**#3GPP TSG SA WG4 Meeting #129eS4-241451**

**Online August 19 2024- August 23 2024 in revision of S4a240044**

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| *CR-Form-v12.3* | | | | | | | | |
| **Pseudo CHANGE REQUEST** | | | | | | | | |
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|  | **26.822** | **CR** | **-** | **rev** | **1** | **Current version:** | **0.1.1** |  |
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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 |  |

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| ***Title:*** | FS\_5G\_RTP\_PH2 KI#12 RTP Header Extension for Dynamic Traffic Characteristics | | | | | | | | | |
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| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | SA WG4 | | | | | | | | | |
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| ***Work item code:*** | FS\_5G\_RTP\_PH2 | | | | |  | ***Date:*** | | | 26-6-2024 |
|  |  | | | |  | |  | | |  |
| ***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 can be 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)* | |
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| ***Reason for change:*** | | FS\_5G\_RTP KI #12 deals with enhancements for data burst marking for 5G RTP. Incorporating dynamic traffic information with the header extension for PDU Set marking, is potentially problematic as the information would be added in each packet, which is not needed as typically announcing a burst size or time to next burst may be signaled in initial packets only. It is commonly understood that the RTP Header extensions for PDU Set marking are added to each RTP Packet in a media stream. Adding dynamic traffic characterstis may therefore introduce considerable overhead.  Another issue with adding new dynamic traffic characteristics is that it may affect backward compatiblity with the release 18 solution for RTP PDU Set Marking, which has no support for explicit signaling of dynamic traffic characteristics.  To address this we introduce a solution for marking of dynamic traffic characteristics that decouples dynamic traffic characteristics and the release 18 RTP Header extension for PDU Set marking. It has the following advantages:   1. Enables reducing the overhead by not adding the dynamic traffic characteristics in each packet 2. Enables backward compatlbility by intertroducing a new RTP header Extension that is independent from the R18 PDU Set RTP HE. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | A solution to KI#12 for RTP Header Extension fordynamic traffic characteristics | | | | | | | | |
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| ***Consequences if not approved:*** | | No solution for dynamic traffic characterstics in release 19 that includes both data burst size and time to next burst. | | | | | | | | |
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| ***Clauses affected:*** | | 2, 6.X (new clause) | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | * Updated text to TCIN to be a bit more flexible (QC) * Add some notes on typical implementation and packager behavior | | | | | | | | |

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| CHANGE 1 |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 26.522: "5G Real-time Media Transport Protocol Configurations".

[3] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[4] IETF RFC 8872: "Guidelines for Using the Multiplexing Features of RTP to Support Multiple Media Streams".

[5] IETF RFC 5761: "Multiplexing RTP Data and Control Packets on a Single Port".

[6] 3GPP TR 23.700-70: "Study on architecture enhancement for Extended Reality and Media service (XRM); Phase 2".

[7] IETF RFC 8285 (2017): "A General Mechanism for RTP Header Extensions", D. Singer, H. Desineni, R. Even.

[8] IETF RFC 3711: "The Secure Real-time Transport Protocol (SRTP)".

[9] IETF RFC 9335: "Completely Encrypting RTP Header Extensions and Contributing Sources".

[10] IETF RFC 6904 (2013): "Encryption of Header Extensions in the Secure Real-time Transport Protocol (SRTP)", J. Lennox.

[11] IETF RFC 8402 (2018): "Segment Routing Architecture".

[12] IETF RFC 791 (1981): "Internet Protocol".

[13] IETF RFC 5109: "RTP Payload Format for Generic Forward Error Correction (ULP FEC): Uneven Level Protection, different redundancies for different packets with different importance".

[14] IETF RFC 8627: "RTP Payload Format for Flexible Forward Error Correction (Flex FEC): flexible FEC".

[15] IETF RFC 6681: "Raptor Forward Error Correction (FEC) Schemes for FECFRAME: FEC scheme based on the Raptor".

[16] IETF RFC 6865: "Simple Reed-Solomon Forward Error Correction (FEC) Scheme for FECFRAME: FEC scheme based on Reed-Solomon".

[17] IETF RFC 5053: "Raptor Forward Error Correction Scheme for Object Delivery".

[18] IETF RFC 6330: "RaptorQ Forward Error Correction Scheme for Object Delivery".

[19] IETF RFC 6363: “Forward Error Correction (FEC) Framework”.

[20] IETF RFC 8854: “WebRTC Forward Error Correction Requirements”.

