**3GPP TSG-SA WG4 Meeting #128S4-241100**

**South Korea, Jeju, 20 – 24 May 2024**

**Source: Nokia Corporation (Rapporteur)**

**Title: Rapporteur's summary of inputs about LS to SA2 on FS\_XRM\_Ph2 Study Item**

**Agenda item: 10.8**

**Document for: Agreement**

# Introduction

This document is the 5G\_RTP\_Ph2 Rapporteur’s view on the contributions related to the liaison statements from SA2 S4-240873 and S4-240874 of competence of the abovementioned SI.

The idea of this document is to summarize the inputs and facilitate a possible way forward. It is anyway recommended to discuss comprehensively all issues before formulating replies to SA2.

# Summary of the SA2 liaison statements content

# The input liaison statements to this SA4 meeting are the following:

# S4-240873 (on Application Layer FEC)

Solutions have been proposed to provide information about the presence of application layer forward error correction (AL-FEC) to NG-RAN to enable NG-RAN to discard obsolete AL-FEC PDUs. Obsolete AL-FEC PDUs refers to PDUs that are not needed at the UE because enough PDUs to reconstruct the actual content have already been successfully sent to the UE.

Questions to SA4:

* SA2 understands that different AL-FEC mechanisms exist (e.g., maximum-distance separable (MDS) schemes like RaptorQ and Reed-Solomon, FlexFEC, etc.) and is discussing for which AL-FEC mechanisms to enable AL-FEC awareness at RAN. **Can SA4 identify commonly used AL-FEC mechanisms (not necessarily 3GPP defined),** which should be supported for AL-FEC awareness at RAN from SA4's perspective?
* Does SA4 see a need (from a general application perspective) to support both **static and dynamic redundancy** ratios (i.e., the ratio of AL-FEC information) for AL-FEC awareness at RAN?
* Does SA4 see a **need for the application layer to distinguish RAN's intentionally dropped obsolete FEC packets from congestion related drops, and related to this, the need for specific application behaviour, e.g., to reduce the sending rate**? The background to this question is the following:
  + Some companies in SA2 commented that transport protocols or applications need to reduce their sending rate in response to packet losses.
  + Other companies argued that there is no need for reducing the sending rate when NG-RAN discards obsolete AL-FEC PDUs as long as NG-RAN can still meet the QoS characteristics of the other QoS flows in the same cell (i.e., because there is no fairness issue in this case).
* **One solution** (solution #3 in TR 23.700-70) proposed that an application may signal the required content ratio for a PDU Set (i.e., the required ratio of PDUs of a PDU Set needed by the receiver to reconstruct the original content) by first providing a mapping between content ratio levels and PDU Set Importance (PSI) values in the control plane to 5GS and by then using the PSI in the GTP-U header and the mapping received to determine the content ratio per PDU Set at NG-RAN. Does SA4 consider this a feasible option?

# S4-240874 (on FS\_XRM\_Ph2 topics)

Questions to SA4:

* **(1):** PDU Set correlation information (Sol#23) provides the dependency relationship among PDU Sets. **Does SA4, RAN2 and RAN3 see any improvement with adding inter-PDU set correlation information to assist RAN making PDU set discarding decision as comparing to the existing (R18) PDU Set information that is already provided by the AS?**
* **(2):** In Sol#29, PDU Set QoS or ordinary per packet based QoS (e.g. PER, PDB) can be applied for different media streams multiplexed in an IP flow, **SA2 would like to ask SA4 whether a media stream (e.g. a video RTP stream) can include packet which is not related to PDU Set?**
* **(4):** In Sol#30, the PSA UPF may identify the size of incoming burst based on N6 protocol, and send it to NG-RAN to assist RAN scheduling. **is it possible that the application server provides the burst size in the first packet of the burst via N6?**
* **(5):** Some of the solutions support only QUIC-based media delivery. **Can SA4 provide feedback on choosing only solutions for PDU Set identification for encrypted traffic that only support QUIC as transport protocol?**

# Summary of the input contributions

This is the list of contributions submitted at this meeting and the related discussions occurred over the RTC email reflector.

**On Application Layer FEC**

Huawei – S4-240973

Meta – S4-241023

Qualcomm – S4-241086

Lenovo – S4-241088

Ericsson - email from 7 May 2024 (RTC Reflector)

**On FS\_XRM\_Ph2 topics**

Huawei, HiSilicon – S4-240967, S4-240972

Meta – S4-241023

Lenovo – S4-241090

Qualcomm – S4-241092

Ericsson’s email from 7 May 2024 (RTC Reflector).

The following table summarizes the company positions for the different topics. The last column represents the 5G RTP Ph2 Rapporteur’s view on a possible RTC recommendation for the reply LS to SA2 and further actions in RTC SWG.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Huawei** | **Meta** | **Qualcomm** | **Lenovo** | **Ericsson** | **RTC Recommendation for LS replies** |
| **Used AL-FEC** | Decision is with SA2 |  | The schemes specified in IETF RFCs should be supported, including RaptorQ, Reed-Solomon, FlexFEC, and ULPFEC. | Active discard in RAN recommended (but not yet studied in SA4), with support of MDS (e.g., RS) or approximate MDS codes (Raptor, RaptorQ) | Feasibility should be studied before thinking what FEC codes could be recommended. | There are two classes of FEC codecs with related implications and challenges. |
| **Static and dynamic FEC redundancy ratios** | Both options should be considered. | Dynamic FEC ratio should be supported. | Both options should be considered. | Dynamic FEC ratio should be supported. | Dynamic, but it requires further study | Dynamic FEC ratio may bring advantages. This may be used in combination with RTP retransmission and there is sufficient RTT. |
| **Need to distinguish dropped packets and reduce tx rate** | Yes. | Yes.  Dropping should be controlled by the sender. | No and SA4 should study more. | Yes | No. | The sender should possibly authorize the network to intentionally drop packets. Whenever this happen, the network should have a mechanism to inform the sender about what packets are dropped. |
| **Content FEC ratio solution is feasible** | No |  | No, there are better solutions. | Needs further study | It would need to be verified | SA4 should study more. |
| **Inter-PDU set correlation info** | Not feasible | a) PDU set dependency discarding and b) independent PDU indicators should be supported. | No benefits | No benefits | No need to add new complex mechanisms. PSI is sufficient. | There seems to be no benefits, or the topic should be studied more. |
| **A stream can include packets not related to a PDU set** | Yes |  | Yes | Yes. | Yes. | Yes |
| **Burst size in the 1st packet of the burst** | Yes. SA4 is studying it. |  | Not generally feasible | For further study | Not feasible | SA4 should study more. |
| **Solutions only for QUIC-encrypted traffic** | Yes, but not only QUIC-based solutions. |  | Requires more study | Requires proper study | Premature. Requires more study. | SA4 should study more. |