**SA WG2 Meeting #S2-151e(e-meeting) S2-2203898r05+**

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**Source: Ericsson, Deutsche Telekom, AT&T, Charter Communications Inc., MediaTek Inc., TMO USA Inc., Telstra, Apple, Verizon, Nokia, Nokia Shanghai Bell, DISH Network, Google, BT, CableLabs, Meta USA, Intel, Telia, Vodafone, China Mobile**

**Title:** **KI#3, New sol: 5GS information exposure on XR/media Enhancements**

**Document for: Approval**

**Agenda Item: 9.19**

**Work Item / Release: FS\_XRM / Rel-18**

*Abstract of the contribution: This contribution provides solution to enable codec/rate adaptation to meet requirements for services as described by KI#3.*

# 1. Introduction

This paper proposes solution for KI#3 as agreed by SA2#149E:

“This Key Issue will study mechanisms that enable codec/rate adaptation to meet requirements for services.

- Study the use cases and whether enhancements to the exposure framework are needed for such use cases;

- What 5GS information needs to be exposed to enable application codec/rate adaptation;

- How to expose 5GS information for application codec/rate adaptation.

NOTE 1: Parameters for exposure may be coordinated with RAN and SA WG4.

NOTE 2: Potential overlap with enhancements done in FS\_EDGE\_Ph2/FS\_UPEAS should be considered.

”

# 2. Proposal

This paper proposes the following updates to TR 23.700-60 clause 6.

\* Start of change \*

# 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 23.501: "System Architecture for the 5G System (5GS); Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[5] 3GPP TS 22.261: "Service requirements for the 5G system; Stage 1".

[6] 3GPP TR 22.847: "Study on supporting tactile and multi-modality communication services; Stage 1".

[y] RFC 8311: Relaxing Restrictions on Explicit Congestion Notification (ECN) Experimentation

[8] Low Latency, Low Loss, Scalable Throughput (L4S) Internet Service: Architecture, Briscoe et al, Internet-draft, IETF, Nov 2020, <https://datatracker.ietf.org/doc/draft-ietf-tsvwg-l4s-arch/>

Editor’s note: The above document cannot be formally referenced until it is published as an RFC.

[9] Explicit Congestion Notification (ECN) Protocol for Ultra-Low Queuing Delay (L4S) , Briscoe et. al, Internet draft, IETF, Mar 2021, <https://tools.ietf.org/wg/tsvwg/draft-ietf-tsvwg-ecn-l4s-id/>

Editor’s note: The above document cannot be formally referenced until it is published as an RFC.

[11] Data Center to the Home, EU project RITE, <https://riteproject.eu/dctth/>

[16] “Linux Kernel tree containing patches for TCP Prague and the dualpi2 qdisc”, <https://github.com/L4STeam/linux/>

\* Next change \*

## 6.X Solution #X: Use of L4S to enable codec/rate adaptation to meet requirements for services

### 6.X.1 Key Issue mapping

Editor's Note: This clause lists the key issue(s) addressed by this solution.

This solution addresses KI#3.

### 6.X.2 Description

Editor's Note: This clause will describe the solution principles and architecture assumptions for corresponding key issue(s). Sub-clause(s) may be added to capture details.

L4S, “Low Latency, Low Loss and Scalable Throughput”, is an AQM-like mechanism which, instead of dropping packets, uses link state indications and rate adjustments proportional to the queue delay.

L4S is subject to standardization in IETF [8], [9] and has wide support from major stakeholders in the industry. L4S has been demonstrated in the RITE EU project [11]. Congestion control algorithms that support L4S are described, e.g. in [16].

This solution proposes that the 5G System uses ECN marking for the purpose of “Low Latency, Low Loss and Scalable Throughput” (L4S [9]) for uplink or downlink so that the application layer can trigger real-time and gradual rate adaptation of the real-time video encoder based on L4S feedback.

In this solution the network is configured by existing means to map desired, L4S enabled packet flows on a pre-configured 5QI and thus QoS Flow.