[21] 3GPP TR 38.340: "Study on User Equipment (UE) power saving in NR".

[22] IETF RFC 8298: "Self-Clocked Rate Adaptation for Multimedia".

[23] Enhancing Video Network Resiliency With LTR and RS Code | At Scale Conferences, available online: https://atscaleconference.com/enhancing-video-network-resiliency-with-ltr-and-rs-code/

[24] P. Aggarwal et al., [2304.03732] Enabling immersive experiences in challenging network conditions (arxiv.org)

[25] Nvidia GeForce Now, Video FEC for WebRTC presentation 17 Nov. 2022, available online: https://www.youtube.com/watch?v=igm7QkqxHqk&ab\_channel=KrankyGeek

[26] Holmer S., et al., Handling Packet Loss in WebRTC, 2013 IEEE International Conference on Image Processing, available online: <https://static.googleusercontent.com/media/research.google.com/en//pubs/archive/41611.pdf>.

[27] A Google Congestion Control Algorithm for Real-Time Communication, draft-ietf-rmcat-gcc-02, 2016.

[28] WebRTC source code: https://source.chromium.org/chromium/chromium/src/+/main:third\_party/webrtc, retrieved May 1, 2024.

[29] IETF RFC 8698: "Network-Assisted Dynamic Adaptation: A Unified Congestion Control Scheme for Real-Time Media", 2020.

[30] Self-Clocked Rate Adaptation for Multimedia, draft-johansson-ccwg-rfc8298bis-screamv2-00, 2024.

[31] IETF RFC 4588: "RTP Retransmission Payload Format".

[32] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia telephony; Media handling and interaction".

[ZZ] IETF RFC 8285: **“A General Mechanism for RTP Header Extensions”**

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| CHANGE 2 (ALL NEW TEXT) |

## 6.X Solution X: RTP Header Extension for Dynamic Traffic Characteristics

### 6.X.1 Key Issue Mapping

### 6.X.2 Description

A data burst indicates a set of multiple PDUs generated and sent in a short period of time as defined in clause 3.1 of TS 23.501 [3]. Data burst is a common transmission characteristic in communication networks.

The traffic characteristics regarding the data burst transmission could be beneficial for the 5GS network, e.g., power saving and efficient radio resource management. In Release 18, the End of Data Burst indication has been introduced to enable the UE power saving in the 5GS, i.e., the NG-RAN node can configure to move a UE into CDRX for power saving after transmitting the end PDU of the data burst. In Release 19, the data burst size has been concluded to enable the RAN radio resource management as described in clause 8.5 of TR 23.700-70 [6].

For marking dynamic traffic characteristics, the RTP HE for Dynamic Traffic Characteristics is defined in this clause.

A new RTP HE is proposed for the following reasons:

1. Avoiding compatibility issues with release 18 Header Extension for PDU Set marking
2. Avoiding overhead, RTP HE need not be present in each RTP packet, but for Release 18 Header Extension it is common understanding that usually each RTP packet is marked. The information for dynamic traffic characteristics on the other hand is specifically useful in specific packets at the beginning of a traffic pattern.

Dynamic Traffic Characteristics marking can be performed by an RTP sender, such as an Application Server (e.g., MRF), a sender UE that sends media to an RTP receiver, such as a UE, or other 5G network components.

Endpoints that support the RTP HE for Dynamic Traffic Characteristics shall support both RTP HE formats (i.e., the one-byte and the two-byte formats) according to RFC 8285 [ZZ].

If the RTP HE for Dynamic Traffic Characteristics is the only RTP HE used, the endpoints shall use the 1-byte header format. If other 2-byte RTP HE elements are used in the same RTP stream, then the 2-byte header shall be used, unless the "a=extmap-allow-mixed" is successfully negotiated through SDP offer/answer, as described by RFC 8285 [11].

NOTE 2: The headers are not shown with padding as this depends on other prospective extension elements in use, as per RFC 8285 [11] alignment specifications.

The IANA registration information for the RTP HE for RTP HE for Dynamic Traffic Characteristics in 6.X.8.

