**SA WG2 Meeting #162 S2-2405102**

**Changsha, China, April 15 – April 19, 2024 (was S2-2404288)**

**Source: vivo, Nokia**

**Title: New Sol for KI#9: PDU Set Performance exposure**

**Document for: Approval**

**Agenda Item: 19.3**

**Work Item / Release:** **FS\_XRM / Rel-19**

*Abstract of the contribution: Propose new solution for KI#9.*

# 1 Discussion

This solution is for Key Issue #9, which addresses the following aspects:

The objective of this Key Issue is to study how to enhance network exposure mechanism to better support the network information/capability exposed to the application layer. In particular, the key issue includes the following aspects:

- Whether and how XR related network capability/information exposure towards the application layer needs to be enhanced.

For rel-18, the granularity of PDU Set and PDU Set QoS are introduced, however, the real PDU Set performance is not estimated and exposed to the Application, e.g. PDU Set delay suffered for a data stream in 5GS.

**Proposal: it is proposed to introduced DL PDU Set delay monitoring and exposure.**

# 2. Proposal

It is proposed to agree the following solution to 3GPP TR23.700-70 v0.3.0.

\* \* \* \* First change \* \* \* \*(all new texts)

## 6.X Solution #X: PDU Set Performance exposure

### 6.X.1 Key Issue mapping

The solution addresses KI#9: Enhancement for XR related network information exposure.

### 6.X.2 Description

#### 6.X.2.1 General

For rel-18, the granularity of PDU Set and PDU Set QoS are introduced, however, the real PDU Set performance is not estimated and exposed to the Application, e.g. PDU Set Delay and/or PDU Set Loss Rate suffered for a data stream in 5GS. For a data stream which request PDU Set QoS before, the server also cares the real PDU Set performance, which is also beneficial for codec adaptations at the server side. For example, for some live streaming applications in practice, streamer uploads the video streams as several video slices instead of a whole video during their live steaming. Each video slice will be identified as a PDU set in 5GS. However, the PDU Set performance is not able to be estimated and exposed to the Application yet, resulting in the situation that the Application is not able to perform the codec adaptations for a single video slice. To enable exposure of PDU Set performance, the DL PDU Set delay exposure and PDU Set Loss Rate are proposed in this solution.

#### 6.X.2.1 PDU Set Delay

The PDU Set delay is a different measure dimension with the packet delay.

- In legacy, the packet delay refers to the time that a packet delayed between the UE and the N6 termination point at the UPF. It is a combination of the RAN part of UL/DL packet delay and UL/DL packet delay between NG-RAN and PSA UPF. The NG-RAN is required to provide the QoS monitoring results on the RAN part of UL/DL packet delay measurement. The measurement of the UL/DL packet delay between NG-RAN and PSA UPF can be performed on different levels of granularities, i.e. per QoS Flow per UE level, or per GTP-U path level, subject to the operators' configuration.

- The PDU Set delay focuses on the performance of a PDU set rather than a packet. The PDU Set delay refers to the time that a PDU Set Delayed between the UE and the N6 termination point at the UPF. Only DL PDU Set Delay is proposed in this solution, i.e. it is a combination of the UPF part which contains the DL PDU Set Delay of the first PDU in PDU set and the RAN part which contains the DL PDU Set Delay of the last PDU in PDU set.

With the help of DL PDU Set delay, the real PDU Set performance can be estimated and exposed to the Application.

Alternatively, the PDU Set Delay is calculated based on the algorithm: PSD = Tend\_N – T1\_i

* Tend\_N is the sending or reception time of the last PDU of the PDU Set to the UE.
* T1\_i is the sending time of the 1st PDU of the PDU Set which can be the 1st PDU of the PDU Set received at the RAN.

#### 6.X.2.3 PDU Set Loss Rate Measurement and Reporting

For each PDU Set sent by the NG-RAN, the NG-RAN starts to record how many PDUs within the PDU set are sent to the UE successfully and/or how many PDUs in the PDU set are lost (not sent to the UE successfully).

- If the NG RAN uses a default criterion that if any PDU of the PDU Set is lost, the PDU Set is considered lost.

