**3GPP TSG-SA WG4 Meeting 130S4-241799**

**Orlando, Florida, USA, November 18 – 22, 2024 (revision of S4aR240106)**

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| *CR-Form-v12.3* |
| **Pseudo CHANGE REQUEST** |
|  |
|  | **26.822** | **CR** | **-** | **rev** | **-** | **Current version:** | **1.0.0**  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | [FS\_5G\_RTP\_Ph2] Solution KI #9 Guidelines for PDU Set Marking in Multiplexing Scenarios without SSRC packet filter |
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| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | SA WG 4 |
|  |  |
| ***Work item code:*** | FS\_5G\_RTP\_Ph2 |  | ***Date:*** | 25-10-2024 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | 19 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | Solution for RTP HE usage when using media multiplexing over a single RTP session is missing.  |
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| ***Summary of change:*** | This is a solution for using RTP HE in combination with media multiplexing. Multiplexing is common in scenarios such as WebRTC (RTP multiplex) or television application (MPEG-2 TS multiplexing). The solution presents guidelines for how multiplexed media content can take advantage of RTP HE for PDU Set Marking and PDU Set QoS in 5G System. This solution assumes the case when no Packet Filter based on RTP-SSRC/PT is enabled to distinguish QoS Flows. |
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| ***Consequences if not approved:*** | KI not addressed, practical adoption of RTP HE for PDU Set marking will be limited |
|  |  |
| ***Clauses affected:*** | 6.X (new clause) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| CHANGE 1 (ALL new Text) |

# References

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[ZZ] [Real-Time Transport Protocol (RTP) Parameters (iana.org)](https://www.iana.org/assignments/rtp-parameters/rtp-parameters.xhtml)

[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)

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| CHANGE 1 (ALL new Text) |

## 6.X Solution #X: Guidelines for PDU Set Marking in Multiplexing Scenarios

### 6.X.1 Key Issue mapping

Solution to key issue #9.

### 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 in the 5G System as defined in [3].

It enables 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 in additional multiplexing scenarios 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 in a QoS flow. It assumes a multiplexed streams are handled in a single QoS flow.

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.

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).

In multiplexing scenarios, multiple types of media and/or control packets are carried on a single QoS flow.

#### 6.X.2.2 Unmarked packets PDU Set handling Guideline.

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.

In some cases, packets may exist that do not belong a PDU Set, but are instead a single independent packet intended for transmission.

NOTE: These lone or unmarked PDU’s can occur in RTP multiplexed streams as there is no requirement to apply RTP HE to each RTP packet in a stream.

The guidelines for handling unmarked packets are discussed in solutions to KI#2.

#### 6.X.2.3 RTP HE for multiplexed content

An RTP sender could also include additional RTP HE for the additional multiplexed streams. This may be useful in the case frames consist of multiple packets that can be grouped in PDU Sets or if setting the PDU Set importance is desired (sc1, sc2). In addition, cases are considered when the content is natively multiplexed and it is hard to distinguish packets based on media type as they may contain multiple media types (sc3, sc4).

To illustrate this, Table 6.X.2.3-1 provides some examples on different multiplexing scenarios and the corresponding guidelines for setting RTP HE are further given in Table 6.X.2.3-2

**Table 6.X.2.3-1: Example of Multiplexing scenarios**

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | Multiplex Type | Description | Implications for RTP Header Extension for PDU Set Marking for sender |
| sc1 | audio + video RTP multiplex [4] | Native Audio and Video streams are carried in separate RTP streams with different SSRC. Packets contain either audio or video. | Typically, RTP HE is used for the video stream, audio packets can be unmarked or in some cases they can also use the RTP HE (if frames comprise multiple packets). |
| sc2 | audio + video [4], RTCP[5] | Same as above, but in this case also RTCP packets. Packets contain audio, video or RTCP. | Same as above for audio and video. RTP HE cannot be used for RTCP packets. End of Data Burst signal cannot be used in case RTCP packet is the last one in a data burst. |
| sc3 | audio, video MPEG-2 TS [36] | MPEG-TS transport stream can contain both audio and video. In this case an RTP packet may contain a MPEG-2 packet that can contain both audio and video content. In addition, MPEG-2 TS can also contain other metadata related to the streams. | In this case in the grouping of PDU sets will contain different media types, additional guidance is provided to handle this case. |
| sc4 | audio, video MPEG-2 TS [36] + RTCP [4] | same as above adding RTCP | same as above including RTCP packets [4] that cannot carry RTP Header Extension |