#### 6.X.2.1 Intended Usage in 5GS

The solution of adding dynamic traffic characteristics serves the following key use case:

1. Based on the SDP negotiation, the RTP HE for Dynamic Traffic Characteristics is enabled. The RTP Sender or Application Server adds header extension of a dynamic traffic characteristic in the first few packets of a data burst.
2. The dynamic traffic characteristics header is added by the packet sender potentially for groups of packets to be sent, this may include multiplexed RTP or Multiplexed RTP/RTCP traffic. The sender, may add information such as the Burst Size of the group of packets to be transmitted, or based on its own internal scheduling the time until the next burst can be sent.
3. The UPF detects packets that include the Header Extension for Dynamic traffic characteristics and marks the dynamic traffic characteristics into the GTP-U header of downlink packets, including the End of Data Burst indication and data burst size.
4. As concluded in clause 8.5 of TR 23.700-70 [6], the data burst size carried in the RTP HE can be identified by the UPF and then further sent to the NG-RAN via the GTP-U header to assist the radio resource management. The procedure is as follows:
   1. The (RTC-)AF may provision the Protocol Description to PCF directly over N5 interface or via NEF over N33. The Protocol Description indicates that the RTP HE for Dynamic Traffic Characteristics is enabled.
   2. PCF may provision the Protocol Description within the PCC rules based on the information provided by the AF and/or the local operator policies.
   3. SMF requests the UPF to detect and mark the burst size of the data burst and mark itin the GTP-U header of the first few PDUs in downlink, according to the PCC rule and/or the local operator policies.
   4. UPF identifies the burst size of a data burst in the downlink traffic based on the RTP HE according to the Protocol Description and provides the data burst size to the RAN in the GTP-U header of the first few PDUs of a data burst to assist radio resource management.
   5. RAN efficiently optimizes the radio resource for the timely data burst transmission based on the data burst size in the GTP-U header.

Editor’s Note: Whether other dynamic traffic characteristics are needed depends on further conclusion of SA2 and RAN WGs.

#### 6.X.2.3 One-byte RTP Header Extension Format

The one-byte RTP HE for the marking of PDU Sets and End of Bursts is defined as follows:

0 1 2 3

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| 0xBE | 0xDE | length |

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| ID | len | R |D| RR | [TCIN] |

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| BSSize | TTNB

+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+

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#### 6.X.2.4 Two-byte RTP Header Extension Format

The two-byte RTP HE for the marking of PDU Sets and End of Bursts is defined as follows:

0 1 2 3

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| 0x100 |appbits| length |

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| ID | len | R |**D**| RR | [TCIN]

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

| BSSize |

+-+-+-+-+-+-+-+-+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+

| TTNB |

+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+.+

#### 6.X.2.5 Semantics

The semantics of the fields of the RTP HE for PDU Set marking are defined as follows:

- **End of Data Burst [D] (1 bit):** This field is a flag that shall be set to 1 for the last PDU of a Data Burst. It shall be set to 0 for all other PDUs. A Data Burst may consist of one or more PDU Sets.

- **Reserved [R] 3 bits):** This field is reserved for future usage (e.g., dynamic burst indication). It shall be set to 0 by the RTP sender and shall be ignored by the RTP receiver.

- **Reserved [RR] 4 bits):** This field is reserved for future usage (e.g., dynamic burst indication). It shall be set to 0 by the RTP sender and shall be ignored by the RTP receiver.

- [**Traffic Characteristics Identifier Number [TCIN] (16 bits):** A pseudo random number or a monotonously increasing number to indicate the Traffic characteristics signalling, this enables the receiver to distinguish different traffic characteristics signalling and identify repeated dynamic traffic identification signalling (if present). The main goal of this identifier is to enable identification of different traffic characteristics signalings.

NOTE: TCIN is helpful to enable identification of packets belonging to a burst in case of out of order delivery on N6]

NOTE: It is still for further study if and how this field should be used this is placed in brackets, as this discussion would happen in case this solution is selected as a basis for normative work.

- **Burst Size [BSSize] (24 bits):** The Burst Size indicates the total size of the burst to be transmitted. The burst size corresponds to the size of the data burst corresponding to the TSSN. If the burst size is not known it is set to 0.

- **Time To Next Burst [TTNB] (16 bits):** Indicates the approximate time to the next burst in milliseconds. If the time to next burst is not known it is set to 0. This time is relative to the time of the current burst that is the send time in milliseconds of the current burst, taking the packet in the middle of the burst as reference.

NOTE: Inaccuracy on the TTNB may occur due to different reasons such as re-ordering or unknown, this number is indicative and should be accurate within 1-5 ms range.

NOTE: If a packager generates all packets of the burst at once, no additional delay is introduced, as the packets can be marked with the complete burst size. If this is not the case a delay as large as the burst duration could be introduced by marking the entire burst. Therefore, this approach may not be suitable for all types of packagers/encoders, especially those that gradually produce packets additional latency may be introduced if the size is not known in advance.

