**3GPP TSG-WG SA2 Meeting #140E e-meeting *S2-200xxxx***

**Elbonia, August 19 – September 1, 2020 (revision of S2-200xxxx)**

**Source: Huawei, HiSilicon**

**Title: Loss ratio and jitter measurement**

**Document for: Approval**

**Agenda Item: 8.6**

**Work Item / Release: ATSSS / Rel-17**

*Abstract: This contribution solves the Editor’s Notes with solution 3.*

# Introduction/Discussion

This paper clarifies that the enhancement of PMF can be applied to the ATSSS-LL and QUIC-based solution. Additionally, some more details on how to measure the loss ratio and jitter are added to the solution 3. The corresponding Editor’s Notes are removed.

# 2. Text Proposal

It is proposed to capture the following changes vs. TR 23.700.

\* \* \* \* First change \* \* \* \*

### 6.3.2 High-level Description

#### 6.3.2.1 Enhancement on link performance measurement

The Rel-16 PMF is enhanced to support the RTT measurement per QoS flow, and to support measurement of the loss ratio and jitter per QoS flow, with both the UE and the UPF sending PMF messages per QoS flow. The enhancement of PMF is applied by the ATSSS-LL (as defined in R16) and the QUIC-based (as defined in solution 8) steering method to improve the traffic steering. For the MPTCP (as defined in R16) or MP-QUIC (as defined in solution 7), there is no need to apply the PMF, as the link performance can be measured based on the MPTCP or MP-QUIC protocol.

**RTT measurement per QoS flow:**

Same as in Rel-16, when an MA PDU Session is established, the network may provide the UE with Measurement Assistance Information.

The RTT measurement per QoS flow may be triggered by UE or the UPF independently. The Measurement Assistance Information contains the QFI(s) for which the RTT measurement is to be applied. Optionally, the RTT measurement frequency can also be decided by the network side and sent to UE if available via Measurement Assistance Information.

The following mechanism is used.

 In the case of the MA PDU session of IP type:

- The PMF in the UE sends PMF messages via one QoS flow to the PMF in the UPF over UDP/IP. The destination IP address and UDP port are as defined in Rel-16, i.e. the destination IP address is the PMF IP address, and the UDP port number corresponds to the access via which this message is sent. When the message is received by the UPF, the UPF can identify the PMF message based on the destination IP address.

- The PMF in the UPF sends PMF messages to the PMF in the UE over UDP/IP. The source IP address is the same IP address as the one provided in the Measurement Assistance Information and the source UDP port is one of the two UDP ports as provided in the Measurement Assistance Information as defined in R16. The destination IP address is the MA PDU session IP address allocated by the UE, and the UDP port is also sent by the UE via user plane after the MA PDU session establishment as defined in R16. When the message is received by the UE, the UE can identify the PMF message based on the source IP address of the PMF.

 In the case of the MA PDU session of Ethernet type:

- The PMF in the UE sends PMF messages to the PMF in the UPF over Ethernet. The destination MAC address is included in the Measurement Assistance Information as defined in R16. Then the UPF can identify the PMF message based on the destination MAC address.

- The PMF in the UPF sends PMF messages to the PMF in the UE over Ethernet. The source MAC address and destination MAC address are as defined in R16. Then the UE can identify the PMF message based on the source MAC address.

The UE and the UPF derive an estimation of the average RTT over an access type by averaging the RTT measurements obtained over this access.



Figure 6.3.2.1-1: RTT measurement in R16 and enhancement for R17

It is not suggested to perform the RTT measurement for GBR QoS flow, considering the QoS parameters for GBR traffic are guaranteed, and the GBR traffic is only transported via one access resulting in no comparing with the other path RTT value.

Comparing with the RTT measurement per PDU session as defined in R16, this solution makes the RTT measurement more accurate. Because even for the non-GBR QoS flow, different QoS flow corresponding to the different 5QI has the different packet delay budget requirement, quote from TS 23.501 [3] Table 5.7.4-1. For example, when the 5QI=5, the packet delay budget is 100ms, but if the 5QI=6, the packet delay budget is equal to 300 ms, three times than 5QI=5. Therefore it is incorrect to use one non-GBR QoS flow RTT representing all the other non-GBR QoS flows.

0) Packet loss ratio measurement per QoS flow, the same mechanism as described in the TR 23.793 [13] clause 6.3.1.4.

 UE and UPF exchange the packet counting information in certain period to calculate the packet loss ratio during the path performance measurement procedure.

- The UE counts the number of UL packets via one QoS flow between one PMF request message and the previous PMF echo request message, and provides the result to the UPF via this PMF request message.

- UPF also counts the number of received UL packets between one PMF request message and the previous PMF request message via one QoS flow. UPF calculates the UL packet loss ratio based on the local counting result and the number of UL packets send by UE.

- UPF sends the UL packet loss ratio result to the UE via PMF response message. In the same message, it can also include the counting number of DL packets between one PMF response message and the previous PMF response message if the DL packets loss ratio is measured.

- UE counts the number of received DL between one PMF response message and the previous PMF response message. The UE calculates the DL packet loss ratio based on the local counting result and the number of DL packets send by UPF, and sends the DL packet loss ratio to the UPF via the subsequent PMF message.

