## 6.52 Solution #52: Consolidated Solution for PDU Set based QoS framework

### 6.52.1 Key Issue mapping

This solution aims to resolve Key Issue #4, "PDU Set integrated packet handling" and Key Issue # 5, "Differentiated PDU Set Handling".

### 6.52.2 Description

#### 6.52.2.0 General principles

This solution provides a framework for the PDU Set based QoS handling. The following principles apply:

PDU Set QoS policies/rules/profiles and PDU Set QoS Flow establishment

- Dynamic PCC rules and non-dynamic PCC rules are supported.

- PDU Set QoS requirements provisioning by AF supported (for dynamic PCC).

- PDU Set QoS policies are provided to SMF by PCF for dynamic PCC rules.

- RAN receives and enforces PDU Set QoS profiles from SMF.

- UPF receives and enforces N4 rules related with PDU Set from SMF.

PDU Set identification and marking over the user plane

- PDU Sets and PDU Set Groups (when needed) are detected in the UPF.

- Between AS and UPF, multiple PDU Set marking techniques can be supported (see bullet 2 below).

- PDU Set and PDU Set Groups (when needed) identification between AS and UPF can be negotiated over Control Plane (via NEF for non-trusted AF), or based on pre-configuration.

Editor's note: the definition of PDU Set Group needs to be further clarified. Whether PDU Set Group or other parameter is needed is FFS.

Editor's note: PDU Set identification for peer-to-peer scenarios (i.e. between two UEs routed via the 5G CN) is FFS.

- UPF marks PDU Sets in GTP-U layer for DL PDU via GTP-U header extension. GTP-U marking is independent from and common to different PDU Set markings between AS and UPF.

The following aspects are included:

In the following subclauses, a set of baseline parameters are identified as part of PDU Set QoS framework. Additionally, a set of potential parameters for further study (as proposed by other solutions) is described.

NOTE 1: The baseline set of parameters does not exclude additional parameters to be agreed in the future.

#### 6.52.2.1 PDU set information detected by the UPF

UPF identifies the PDUs belong to a PDU Set and the following information for each PDU Set:

 Info for intra-PDU Set handling (i.e. KI#4, PDU Set integrated handling).

 Baseline parameters:

- PDU Set Sequence number (SN) (solution 7, 8, 9, 11, 12, 14, 19, 20, 21, 22, 23, 50, 53, 55, 56).

- Start/End PDU of the PDU Set (solution 11, 12, 15, 18, 21, 22, 55, 56).

- PDU SN within a PDU Set (solution 11, 20, 22, 55, 56).

- Number of PDUs within a PDU Set (solution 9, 20, 50) and/or PDU Set size in bytes.

NOTE: It is possible that “Start PDU” can be implicitly indicated via the PDU SN. This is left to stage 3 to decide.

Editor's note: Among above parameters, which one is mandatory or optional need further discussion.

The QoS Flow is identified using QoS Flow ID and each PDU Set within the QoS Flow is identified using PDU Set SN. Each QoS Flow can be used to deliver one or more PDU Set.

 Info for inter-PDU Set handling (i.e. KI#5, PDU Set differentiated handling)

 Baseline parameters:

- PDU Set importance (solution 7, 11, 14, 15, 18, 19, 22, 24)

 Parameters for further study:

- PDU Set dependency (solution 11, 14, 19, 22, 24)

#### 6.52.2.2 PDU Set information identification by the UPF

UPF identifies the above information (listed in bullet #1 in clause 6.51.2.1) based on the following mechanism(s):

 Options for further study:

 Option 1: by matching RTP/SRTP header and payload (RFC 3550/6184/7798/draft-ietf-avtcore-rtp-vvc/draft-ietf-avtext-framemarking).

 (solution 7, 12, 14, 15, 16, 17, 18, 23, 24, 54).

 Option 2: new 3GPP specific RTP extension header (solution 8).

NOTE: Option 1 and 2 can only work if these headers are not encrypted (e.g., not carried above TLS/QUIC/DTLS layer).

Editor's note: Whether the support for traffic with partly encrypted RTP/SRTP header is needed is pending SA4’s feedback.

NOTE: Option 2 can be supported after SA4 confirmation. The information carried via new 3GPP specific RTP extension header will be confirmed based on SA4 outputs.

