**3GPP TSG-S4 Meeting #115e**

**, – 27th August 2021**

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| *CR-Form-v12.1* |
| **Pseudo CHANGE REQUEST** |
|  |
|  |  | **CR** |  | **rev** |  | **Current version:** | 0.2.0 |  |
|  |
| *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 | **X** | Radio Access Network |  | Core Network | **X** |

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| --- |
|  |
| ***Title:***  |  |
|  |  |
| ***Source to WG:*** | Ericsson LM, BBC, EBU, Sennheiser, Dolby |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | FS\_NPN4AVProd |  | ***Date:*** | 12/08/21 |
|  |  |  |  |  |
| ***Category:*** | **B**  |  | ***Release:*** | 17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | The current version of the technical report only contains some few potential key issues. The intention of this contribution is to extend the list of potential key issues with media protocol specific key issues, which should be studied in more detail. |
|  |  |
| ***Summary of change:*** | Two new new potential key issues are proposed, focusing on applying existing media production workflows onto 5G Systems. |
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| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **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:*** |  |

\*\*\*\* First 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".

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[38] Wikipedia: "MADI", last modified 19th April 2021, <https://en.wikipedia.org/wiki/MADI>

[39] Wikipedia: "Time-Sensitive Networking", last modified 23rd June 2021, <https://en.wikipedia.org/wiki/Time-Sensitive_Networking>

[40] AES67 / SMPTE ST 2110: "COMMONALITIES AND CONSTRAINTS", https://aimsalliance.org/wp-content/uploads/2019/04/AES67-SMPTE-ST-2110-Commonalities-and-Constraints-Updated-April-2019.pdf

[41] IETF RFC 5104: "Codec Control Messages in the RTP Audio-Visual Profile with Feedback (AVPF)".

[42] IETF RFC 4585: "Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback (RTP/AVPF)".

\*\*\*\* Next Change \*\*\*\*

### 5.2.3 Key issues

#### 5.2.3.1 General

#### 5.2.3.2 Key Issue #1: Utilizing Available Capacity in Multi-Camera Scenarios

##### 5.2.3.2.1 QoS requirements – bit rate

Usual fiber-based studio setups use 3-24 Gbit/s per camera (uncompressed, see [37]). A 5G cellular setup is obviously limited in uplink capacity compared to that. Considering this, SA1 produced a table in [3] containing also somewhat lower numbers, assuming various degrees of compression:

Table 5.2.5.2-1: reproduced from [3] table 6.2.1-3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Profile | # of active UEs | UE Speed | Service Area | E2E latency  | Packet error rate (Note 1) | Data rate UL | Data rate DL |
| Uncompressed UHD video | 1 | 0 km/h | 1 km2 | 400 ms | 10-10 UL10-7 DL | 12 Gbit/s | 20 Mbit/s |
| Uncompressed HD video | 1 | 0 km/h | 1 km2 | 400 ms | 10-9 UL10-7 DL | 3 .2 Gbit/s | 20 Mbit/s |
| Mezzanine compression UHD video | 5 | 0 km/h | 1000 m2 | 1 s | 10-9 UL10-7 DL | 3 Gbit/s | 20 Mbit/s |
| Mezzanine compression HD video | 5 | 0 km/h | 1000 m2 | 1 s | 10-9 UL10-7 DL | 1 Gbit/s | 20 Mbit/s |
| Tier one events UHD | 5 | 0 km/h | 1000 m2 | 1 s | 10-9 UL10-7 DL | 500 Mbit/s | 20 Mbit/s |
| Tier one events HD | 5 | 0 km/h | 1000 m2 | 1 s | 10-8 UL10-7 DL | 200 Mbit/s | 20 Mbit/s |
| Tier two events UHD | 5 | 7 km/h | 1000 m2 | 1 s | 10-8 UL10-7 DL | 100 Mbit/s | 20 Mbit/s |
| Tier two events HD | 5 | 7 km/h | 1000 m2 | 1 s | 10-8 UL10-7 DL | 80 Mbit/s | 20 Mbit/s |
| Tier three events UHD (Note 2) | 5 | 200 km/h | 1000 m2 | 1 s | 10-7 UL10-7 DL | 20 Mbit/s | 10 Mbit/s |
| Tier three events HD (Note 2) | 5 | 200 km/h | 1000 m2 | 1 s | 10-7 UL10-7 DL | 10 Mbit/s | 10 Mbit/s |
| Remote OB | 5 | 7 km/h | 1000 m2 | 6 ms | 10-8 UL10-7 DL | 200 Mbit/s | 20 Mbit/s |
| NOTE 1: Packets that do not conform with the end-to-end latency are also accounted as error. The packet error rate requirement is calculated considering 1500 B packets, and 1 packet error per hour is 10-5/(3\*x) $=\frac{10^{-5}}{3x}$, where x $x$ is the data rate in Mbps.NOTE 2: Could use either professional equipment or mobile phone equipped with dedicated newsgathering app  |

Further, Table 4.3‑1 in the present document shows a range of bit rates for different event types.

