**3GPP TSG-SA WG4 Meeting #130S4-241833**

**USA, Orlando, 18 – 22 November 2024** Revision of **S4aR240090**

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| *CR-Form-v12.3* | | | | | | | | |
| **Pseudo CHANGE REQUEST** | | | | | | | | |
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|  | **26.822** | **CR** | **-** | **rev** | **-** | **Current version:** | **1.0.0** |  |
|  | | | | | | | | |
| *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] TR 26.822 clause 7 Analysis (draft) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Qualcomm, Lenovo | | | | | | | | | |
| ***Source to TSG:*** | SA WG 4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_5G\_RTP\_Ph2 | | | | |  | ***Date:*** | | | 12-11-2024 |
|  |  | | | |  | |  | | |  |
| ***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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Clause 7 Analysis is left blank | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | A summary of the progress added and light analysis regarding the next steps | | | | | | | | |
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| ***Consequences if not approved:*** | | Report is incomplete, analysis is missing, discussion of solutions will lack appropriate context for unaware readers. No recommendations for next steps including normative work. | | | | | | | | |
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| ***Clauses affected:*** | | 7( and all subclauses) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | This document is the output of the offline discussion on October 30 and submitted as an input contribution to SA4#130 as basis for future work. | | | | | | | | |

**====== CHANGE 1 (all new) ======**

# 7 Overall Analysis

## 7.0 Key Issue and Solution Overview

Table 7.0-1 summarizes the progress of each of the key issues.

The following clauses provide a more detailed analysis of the progress for each key issue.

