2: RAN3 to discuss and decide on the potential solutions for supporting QoE measurements in mobility scenarios fulfilling SA4 requirements i.e., avoid stopping a QoE measurement for an ongoing session, even if the UE moves across area boundaries.**

# 3 Conclusion

In the previous sections we made the following observations:

**Observation 1: Seamless mobility is a key functionality in NR and its impacts should be measurable at application layer.**

**Observation 2: To enable measuring the impact of the mobility on application and users’ QoE it is required to support QoE measurements in mobility scenarios for both signalling and management based QoE.**

**Observation 3: The SA4 requirements for QoE measurements stipulate that the client shall check the QoE configuration when each session starts. This means that the client shall continue the QoE measurements for an ongoing session even if the UE moves out of the configured area.**

**Observation 4: The SA4 requirements are RAT-independent and shall therefore be applied to the mobility solution for QoE measurement in NR.**

**Observation 5: QoE measurement in CONNECTED mode mobility can be supported based on one of the following options:**

1. **Sending the entire area configuration list to the UE;**
2. **Sending release command to UE upon moving outside the area;**
3. **Sending *WithinArea* indication to UE upon handover.**

Based on the discussion in the previous sections we propose the following:

**Proposal 1: RAN3 agree to transfer QoE configuration over Xn and NG interface as part of Trace Activation IE.**

**Proposal 2: RAN3 to discuss and decide on the potential solutions for supporting QoE measurements in mobility scenarios fulfilling SA4 requirements i.e., avoid stopping a QoE measurement for an ongoing session, even if the UE moves across area boundaries.**

# References

1. 3GPP TS 26.114 Technical Specification 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction (Release 16).
2. 3GPP TS 26.247 V16.2.0 Technical Specification 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH) (Release 16).
3. 3GPP TS 28.405 V1.2.0 Technical Specification 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Quality of Experience (QoE) measurement collection; Control and configuration (Release 16)

# Annex: pCR to TR 38.890

-------------------------------------------Change 1-------------------------------------------

### 6.x NR QoE Support in Mobility

Seamless mobility is a key functionality in NR and its impacts should be measurable at the application layer. To enable measuring the impact of the mobility on the application and users’ QoE, it is required to support QoE measurements in mobility scenarios for both signalling- and management-based QoE.

In the LTE system, to support the QoE measurement in mobility scenarios, the QoE configuration is forwarded from the source eNB to the target eNB as part of *Trace Activation* IE over X2 interface. The same IE is sent over S1 interfaces for mobility scenarios when the Xn interface is not established between the source and target. The same solution should be applied to the NR inter-RAN node interfaces i.e., Xn and NG interfaces, to support QoE measurement in mobility scenarios in NR.

In addition, the SA4 requirements for QoE measurements stipulate that the client shall check the QoE configuration only when a session starts. This means that the client shall continue the QoE measurements for an ongoing session even if the UE moves out of the configured area. The SA4 requirements are RAT-independent and shall therefore be applied to the mobility solution for QoE measurement in NR, as well.

In order to fulfil the SA4 QoE requirements, *WithinArea* indication-based solution should be used. Upon moving from one cell to another, using this indication target cell informs the UE about whether it is within the configured area scope or not. The UE can then finalize the ongoing session in the new cell, but it shall not start any new measurements for any new session if the new cell is outside the area.

-------------------------------------------End of changes-------------------------------------