**3GPP TSG-SA WG4 Meeting #130S4-241798**

**USA, Orlando, 18 – 22 November 2024**

**Source: Huawei, HiSilicon**

**Title: FS\_5G\_RTP\_Ph2 Solution KI#2 guidelines for handling lone/unmarked PDU without SSRC packet filter in 5G System**

**Spec: 3GPP TR 26.822**

**Agenda item: 10.6**

**Document for: Agreement**

**1. Introduction**

A solution for KI#2 is needed to enable users of 5G RTP Header Extension for PDU Set Marking to be used in case lone PDU’s/unmarked PDU’s are present.

In this contribution guidelines for adoption by senders and receivers using the RTP Header Extension are presented for the case when unmarked or lone PDU’s are present.

In addition, potential guidelines for UPF behavior are presented, this is mainly to make sure fields from RTP HE can be mapped and used correctly by a UPF implementation.The intention is not to define normative behavior for the UPF, but instead a guideline that guarantees implementability.

This solution specifically addresses the case when no additional packet filter in 5G System is used and the lone PDU’s are the results of RTCP or Media multiplexing.

**2. Reason for Change**

The RTP Header Extension for PDU Set Marking was introduced in the Release 18 version of TS 26.522. Practical implementations such as WebRTC and different IPTV solutions use some form of multiplexing, namely RTP multiplexing or MPEG-2 TS multiplexing.

Having a guideline for adopting PDU Set Header Extension in these cases will be beneficial.

Also SA2 asked in a Liaison if applying PDU Set QoS Parameters to unmarked packet could have issues.

**3. Conclusions**

Additional guidelines/solution is needed to cover the objectives of KI #2 as presented in this pseudo CR.

**4. Proposal**

It is proposed to agree the following changes to 3GPP TR 26.822.

|  |
| --- |
| \* \* \* First Change \* \* \* \* |

# References

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[ZZa] 3GPP TS 29.571 3rd Generation partnership project; technical specification group core network and terminals; 5G System; common data types for Service based interfaces; stage 3

[ZZb] 3GPP TS 38.415 NG-RAN; PDU Session User Plane Protocol (Release 18)

\* \* \* Second Change (All new text) \* \* \* \*

## 6.X Solution #X: Guidelines for PDU Set Marking of Unmarked/Lone PDU’s

### 6.X.1 Key Issue mapping

This is a solution to key issue #2.

## 6.X.2 Description

#### 6.X.2.1 General

The RTP Header Extension for PDU Set marking aims to support enabling PDU Set QoS for RTP media traffic in the 5G System as defined in [3].

It helps components in the 5G System to identify PDU Sets and apply PDU Set QoS, i.e. see 5.37.5 in [3].

This clause proposes guidelines for applying and using the RTP Header Extension for PDU Set Marking when lone/unmarked PDU’s are present to enable effective PDU Set based QoS handling.

NOTE: This solution covers the case where 5G System cannot apply packet filter based on RTP SSRC and/or RTP PT in a QoS flow (Release 18). The case of using this packet filter is covered in clause 6.2.

For PDU Set based QoS handling, the PDU Set QoS parameters are introduced in TS 23.501 [3] as follows:

- PDU Set Delay Budget, which defines an upper bound for the delay that a PDU Set may experience for the transfer between the UE and the N6 termination point at the UPF.

- PDU Set Error Rate, which defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g., RLC in RAN of a 3GPP access) but that are not successfully delivered by the corresponding receiver to the upper layer (e.g., PDCP in RAN of a 3GPP access).

- PDU Set Integrated Information, which indicates whether all PDUs of the PDU Set are needed for the usage of the PDU Set by the application layer in the receiver side.

Provisioning of protocol description to assist UPF for the PDU Set information identification is defined in [ZZa].

PDU Set information in the GTP-U header added by the UPF to the NG-RAN is defined in [ZZb].

If the NG-RAN receives PDU Set QoS Parameters, it enables the PDU Set based QoS handling and applies PDU Set QoS Parameters. When the PDU Set QoS parameters are available, they will supersede the PDU QoS parameters (i.e. PSDB/PSER supersedes the PDB/PER).

#### 6.X.2.2 Guideline for PDU Set marking of lone/unmarked PDU’s

An additional guideline is provided to support this case for the following scenario:

* The case of unmarked Packets in a stream to which RTP Header Extension for PDU Set marking is applied (including the marking of data bursts that are not part of a PDU Set).

It is recommended that when the RTP HE for PDU set marking is enabled, the RTP HE is applied to each RTP packet that belongs to a PDU Set. This enables effective identification of all packets belonging to a PDU Set by the 5G System. This can subsequently enable suitable PDU Set QoS based Handling for each PDU Set in the NG-RAN.

Please see clause 6.2 for a detailed gap analysis of when and how lone/unmarked PDU can occur. In the 5G System, such an unmarked PDU will be treated as a separate PDU Set and PDU Set QoS parameters are applied instead of PDU QoS Parameters to a single packet.

NOTE: Due to this behaviour of the 5G System, PDU Set QoS parameters such as delay budget, when configured, have to be suitable for the unmarked PDU’s as well as the marked PDU’s.