To address service requirements, by using L4S marking of payload packets as specified in RFC 8311[7] and in IETF drafts [8] and [9], the NG-RAN exposes current load level. L4S marking interacts with the application layer, wherein the application layer triggers rate adaptation based on L4S feedback. In this solution NG-RAN makes use of L4S marking for both, DL and UL direction. . Enablement of L4S in a packet flow is based on e2e support for L4S.

The solution is based on following two components:

* - Use of L4S in NG-RAN
* - Enablement of using L4S

NOTE: This solution is applicable only in case UE and Application Server support L4S defined in RFC 8311[x] and IETF drafts [8] and [9] and use protocols that support L4S feedback between UE and application server.

### 6.X.2.1 Use of L4S in NG-RAN

It is assumed that the varying radio conditions and resource availability in NG-RAN are the main contributors to the need for the application to adapt its rate accordingly.

Given that it is NG-RAN that has the visibility of the resource availability and sudden changes on the radio interface that impact the performance in terms of latency, any fast reaction to trigger rate adaptation, that is required for services with tight latency requirements and benefit from bounded latency, must be triggered by NG-RAN. NG-RAN makes use of L4S marking of payload packets as specified in RFC 8311[7] and in IETF drafts [8] and [9]. L4S marking interacts with the application layer, wherein the application layer triggers rate adaptation based on L4S feedback. In this solution NG-RAN makes use L4S marking for both, DL and UL direction.

NOTE: The criteria that RAN perform the marking is up to RAN implementation.

Editor’s Note: Whether RAN can support such a marking need to be coordinated with RAN WG.

### 6.X.2.2 Enablement of using L4S

To enable L4S, an existing or a separate QoS flow can be used for L4S traffic supporting RFC 8311[x] and IETF drafts [8] and [9]. In context of this descriptive text for readability reasons, we refer to it as an‘L4S QoS Flow’. It shall be noted that this solution does not propose to introduce a new concept and instead it reuses the 5QI framework. Namely, use of a certain QoS flow for L4S traffic, enabling L4S treatment in NG-RAN, is achieved via a preconfigured 5QI value. One or several 5QI(s) may be defined for this purpose by the operator in a deployment.

There are 3 main principles to establish a L4S QoS flow within a PDU session:

- Statically: At PDU session establishment the L4S QoS flow is always established. This by either a pre-configured PCC rule if PCF is used, or by configuration in SMF.

NOTE: In this case, the configuration should ensure the application using the L4S QoS Flow supports L4S and uses one of the protocols that support L4S feedback.

- Dynamically based on 5GC configurations: SMF installs a Detection filter in UPF. This is either based on a request from PCF or from local configuration. The Detection filter can either use the L4S bits (ECN bits) in the IP header or the XR server IP address(es). When L4S traffic is detected, the UPF notifies SMF. If PCF is used, SMF notifies PCF which triggers a L4S QoS flow establishment, or if PCF is not used, SMF is configured to establish a L4S QoS flow.

- Dynamically based on AF request: The AF makes an authorization request either via NEF (untrusted) or directly to PCF, which triggers a Session modification procedure as per clause 4.3.3 in TS 23.502 [3].

The filters provided by SMF in the QoS rule to the UE and PDR to the UPF to identify traffic to be routed onto the L4S QoS flows can be a combination of existing filters and/or the L4S bits (ECN bits) in the IP packet header of the XR service.

Editor's Note: Other means to enable of L4S use are FFS.

### 6.X.3 Procedures

Editor's Note: This clause describes high-level procedures and information flows for the solution.

### 6.X.4 Impacts on services, entities and interfaces

Editor's Note: This clause captures impacts on existing 3GPP nodes and functional elements.

NG-RAN: support for L4S marking of payload packets as described in subclauses 6.x.1, 6.x.2.

UE: L4S feedback is fed back in UL over transport protocol (e.g. TCP ACK, QUIC ACK, RTCP).

\* End of changes \*