**Table 7.0-1 Progress of Key issues**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Key Issue #** | **Short Description** | **Progress** | **Objectives met** | **Normative work proposed** | **Convergence possible ?** | **Dependencies** | **Comments** |
| 1 | PSSize accuracy | #4 and #7 and #A (1800) | Partially | Yes (#4), Yes (#7), Yes (#A) | #4 and 7 same source, Complementary solutions  #A is not complementary | #7 depends on SA2  #4 is fully contained in SA4  #A has dependency on RAN feedback | Based on all of the above the following way forward is advisable:   1. Maintain Rel-18 general principle and verify (by means of LS to: RAN2, cc: SA2) the SA4 assumptions regarding the RAN accuracy needs regarding the PDU Set size values. 2. Consider towards normative work KI#1 candidate solutions from Rel-18 and Sol#4 from TR 26.822, conditionally based on RAN2 feedback as:    1. If exact PDU Set Size accuracy is required by RAN consider Rel-18 towards normative work effectively solving the NAT46/64.    2. If PDU Set Size accuracy may slightly vary at RAN consider Sol#4 from TR 26.822 towards normative work based on RTCP feedback mechanisms to indicate the correction factor   The solution on PDU Set Size overprovisioning may be generally regarded as implementation aspect in determining the PDU Set size in the GTP-U header for PDU Set Information. Based on RAN2 feedback, PDU Set Size overprovisioning informative guidelines may be considered. |
| 2 | Lone PDU | #2 and #15  #B(1798)  #C(1863p) | Partially | No (#2),  Yes (#15)  Yes (#B) | #2 provides gap analysis.  Complementary solutions in 15 and B | SA2 | Extend the RTC provisioning feature in TS 26.510 and TS 26.113 to include PDU Set Importance values for PDUs of protocols that may be treated as lone PDUs in the UPF.  Consider guidelines for handling lone PDU in TS 26.522  NOTE: Coordinate with SA2 on whether Protocol Description needs to be extended with the lone PDU information.  --- Analysis and conclusion to be updated based on decision on 1863  - |
| 3 | FEC support | #5, #17 and #18 | Yes | Yes (#5), Yes (#17), Yes (#18) | Complementary solutions FEC schemes, congestion control and FEC awareness | None | Existing AL-FEC and congestion control schemes were studied in this KI.  No recommendation for normative work to include new AL-FEC schemes in the 3GPP specifications was identified. |
| 4 | FEC awareness | #8, #10, #17, #18, #19 | Yes | Yes #8 Yes #10 Yes #17 Yes #18 Yes #19 | Complementary solutions | RAN2, SA2 | 1. Agree on supporting PDU Set handling with AL-FEC awareness in Rel-19 5G\_RTP\_Ph2 normative work.     NOTE 1: The agreement is conditioned by RAN confirmation to feasibility of using content ratio information for discarding DL PDUs during congestion for RLC AM/UM mode based on the above SA2 principles in Rel-19; this would apply for success of delivery of a group of packets.   1. Specify any necessary (S)RTP HE enhancements for PDU Set marking with AL-FEC awareness.   NOTE 2: To realize Stage-3 aspects of the agreed SA2 design over 5G-RTC other impacted technical specifications are not precluded (e.g., TS 26.510, TS 26.113).   1. Specify requirements and guidelines for MDS AL-FEC coding schemes necessary for PDU Set handling with AL-FEC awareness by the 5GS.  * FFS: a generic mechanism to improve congestion control algorithms for AL-FEC encoded traffic considering intentional packet discarding by the network. |
| 5 | RTP transport for XR | - | - | - | - | - | This key issue was not progressed, hence no recommendation for normative work. |
| 6 | Encryption | #3 | Yes | Yes (but limited) | Single solution |  | Extend the guidelines for support of SRTP in such cases in TS 26.522  No additional normative work has been identified for Rel-19 since SRTP usage is already supported in Rel-18. |
| 7 | RTCP messages for 5G | #14 | Yes | No | Single solution | none | Existing RTCP messages and RTP HEs were studied in this KI.  No potential normative work has been identified for Rel-19. |
| 8 | RTP retransmission | #9 and #11 | Yes | Yes #9, Yes #11 | Same source | SA2/RAN2 | Coordinate with SA2 and RAN2 on network awareness of retransmitted PDUs as well as core network and RAN handling of retransmitted PDUs based on the information provided by the application. Based on SA2 and RAN2 guidance, consider sending information related to end-to-end retransmissions from the application to the 5G Core Network. |
| 9 | RTP Multiplexing | #12  #D (1799) | Yes | Yes #12 and #D | Complementary solutions | SA2 | Based on response from SA2, normative work on multiplexed RTP streams may be needed. Furthermore, we recommend to add guidelines to TS 26.522 for RTP senders that use multiplexing. |
| 10 | Use cases | - | - | - | - | - | Not progressed. |
| 11 | Enhancements to PDU Set HE | - | - | - | - | - | Not progressed. |
| 12 | Data Burst marking | #6, #13, #16,  X3: 1901, X4:1902p, X5: 1906a, X6: 1907p, X7: 1910p, X8: 1864 | Yes | Yes #6, Yes #16,  #13: Reinforces the normative work proposed in #6 and #16  X3: No X5: Yes  X8: Yes  X4:1902p,  , X6: 1907p, X7: 1910p, | Some solutions are complementary and convergence needed for others, possible way forward proposed in clause 8. | SA2, RAN2 | Do normative work for adding burst size notification, when deterministically known, from RTP senders in a HE. Revisit definition of a data burst in TS 26.522 to indicate what is meant by idle time and if it is required.  Possibly inform SA2 and RAN2 about the SA4 about our work.  Define normative work to enable the application to provide data boosting indication to the 5G network for downlink using RTP/RTCP signalling.  Define TTNB with coordination with SA2 and RAN2.  TTNB-parked: RAN2 has indicated that TTNB may be useful if provided in time and is reliable. SA4 needs further evaluation needs to be done before proceeding with normative work but it is recommended to do normative work if the evaluation shows that TTNB value can be signalled. |
| 13 | Applicability of PDU Set HE | #1 | Partially | Yes #1 | Single solution | SA2, RAN2 | The following aspects are concluded as principles for normative work:  - Consider extending the PSI guidelines in TS 26.522 for the case when a PDU Set is defined as a tile (as opposed to a video frame or slice).  - Coordinate with SA2 and RAN2 on potential benefits of signaling PDU Set type to the 5G network. |
| 14 | QoS flow multiplex | #12 | Partially | Yes | Single solution | SA2 | Based on response from SA2, normative work on multiplexed RTP streams may be needed. Furthermore, we recommend to add guidelines to TS 26.522 for RTP senders that use multiplexing. There may be potential normative aspects to be added to TS 26.510. |
| 15 | Media and metadata | - | - | - | - | - | Not progressed |

## 7.1 Analysis for Key Issue #1

Two solutions are proposed i.e. solution #4 and solution #7.

Solution #4: First, it shows that due to different factors differences in estimated and received PDU Set Size can occur, and it explains the significance of the impact of such differences for the NG-RAN. Second, it proposes a measurement-based precompensation scheme. Third, it compares the proposed scheme to two other schemes: NAT46/64 only correction, and IP fragmentation prevention.

It emphasizes that limited processing should happen in the network (e.g. UPF) and shifts logic to the client, and that accuracy is important.

Solution #4 can address all causes of the inaccuracy.

Solution #4 requires standardization on signaling of the feedback. It has no dependency on SA2 or other 3GPP working groups, and it is fully contained within SA4.

In Solution #7 sending remaining PSSize in the RTP Header extension is proposed. It addresses the inaccuracy caused by NAT46/64.

Solution #7 in clause 6.7 discusses the pros and cons of the solution.

NOTE 1: Solution #7 needs to change the semantics of the PSSize field in the RTP header extension for PDU Set marking in TS 26.522.

NOTE 2: For Solution #7, it needs to change the Protocol Description which needs coordination with SA2 and/or RAN2.

## 7.2 Analysis for Key Issue #2

Two solutions are proposed i.e. #2 and #15.