A practical example could be an audio and a video stream multiplexed in a single RTP session which is carried on a QoS flow. In this case the video stream RTP packets include RTP Header Extension for PDU Set marking for each RTP Packet but on the other hand the audio stream RTP Packets do not contain the RTP Header Extension. The PDU Set delay budget is set to 20 milliseconds (as example) in order to support the real-time video frame transmission. This delay budget is used in the 5G System for video PDU sets but also for the independent audio packets that are treated as a single PDU Set in the 5G System. In this practical case, a delay budget of 20 milliseconds is also suitable for the audio stream as this delay leads to a satisfactory end-to-end delay performance.

The unmarked packets do not count towards the PDU set size of marked PDU Sets as optionally signalled in the RTP Header extension. In the case of an unmarked packet, it is handled as a separate PDU Set instead, and the size of the packet is identical to the PDU Set Size of this separate PDU Set (which should equal to the size of the PDU).

End of data burst signalling may still apply in the RTP Header Extension to all packets (both marked and unmarked).

In case the last packet of the data burst is an unmarked packet it may be possible to add RTP HE for PDU Set marking to the packet if possible (i.e is an RTP Packet). Otherwise the end of data burst marking may not be valid.

The guideline for determining PDU Set information at the UPF from either RTP HE or unmarked PDU is given in Table 6.X.2.2-1.

**Table 6.X.2.2-1: Determining PDU Set information ([ZZb]) at UPF from RTP HE and unmarked PDU**

|  |  |  |
| --- | --- | --- |
| **PDU Set information [ZZb]** | **RTP HE** | **Lone/unmarked PDU (and UPF cannot derive PDU Set based on content type as in Annex A of 26.522)** |
| PDU Set importance | set by interpreting PSI field in [2] | set by 5G System to a configured valueOr set as proposed in solution #15 |
| PDU Set Size | Optionally transmitted in additional PSSize field and derived from this field. | PDU Size |
| End of Data Burst | can be set by EoDB flag | N/A for lone PDU |
| PDU Sequence number | from PDU sequence number in RTP HE | Set to 0 |
| PDU Set Sequence number  | PSSN field from RTP HE with most significant bit is set to 0 | set by UPF with most significant bit set to 1  |
| end of PDU set | End of the PDU Set in RTP HE | always 1 |

The PDU Set information can be determined by the UPF as shown in table 6.X.2.2-1 with different PDU Set information in the left most column. The middle column indicates how the UPF can derive PDU Set information for packets that include RTP HE for PDU Set information. The right most column indicates how UPF can derive PDU Set information for unmarked packets (lone PDU’s).

The PDU Sequence number could be retrieved from the PSN in RTP HE, or when no RTP HE is present it can be determined by the UPF.

The PDU Set Sequence Number has some additional steps applied by the UPF to enable to generate a PDU Set Sequence Number that can identify the PDU Set as defined in [ZZa, ZZb] (these steps are an example, UPF could apply different steps, this is just to give how this scenario can be addressed). Alternatively, the PDU Set Sequence Number can also be allocated by UPF following its own implementation that lead to PDU Set Sequence Number.

As an example, the UPF can only use the 9 least significant bits of the RTP HE mapping PSSN from RTP HE to PSSN in PDU Set Information and set the most significant bit of PSSN in PDU Set information to 0.

NOTE: The RTP HE PSSN cannot map directly to PSSN for PDU Set information when lone PDU's are present

The UPF can then use the 9 least significant bits of PSSN in PDU Set information based on a counter for unmarked PDU ‘s, and set the most significant bit to 1. This is an example of how the UPF can deal with both PSSN from RTP HE and unmarked PDU and still get PSSN values that can be used to identify the PDU Set (following definitions from [ZZb] and [ZZa] for PDU Set Sequence Number) .

NOTE: This is solution is to show a possible mapping of PSSN from RTP HE and non RTP HE packets can be done at UPF to enable implementability at UPF. Other solutions can be equally valid and applicable by the UPF.

Signalling presence of unmarked PDU’s could be developed in TS 26.510, as currently TS 26.510 explicitly states that signaling requires PDUs to be marked, but for the lone PDU case it is optional, therefore some updates to TS 26.510 can be considered. There is also the case in Annex A of TS 26.522 where the UPF determines the PDU Sets based on codec characteristics for H.264 and H.265 for unmarked packet. This option should be seen as alternative and potentially signalling in TS 26.510 can be developed for both cases.

The definition of PSSN in 5G RTP [2] and [ZZb] are currently not aligned, the strict increment by one only applies for 5G RTP not for PSSN generated by UPF as part of PDU Set information.

NOTE: This guideline does not require changes to the definition of PSSN in [2].

#### 6.X.2.3 Discussion

**Pros:**

SA2 has asked SA4 about the possibility of lone PDU’s being present and if PDU Set QoS will have an effect on the user experience. The benefit of this solution are:

1. Explicit guideline for how the UPF could potentially deal with the case of unmarked PDU’s, even though the UPF behaviour is up to implementation. Such a recommendation can still be useful to make sure that RTP HE can be used in practice by the UPF
2. A reference to TS 23 501 can potentially be added to clarify that unmarked and marked PDU's will both be using PDU set QoS.

**Cons:**

This solution proposes informative text to a normative technical specification making adoption of the specification easier and more straightforward. As long as it is clear that it is an example guideline, it should not be harmful as it does not contradict existing specifications. In the case a different PDU Set QoS Parameter is required for unmarked PDU's, this is not covered in this solution. This may require additional coordination with SA2 to enable such handling in 5GS. Other solutions to other key issues such as KI #9 or KI #14 could potentially bring forward solutions that could address this case.

\* \* \* End of Changes \* \* \* \*