The PMF message applied to calculate the packet loss ratio is the same as the PMF message used to measure the RTT, just adding the number of packet or/and the packet loss ratio IE(s) to these PMF messages. Taking the UE initiated UL packet loss ratio measurement as an example, the PMF request messages from UE and the corresponding PMF response messages (Transaction ID is used to identify the request/response message) from UPF are applied to transport the number of packet and loss ratio, see the following figure 6.3.2.1-2.



Figure 6.3.2.1-2: packet loss ratio measurement for UL traffic

2) Jitter measurement per QoS flow, the same mechanism as described in the TR 23.793 [13] clause 6.3.1.4.

 Jitter is regarded as the reflection of transfer quality stability within certain time interval. The UL jitter could be calculated by the UPF, and the DL jitter could be calculated by the UE. The following solution is an example method for calculating the UL jitter per QoS flow, and the DL jitter could be calculated using the similar method.

- It is assumed to calculate the jitter between one PMF request message and the Nth PMF request message after this certain PMF request message received by the UPF.

 These continuous PMF request message could be numbered from n-N+1 to n.

 The average expectation value of arriving time interval between any two PMF requests could be represented as Avg(n) Avg(n).

 The value of variance of arriving time interval of N PMF echo request could be represented as Var(n).

 In this example, the Var(n) is regarded as the packet transport jitter for the corresponding QoS Flow. It is assumed that t\_k is the local time of UPF when receiving the PMF request message numbered by variable k between n-N+1 and n.

 $Avg\left(n\right)= \sum\_{n-N+1}^{n}\left(t\_{k}-t\_{k-1}\right)/N$, $Var\left(n\right)= \sqrt{\frac{\sum\_{n-N+1}^{n}\left(t\_{k}-t\_{k-1}-Avg\left(n\right)\right)^{2}}{N}}$

The jitter measurement can be enabled based on the indication from PCF. For example, the PCF sends the jitter threshold (as defined in subclause 6.3.2.2) for SDF to the SMF. If one or more SDF(s) in the QoS flow apply the jitter threshold, the jitter measurement for this QoS flow is enabled. The PMF message for jitter measurement is transported via this QoS flow, and the frequency of these PMF messages can be decided based on the implementation, according to jitter threshold received from PCF.

NOTE: The jitter measurement precision depends on the number of PMF messages sent within a certain time interval. It can be decided based on the requirement of the traffic. For example, the microsecond-level latency-sensitive services will need more PMF messages sent in a certain period than the millisecond-level delay-sensitive services.

#### 6.3.2.2 Thresholds for traffic steering/switching/splitting

Some thresholds, such as Maximum RTT, Maximum UL/DL Packet Loss Rate and/or jitter, are provided to the UE and the UPF for triggering traffic steering/switching/splitting. These thresholds are applied for non-GBR QoS flow..

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The PCF can provide the Maximum RTT, UL/DL Maximum Packet Loss Rate and jitter threshold paramters to the SMF, and SMF will forward these parameters to the UE and UPF via ATSSS rule or MAR rule. The threshold can be provided per QoS flow, working together with the link performance measurement per QoS flow as defined in clause 6.3.2.1. It can be applied to both the MPTCP functionality and ATSSS-LL functionality if the PMF is enhanced to support the RTT, loss rate and jitter measurement per QoS flow as defined in clause 6.3.2.1.

- The *Maximum RTT* indicates parameter for the decision of access availability via 3GPP access and non-3GPP access, i.e. the maximum RTT threshold that can be tolerated in the round trip for the QoS flow.

- The *UL Maximum Packet Loss Rate* indicates parameters for the decision of UL access availability via 3GPP access and non-3GPP access, i.e. the maximum rate for lost packets that can be tolerated in the uplink direction for the QoS flow.

- The *DL Maximum Packet Loss Rate* indicates parameters for the decision of DL access availability via 3GPP access and non-3GPP access, i.e. the maximum rate for lost packets that can be tolerated in the downlink direction for the QoS flow.

- The *UL Maximum jitter* indicates parameters for the decision of UL access availability via 3GPP access and non-3GPP access, i.e. the maximum jitter that can be tolerated in the uplink direction for the QoS flow.

- The *DL Maximum jitter* indicates parameters for the decision of DL access availability via 3GPP access and non-3GPP access, i.e. the maximum jitter that can be tolerated in the uplink direction for the QoS flow.

The Maximum RTT, UL Maximum Packet Loss Rate or DL Maximum Packet Loss Rate parameters for 3GPP and non-3GPP access can be provided separately. If the parameters for non-3GPP access are not included in the PCC rule, the corresponding values for 3GPP access apply.

Taking the redundancy steering mode as an example by using the above thresholds, if one access packet loss rate does not reach the UL/DL Maximum Packet Loss Rate, then only one access is applied to transport the traffic. But when one access packet loss rate is equal to or higher than the UL/DL Maximum Packet Loss Rate, then the redundancy transmission mode is triggered, till one access performance is improved.

NOTE: These thresholds can also be applied to existing steering modes, such as Priority-based steering mode, Active-Standby steering mode.

\* \* \* \* End of changes \* \* \* \*