The solution #2 in clause 6.2 discusses when lone PDUs can occur, but no detailed proposal on how to overcome the issue in TS 26.522 is yet proposed.

Solution #15 introduces a configurable PSI signalling for lone PDUs according to the protocol type (e.g. RTCP) carried in the PDU. The solution makes use of control plane signalling and extends the RTC provisioning feature defined in TS 26.510 clause 5.2.10 and therefore requires updates to 26.510.

NOTE: It needs to be clarified if and what coordination is needed with SA2

## 7.3 Analysis for Key Issue #3

Three solutions were proposed i.e. #5 #17 and #18.

The solution in #5 discusses the mechanisms for FEC defined in IETF and dissected different properties, it seems that the (near) MDS codes have some benefits compared to other solutions, but the current WebRTC solution uses a non MDS code.

Solution #17 analyses the overhead and end-to-end perspective of using FEC in 3GPP Setting. In particular it shows that when a frame/access unit is smaller the overhead of FEC increases to achieve the successful reconstruction probabilities.

Solution #18 overviews congestion control used for real time communication and ask the question what the effect could be when using AL-FEC, it also implies that this should be further studied (see solution #19).

## 7.4 Analysis for Key Issue #4

Five solutions, i.e. #8, #10, #17, #18, #19 are proposed for key issue #4.

Solution #8 adds support for the PDU Set definition when using AL-FEC. It analyses different options with a preference for combining source and repair packets in a single PDU set.

Solution #10 analyzes the effect of upstream and downstream losses in case 3GPP network actively intervenes to optimize traffic delivery when using AL-FEC.

Solution #17 and #18 were also proposed for key issue number 3 (see clause 7.3)

Sol #19 considers the case if network components discard some packets how that should be accounted for, also both the case when the network is congested versus the case that a network is not congested are considered.

## 7.5 Analysis for Key Issue #5

No contributions yet on this Key Issue #5 have been progressed.

## 7.6 Analysis for Key Issue #6

Only a single solution #3 was proposed to address this key issue.

The solution is based on SRTP solution already available in Release 18.

It needs to be considered if additional text is needed to improve the support for this solution.

## 7.7 Analysis for Key Issue #7

A single solution for this key issue was proposed in solution #14.

Commercial systems indeed use different RTCP messages and RTP header extensions and these may also be considered in 5G\_RTP\_Ph2.

NOTE: It should be clarified what and or which messages would need further documentation and specification and what the benefits can be.

## 7.8 Analysis for Key Issue #8

Two solutions were proposed, solution #9 and solution #11.

In solution #9 an additional flag is used to indicate that a packet is a retransmitted packet and some other aspects are introduced to enable RTP based retransmission. The solution also identifies that not all fields of the RTP HE for PDU Set marking may be necessary for retransmitted PDUs.

This enables the network to potentially handle retransmitted packets in a differentiated way

NOTE: It needs to be checked with SA2 whether/how network can benefit from E2E retransmission awareness.

Solution #11 proposes setting a threshold on PSI values to enable senders to indicate a PSI value below which lost packets have to be retransmitted. This way a receiver can easily identify the need for a retransmission request for a lost packet.

The objectives from the key issue description are fully addressed.

## 7.9 Analysis for Key Issue #9

Only a single solution was proposed for this KI so far: solution #12. The solution shows that MID values inserted as a header extension to bundled (via SDP BUNDLE) streams can be used by the 5G System to map to different QoS flows.

Not all objectives of the key issue description have been addressed.

## 7.10 Analysis for Key Issue #10

This key issue was not progressed.

## 7.11 Analysis for Key Issue #11

This key issue was not progressed. Enhancements to RTP HE for PDU Set marking have been considered in different key issues.

## 7.12 Analysis for Key Issue #12

Three solutions were proposed for this key issue: #6, #13, #16.

Solution #13 measures dynamic traffic characteristics in different settings using different types of RTP senders.

Solution #6 adds the Time to next Burst (TTNB) to RTP Header extension for PDU Set marking.

Solution #16 introduces a new header extension to support dynamic traffic characteristics such as TTNB and burst size signalling.

NOTE: Alignment may be needed in the normative work, but the solutions point in the same direction of extending the header extension.

## 7.13 Analysis for Key Issue #13

A single solution (#1) was proposed for this KI.

Solution #1 identifies the benefits of defining PDU Sets as tiles or subpictures (as opposed to frames or slices) in immersive video use cases and proposes to the signal the PDU Set type (e.g. frame, slice, tile) to the network for potentially improved network handling.

## 7.14 Analysis for Key Issue #14

One solution #12 was proposed. The mapping of SSRC multiplexed RTP streams to different QoS flows is supported and the bundling of streams is supported.

It seems that the support for PDU Sets as indicated in the description is not yet discussed.

## 7.15 Analysis for Key Issue #15

This key issue does not yet have a solution, but the description was progressed.