**Table 6.X.2.3-2: Guidelines for applying RTP HE in different example multiplexing scenarios**

|  |  |  |
| --- | --- | --- |
| Scenario | Guideline | Additional Comments |
| sc1 | Video PDU Sets may be assigned for video frames or slices and PDU Set importance can be set using guidelines from 4.6.2 of TS 26.522.Audio Packets can be unmarked or in case audio frames consist of multiple packets they may be marked using RTP HE. PDU Set importance of the unmarked packet is determined by the 5G System. | Typically RTP HE is used for the video stream, audio packets can be unmarked (see the lone PDU case)  |
| sc2 | same as above. RTCP packets cannot be marked using RTP HE and are treated as unmarked packet in the 5G System, PDU Set importance can be determined by the 5G system. | Same as above for audio and video. End of Data burst signal may not be valid if RTCP is the last packet in a burst. |
| sc3 | PDU Sets can be identified by the RTP sender based on the presentation time and the RTP HE can be used to support the PDU Set based QoS handling. The PDU Set importance can be set to a default value or the value corresponding to the video part of the stream using guidelines from 4.6.2 in [2] | In this case in the grouping of PDU sets will contain different media types, and therefore the guidance cannot only be based on one specific media type, which may not be appropriate. Therefore, PDU Sets could be identified and marked by the RTP sender based on other aspects such as the presentation time.  |
| sc4 | same as sc3RTCP packets cannot be marked and are treated as unmarked packet in the 5G System. | Same as above including RTCP packets [4] that cannot carry the RTP Header Extension.Data burst signal cannot be used if RTCP is the last packet in a burst. |

To support multiplexed content in combination with PDU Set QoS based Handling in the 5G System, groups of packets of different media types may also be grouped as a PDU Set (sc 3). This enables frames/groups of packets to benefit from expedited transfer using PDU Set QoS parameters in NG-RAN. In this case, each of the RTP packets can set the RTP Header Extension for PDU Set Marking to enable 5G System to identify corresponding PDU Sets.

Different options exist when applying RTP HE for multiplexed content, for which some guidelines are as follows:

* When RTP multiplexing (sc1 and sc2) is used, it is possible to separately mark the PDU Sets in different streams. In this case, the PDU Sets may also be indicated with different PDU Set importance as already discussed in [2]. As concluded in TR 23.700-70, the UPF packet filter can be extended to include SSRC, payload type, etc. in order to detect and map the each marked media stream to the specific QoS Flow with PDU Set QoS handling enabled. In this guideline, it is assumed that this filter is not available ( as in the case of release 18).
* When packets may combine different media types such as in sc3 and sc4 PDU sets can be created around a common media presentation time grouping packets based on timestamps. Additional sender behaviour can be detailed in case such as solution is selected for normative work. In this case the PDU set importance can be set to a derived or default value.
* In case only packets of single stream are marked (e.g. the video stream), the situation as described in the previous sub-clause applies.
* In case Packets cannot carry the RTP header extension (e.g. RTCP packet), packets can be handled as a lone/unmarked PDU.

The protocol description can be used to indicate to the 5G System that PDU Sets contain multiplexed content. For example by indicating a payloadType with a number that corresponds to a multiplexed data type (e.g. payloadType 33 for MPEG-2 TS). In this case the transport protocol would still be RTP, but the payload type could be MPEG-2 TS and/or a combination of format types e.g. (H.264, AAC) (in case of RTP multiplex). In such a case it is optional to provide additional format parameters.

**Table 6.X.2.3-3: Example protocol description for different multiplexing scenarios**

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | protocol |  rtpPayloadFormat (example) | Rtppayloadtypelist (example) |
| sc1 | RTP/SRTP | H265, PCMA | 97,8 |
| sc2 | RTP/SRTP | H265, PCMA | 97,8 |
| sc3 | RTP/SRTP | MP2T | 33 |
| sc4 | RTP/SRTP | MP2T | 33 |

NOTE: There is no way to explicitly mark the presence of RTCP packets, defining signalling for this is FFS.

The guidelines for PDU Set Marking for H.264 and/or H.265 can still apply but in this case, but when the PDU Set importance of video packets cannot be identified, it can be set to a default value by the sender.

Note that any of the encoding types or payload types as registered by IANA [ZZ] and beyond can be used, but this table is not fully up to date in [ZZa].

### 6.X.3 Proposal

a) Develop these guidelines for multiplexed content and add them to TS 26.522 to support both the PDU Set identification by RTP senders and enable PDU Set information derivation by the UPF if needed.

b) Add more explicit text on the supported payload types and content types in TS 26.522 and potentially align this with stage 3 specifications developed TS 29.571 (CT3, CT4).

c) Check the case for signalling presence of RTCP in the protocol description in a flow.