NOTE1: This default criteria is consistent with the Rel 18 PSER definition that a PDU Set is only considered successfully delivered when all PDUs of a PDU Set are delivered successfully.

NOTE2: If the FEC of Key Issue #1 can be concluded, i.e. an application layer Forward Error Correction (FEC) ratio that indicates the fraction of PDUs of a PDU Set required by the application to recover the PDU Set is provided to the RAN, the FEC Ratio can also be used to determine whether a PDU Set loss has occurred.

### 6.X.3 Procedures



Figure 6.X.3-1 PDU Set Performance exposure

1. AF requests to subscribe the event notification for DL PDU Set Delay and/or PDU Set loss rate, which is a part of *QoS Monitoring parameter(s)*.

2. Based on QoS monitoring request from AF or based on PCF local policy, the PCF generates the QoS Monitoring policy for the corresponding service data flow and provides the policy in the PCC rules to the SMF.

3. The SMF may also configure NG-RAN to measure the QoS monitoring parameters by sending QoS monitoring request based on the authorized QoS Monitoring policy received from the PCF and/or local configuration. The QoS monitoring request is sent via AMF.

4. AMF forwards the QoS monitoring request to NG-RAN via N2 message.

5. For PDU Set Delay monitoring, the SMF configure the UPF to perform QoS monitoring for the QoS Flow and to report the monitoring results with parameters determined by the SMF based on the authorized QoS Monitoring policy received from the PCF or local configuration or both.

6. AS sends DL traffic.

7. For PDU Set Delay monitoring (for simplicity the first option is described), UPF records the time T1, which is the time that the first PDU of a PDU set is received at the UPF.

8. For PDU Set Delay monitoring, UPF sends T1 to NG-RAN via GTP-U header of the first PDU of a PDU set.

9. For PDU Set Delay monitoring, NG-RAN records the time T2, which is the time that the last PDU of a PDU set is received at the NG-RAN. NG-RAN determines the DL PDU Set Delay based on T2 minus T1, PDU Set Delay

 For PDU Set Loss Rate monitoring, NG-RAN measure the PDU Set Loss Rate.

10-11, The NG RAN report the measured result of DL PDU Set Delay and PDU Set Loss Rate to SMF via AMF.

PDU Set Delay12. SMF sends the measured result of DL PDU Set delay and/or PDU Set Loss Rate to PCF.

13. PCF sends the measured result of DL PDU Set delay and/or PDU Set Loss Rate to AF directly or via NEF.

### 6.X.4 Impacts on services, entities and interfaces

<For PDU Set Delay exposure>

AF:

- Request of DL PDU Set Delay monitoring via NEF or directly to PCF.

PCF:

- Generates the QoS Monitoring policy for DL PDU Set Delay based on AF request.

- Exposures the measured result of DL PDU Set Delay.

SMF:

- Sends QoS monitoring request for DL PDU Set Delay NG-RAN and PSA UPF based on QoS Monitoring policy in PCC rule;

- Reports the measured result of DL PDU Set Delay to the PCF.

PSA UPF:

- Records the time T1, which is the time that the first PDU of a PDU set is received at the UPF.

- Sends T1 to NG-RAN via GTP-U header.

NG-RAN:

- Records the time T2, which is the time that the last PDU of a PDU set is received at the NG-RAN;

- Determines the DL PDU Set Delay based on T2 minus T1 and measured result of DL PDU Set Delay to SMF.

- Alternatively calculates the PDU Set Delay based on the algorithm: PSD = Tend\_N – T1\_i

<For PDU Set Loss Rate exposure>

AF:

- Request of PDU Set Loss Rate via NEF or directly to PCF.

PCF:

- Generates the QoS Monitoring policy for PDU Set Loss Rate based on AF request.

- Exposures the measured result of PDU Set Loss Rate.

SMF:

- Sends QoS monitoring request for PDU Set Loss Rate to NG-RAN based on QoS Monitoring policy in PCC rule;

- Reports the measured result of PDU Set Loss Rate to the PCF.

NG-RAN:

- Measure and report PDU Set Loss Rate.

\* \* \* \* End of change \* \* \* \*