**Observation 1**: The data rate requirements per camera in [3] span a range of more than 1000 times, from 10 Mbit/s to 12 Gbit/s, depending on the profile/scenario.

**Observation 2**: The overall uplink capacity of a 5G system with realistic amount of radio spectrum and realistic ratio between downlink and uplink time resources, is in the same order of magnitude as the required/desired data rate for a *single* camera for tier 2 and tier 1 events.

Editor’s note: example values for uplink cell capacity are invited.

**Conclusion 1**: For multi-camera scenarios, there is a need to dynamically control media rates such that not all cameras use the maximum rate all the time.

**Conclusion 2**: For multi-camera scenarios, there is a desire from the producer’s point of view to see all cameras in pristine quality but in case of increased cell load or worsening radio conditions, there is also a need to quickly reduce media rates to avoid data loss on important camera feeds. Specifically, within a group of cameras that are used for the same live programme, there is need for reducing the rate for lower-prioritized cameras in order to protect the camera that is currently “live” (production camera) and the camera that is next to go “live” (according to the producer’s wishes).

See clause 7.1 for candidate solutions to this issue.

#### 5.2.5.3 Key Issue #2: Media Protocols on 5G: Using QoS for traffic segregation

##### 5.2.5.3.1 General

This clause focuses on the usage of 5G Systems, assuming that multiple application flows – either from multiple cameras or from a single camera unit (see Figure 5.2.2.4-1) – would experience a different priority treatment by the RAN traffic scheduler and likely by the traffic policing function in 5GC. Different protocols may be used to carry media and other data.

An application flow is typically described by a 5-tuple, i.e. source and destination IP addresses (Layer 3), Layer 4 protocol and Layer 4 source and destination ports. Some protocols may multiplex multiple elementary streams (and potentially other data) into one application flow. Other protocols map one elementary stream to one application flow.

The traffic characteristics and the main flow direction (uplink or downlink) depend on the usage. For example, a program video stream, produced by a camera, is typically of higher bit rate than a return video stream.

NOTE: Some application flows may carry non-media content, for example camera control, telematics (e.g. battery status), and position information for AR tracking.

Editor’s Note: Solutions may use IP multicast or IP unicast packet routing to transport media streams. IP multicast is popular in AV Production because the same feed from a camera, microphone or talkback circuit can then be consumed by monitoring devices (screens, headphones, etc.) as well as feeding into vision mixers, sound mixers, etc. However, there are challenges to be overcome in using IP multicast over Wide-Area Networks and therefore in Remote Production scenarios.

Editor’s Note: Solutions should consider multiple combinations of application flows. Input is needed on the prioritization between application flows, e.g. when audio is present with the program video. It will be studied how audio or video is dropped in contentious situations.

Editor’s Note: Evaluation of this Key Issue can allow protocol consideration and recommendations on network usage, e.g. flow separation, etc.

##### 5.2.5.3.2 Usage of RIST Simple Profile

Editor’s Note: This section aims to describe the usage of RIST Simple profile [7] features on 5G (NPN) Systems. Here, the various flows (uplink and downlink) should be separated & prioritized using 3GPP QoS framework. (Media and Non-Media like RC & telematics)

##### 5.2.5.3.3 Usage of RIST Main Profile

Editor’s Note: Same as previous subclause, but with RIST Main Profile [8] feature.

##### 5.2.5.3.4 Usage of SRT

Editor’s Note: Same as previous subclause, but with SRT [5] features.

##### 5.2.5.3.5 Summary

#### 5.2.5.4 Key Issue #3: Media Protocols on 5G: Using Network Slices or Multiple PDU Sessions for traffic segregation

##### 5.2.5.4.1 General

This clause focuses in the same set of issues (i.e. media protocol usage) as described in clause 5.2.5.3, with the difference of using Network Slices or multiple PDU Sessions for traffic separation. Traffic separation is needed when multiple concurrent productions are sharing the same NPN facility (SNPN or PNI-NPN) at a shared outside broadcast venue. The Key Issue #3 aims to examine the pros and cons of network slices versus different PDU sessions for supporting such Use Cases. It is assumed that each PDU session contains only a single QoS flow with a default QoS PCC rule.

Example realizations:

- Program Video and Audio are carried by a separate Network Slice or PDU Session from other Media Production traffic, i.e. audio and video in the same Network Slice or PDU Session.

- Return Video is carried is carried by a separate Network Slice or PDU Session from Program media and other media.

##### 5.2.5.4.2 Usage of RIST Simple Profile

##### 5.2.5.4.3 Usage of RIST Main Profile

##### 5.2.5.4.4 Usage of SRT

##### 5.2.5.4.5 Summary

\*\*\*\*Last Change \*\*\*\*