**Source: Huawei (Rapporteur)**

**Title: KI#4 and KI#5, key questions for company view collection**

This document is to collect company views on key questions of KI#4 and #5 to facilitate the following conclusion discussion. Please kindly provide your company views on the following questions before EoB of Sep 16th. The rapporteur will collect the views and propose summary/way forwards/SoH for further discussion afterwards.

### Q1: How does UPF identify DL PDU Set info?

* Option 1: use existing IETF RTP/SRTP RFC and draft
* Option 2: Define/extend N6 protocols to carry related info
  + Option 2.1: extend GTP-U protocol
  + Option 2.2: extend HTTP header (S2-2205830)
  + Option 2.3: extend RTP header
* Option 3: UPF implementation based on e.g. traffic characteristics.
* Option 4: UPF interacts with NWDAF (S2-2205838)

**[Company view]**

**Position:** As a minimum, Option 2.1 to be progressed to normative work. Other options are FFS.

**Justification**: Option 2.1 has minimum impact on the 5G system as the burden of PDU Set identification is delegated to the Application Server.

In contrast, Option 1 requires “PDU Set identification rules”, which implies PDR extensions to include packet fields beyond the traditional IP 5-tuple which are specific to the upper layer protocol (RTP, SRTP, NAL). Option 3 does not require any specification. Option 4 is unclear.

### Q2. How to deliver PDU Set importance information to RAN:

* Option 1: use different QoS Flows with different priority level. PDU Set importance is mapped to existing QoS flow priority.
* Option 2: use one QoS flow for different PDU Set with different priority level
  + Option 2.1: use different sub-QoS Flow within one QoS Flow, and using sub-QoS flow Identifier in GTP-U header
  + Option 2.2: use PDU Set importance information in GTP-U header

**[Company view]**

**Position:** Option 2.2.

**Justification**: Option 2.2 of Q2 (together with Option 2.1 of Q1) relies on the traditional IP 5-tuple for QoS Flow binding, the additional information for PDU Set importance being conveyed in-band. This option preserves the order of packet arrival. When combined with Option 2.1 of Q1 it implies simple copy/paste of the PDU Set importance information received on N6. In our view the PDU Set importance information should primarily be understood as “discard eligibility” i.e. it is used by NG-RAN primarily for the purpose of discarding entire PDU Sets of lower importance in presence of congestion. It is possible that NG-RAN could use the PDU Set information for additional purpose (e.g. setting of more relaxed parameters for transmission on the radio interface), but this is up to RAN2 WG to discuss.

In contrast, Option 1 increases the number of QoS Flows and may lead to out-of-order delivery if the QoS Flows are mapped to different DRBs by NG-RAN. Option 2.1 introduces unnecessary complexity implying that a “QoS Subflow” could have a set of 5QI characteristics.

### Q3: Support to PDU Set dependency-based scheduling

* Option 1: Identify accurate dependency relationship between PDU Sets for scheduling.
* Option 2: In some scenario (e.g. closed GOP), the decoding of the non-I frames between two successive I frames always directly or indirectly relies on the 1st I frame of the two successive I frames. If the 1st I frame is in error, the non-I frames can be dropped until the next I frame. (proposed in S2-2205839)
* Option 3: If a PDU Set is depended by others, it can be considered as more important during scheduling. But the scheduling will not further consider the accurate dependency relationship.

**[Company view]**

**Position:** Leaning towards Option 3, but open for further discussion.

**Justification**: In our reading of the SA4 reply LS (S2-2203658), SA4 are advising against any handling of PDU Set dependencies at transport level because corresponding use cases that would benefit from such handling seem difficult to identify (refer to the text below from S2-2203658). According to Option 3, the “reference PDU Set” could be indicated explicitly (e.g. in the GTP-U header) or can be indicated implicitly by assigning a high PDU Set priority to it.

***4. Clarify what, if any, dependency there is between PDU Sets that may carry, e.g. different frames/”slices”.***

*Again, referring to the response in question 1, no single comprehensive answer can be provided. In some cases, there are no dependencies, in other cases dependencies exist. Referring to the examples, spatial and or temporal prediction of slices/frames across NAL units in the case of the video coding typically applies.* *In motion-compensated predicted video decoding, some frames/slices refer to other frames (typically entire frames and not restricted to slices) based on the video encoding configuration but also based on dynamic operational decisions. As consequence, a PDU Set may “depend” on previously received PDU Sets. However, such dependencies do not necessarily result in discarding dependent information units, but the user experience may be degraded.*

*SA4 would like to point out, that due to its heavy-compression and spatial-temporal prediction, any packet losses in video generally result in degradation of the user-perceived quality of experience. Hence, video applications generally (i) benefit, (ii) are more efficient and (iii) can be simplified, if the network minimizes video packet losses. Nevertheless, a video decoder in particular in a low-latency application needs to include mechanisms to handle packet losses and delayed packets, such as frequent resynchronization and error concealment. In those cases, the operation of the receiver/network may vary. For example, the handling of dependent PDU Sets once a leading PDU Set is lost is not universally defined and depends on the operation of the application. However, typically, video applications prefer reducing the encoding bitrate in order to minimize congestion-related packet losses. If the application and the 5GS have agreed to a QoS flow establishment, then the network is obviously expected to support the delivery of PDUs according to the QoS requirements of the application.*

### Q4. Support to hierarchical PDU Set:

* Option 1: introduces PDU Set group. (S2-2205938)
* Option 2: not support.

**[Company view]**

**Position:** Option 2.

**Justification**: Unnecessary complexity without a clear benefit.

### Q5. On “*Whether to drop a PDU Set in case PSDB is exceeded*”, do we need further define “*PDU Set Discard Time*” (A PDU Set shall be dropped in case this time is exceeded (sol 25 etc):

* Option 1: Support
* Option 2: not support.

**[Company view]**

**Position:** Option 2 (or FFS).

**Justification**: SA2 should focus on the PSDB definition. Any need for “discard time” will be assessed based on the agreed PSDB definition.