 Option 3: by information provided by the AS in N6 header e.g. encapsulation GTP-U header, IP packet fields (solution7, 9,17,18, 22).

Editor’s Note: Option 3 solutions 7, 17 and 18 needs further discussion.

 Option 4: by non-standardized UPF implementation mechanism, e.g., detection based on traffic characteristics (solution 7, 12, 17, 18, 20, 24, 25).

Editor's note: Which above options will be supported is FFS.

Editor's note: What information can be achieved by each option and more options need further discussion.

#### 6.52.2.3 PDU Set information provided by the UPF to the RAN

UPF provides the above PDU Set related information (listed in bullet #1 in clause 6.51.2.1) to the RAN.

 For PDU Set importance:

 Options for further study:

 Option 1: UPF classifies the DL traffics into different QoS Flows based on PDU Set importance (solution 10, 14, 24, 26).

 Option 2: UPF classifies the DL traffics into different sub-QoS Flows based on PDU Set importance (solution 17, 18).

 Option 3: UPF adds PDU Set importance into GTP-U header (solution 7, 11, 14, 15,17, 18, 19, 22, 25, 56).

 For other PDU Set related info (listed in bullet #1):

 UPF adds them into GTP-U Header (solution 7, 11, 14, 15, 19, 22, 23, 53, 54, 56).

#### 6.52.2.4 QoS parameters for PDU Set Based QoS handling

New QoS parameters for PDU Set based QoS handling in 5GS:

 Baseline parameters:

- PDU Set Delay Budget (PSDB) (solution 8, 9, 12, 14, 25, 26).

- PDU Set Error Rate (PSER) (solution 8, 12, 25, 26). The PDU Set Error Rate applies to PDU set which needs PDU set content integrated handling.

NOTE: A PDU Set is considered as error in case all or partial PDUs of the PDU Set are not successfully delivered. The other PDU Set error cases depends on the consensus of the other PDU Set content integrity handing.

Editor's note: PSDB and PSER definitions need further discussion. Also, it is FFS how the PSDB, PSER are differentiated on a PDU Set basis. Should importance parameter be considered to differentiate the PSDB, PSER, Priority provided over NGAP is FFS?

- Whether all PDUs are needed for the usage of PDU Set by application layer (solution 22, 23, 25, 49, 51).

 Parameters for further study:

- Whether to drop a PDU Set in case PSDB is exceeded (solution 8, 22, 24, 25).

- PDU Set Priority (14, 56).

NOTE 3: Following are some examples: 1) In some implementations, all PDUs in a PDU Set are needed by the application layer to use the corresponding unit of information applies. 2) In other implementations, as an example if the first packet of the PDU Set is lost, all other packets of the fragmentation units are useless, whereas of the last packet is lost, the decoder can use all packets except the last one. 3) In yet another example, a PDU Set may be mapped to all source and repair packets of an Application Layer FEC source block.

#### 6.52.2.5 QoS parameters provided by the AF to the CN

Information from AF:

 Baseline QoS parameters for each PDU Set within the QoS Flow:

- PDU Set handling indication (solution 8, 15,19, 25, 26, 49) (indicating if PDU Set based handling should be activated to a flow).

NOTE 3: This indication may be implicitly indicated via other PDU Set related information provided by the AF.

- all PDUs are needed for the usage of PDU Set by application layer (solution 22, 23, 25, 49, 51).

Editor's note: Except for “all PDUs are needed for the usage of PDU Set by application layer”, it is FFS whether the other PDU Set content integrated handling cases as defined in clause 6.51.2.4 are also considered.

Editor's note: Whether more detailed indicators are needed for different PDU Set QoS handling features (e.g. PDU Set integrated handling, QoS handling based on PDU Set importance, PDU Set dropping due to delivery failure of dependent PDU Sets) is FFS.

- PDU Set Delay Budget (solution 8, 12, 25, 26).

- PDU Set Error Rate (solution 8, 12, 25, 26).

 Baseline parameters on frame identification:

- Burst periodicity (solution 8, 12, 14, 24, 26, 56).

NOTE 4: The details of RAN behaviour are up to RAN WG.

NOTE 5: Whether and how to support the PDU Set handling for Uplink will be studied and led by RAN WG. SA2 will align with RAN’s progress and decision for Uplink, if any.

Editor's note: Whether and how to address the charging offset issue of DL PDU set eligible dropping by the NG-RAN is FFS.