NOTE: This solution has some overlap with the solution for Data burst marking in R18 and PDU Set marking, more discussion is needed on the benefits. As PDU Set marking requires marking each packet while traffic characteristics marking does not, this separate solution is proposed.

NOTE: The introduction of this header extension may need some alignement with other working groups such as SA2 and/or RAN2.

NOTE: The anchor time of the Time to Next burst is expected to be for further study in case the solution is adopted as a basis for normative work.

NOTE: additional optional fields of this Header Extension are for further study

NOTE: The layout of the dynamic traffic characteristics header extension mimics the RTP Header for PDU set marking enabling re-using of parsing mechanisms.

#### 6.X.2.6 SDP Signaling

An RTP sender capable of sending RTP HE for Dynamic Traffic Characteristics shall use the SDP extmap attribute for RTP HE for RTP HE for Dynamic Traffic Characteristics in the media description of the RTP stream(s) carrying the RTP HE for RTP HE for Dynamic Traffic Characteristics. An RTP receiver that does not support RTP HE for Dynamic Traffic Characteristics can ignore that RTP HE when included. The signaling of the Dynamic Traffic Characteristics RTP HE shall follow the SDP signaling design and the syntax and semantics of the "extmap" attribute as outlined in RFC8285.The URN for the PDU Set marking shall be set to "**urn:3gpp:dynamic-traffic-characteristics:rel-19**".

The ABNF syntax for the extmap attribute for the signaling of RTP HE for PDU Set marking is defined as follows, extending the ABNF in RFC 8285:

*extensionname = "urn:3gpp:dynamic-traffic-characteristics:rel-19"*

*format = "short" / "long"*

The extension attributes have the following semantics:

- format: indicates if the RTP HE for Dynamic Traffic Characteristics uses the 1-byte (short) or the 2-byte (long) format. This extension attribute shall not be included more than once.

NOTE: Regardless if this extension attribute is present or not, the use of long or short format is determined as described by section 4.1.2 of RFC 8285, i.e., based on what format other RTP HEs use in the same RTP session, unless both endpoints announced support for handling mixed format with "a=extmap-allow-mixed" as described by section 6 of RFC 8285[ZZ].

Below is an example:

a=extmap:7 dynamic-traffic-characteristics:rel-19 long

#### 6.X.2.7 Guidelines ForDynamic Traffic Characteristics Signaling

It is recommended that the first several RTP packets and the last packets contain the the dynamic traffic characteristics traffic signalling. In addition some additional RTP packets may contain the RTP Header Extension for dynamic traffic characteristics.

It is recommended that the application signals the presence of RTP HE for dynamic traffic characteristics out of band using SDP signalling as defined in 6.X.6.

In addition, dynamic traffic characteristics should only be used if the generated data can be marked for such characterstics, i.e. it contains burst and potentially some periodicity information or it knows the timing to a next data burst.

A sender, that is scheduling to send out a group of packets, may calculate the size of the group of the packets, and then add the overhead of adding the RTP Header and then update the packets to include the RTP Header Extension for dynamic traffic characteristics.

#### 6.X.2.8 Proposed Annex D.3

The desired extension naming URI:

urn:3gpp:dynamic-traffic-characteristics:rel-19

A formal reference to the publicly available specification:

[TS 26.522]

A short phrase describing the function of the extension:

Marking of dynamic traffic characteristics such as burst size and time to next burst

Contact information for the organization or person making the registration:

3GPP Specifications Manager

3gppContact@etsi.org

+33 (0)492944200

#### 6.X.2.9 Discussion of the solution

This solution presents a way forward to enable dynamic traffic characteristics signalling in release 19. The main advantages are that:

1. Backward compatibility is achieved by not changing the Release 18 HE for PDU Set marking. The default behaviour is to ignore unknown RTP headers. By not changing the release 18 RTP HE for PDU Set marking this can still be used the same way. In case efficient data burst marking is needed in the first packet as requested by RAN2 the current solution can be used.
2. Sparsity and reduced overhead is achieved as recommended in RFC 8285. Not every RTP packet has to carry the Header Extension for Dynamic Traffic Characteristics.
3. Can be implemented separately and independently from the PDU Set marking Header Extension, a sender or scheduler that sends out a group of packets in a burst such as multiple pdu sets, can apply marking for the traffic characterstics.
4. Well defined usage within the 5G System context is documented.

NOTE: How to combine bursts sent over different IP Tuples is for Further Study.

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| End of Changes |