**3GPP TSG SA WG4 127 Meeting S4-240317**

**Sophia Antipolis, France, 29 January – 2 February 2024 revision of S4-240120**

**Source: Qualcomm Incorporated, Dolby France SAS, China Mobile Com. Corporation, AT&T, Telecom Italia, Comcast, ATEME, Orange, Samsung Electronics Co. Ltd.,** **NTT, BBC, ZTE, SWR, EBU, Rohde & Schwarz, China Unicom, Huawei Technologies Co Ltd., Ericsson LM, Tencent, InterDigital Communications**

**Title: New Feasibility Study on Advanced Media Delivery**

**Document for: Agreement**

**Agenda Item: 6.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Feasibility Study on Advanced Media Delivery

Acronym: FS\_AMD

Unique identifier: 11xxxxxx

Potential target Release: Rel-19

1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | **UICC apps** | **ME** | **AN** | **CN** | **Others (specify)** |
| **Yes** |  | X |  | X |  |
| **No** | X |  | X |  | X |
| **Don't know** |  |  |  |  |  |

2 Classification of the Work Item and linked work items

2.1 Primary classification

This work item is a …

|  |  |
| --- | --- |
|  | **Feature** |
|  | **Building Block** |
|  | *Work Task* |
| X | **Study Item** |

2.2 Parent Work Item

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| --- |
| **Parent Work / Study Items**  |
| **Acronym** | **Working Group** | **Unique ID** | **Title (as in 3GPP Work Plan)** |
|  |  |  |  |

2.3 Other related Work Items and dependencies

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| --- |
| **Other related Work Items (if any)** |
| **Unique ID** | **Title** | **Nature of relationship** |
| 840001 | 5GMS3 5G Media Streaming stage 3 | Addressed stage-3 in 5G Media Streaming by updating TS 26.247 as well as new specs in TS 26.511, TS 26.512, and TS 26.117. |
| 900029 | Study on 5G media streaming extensions | Studied the current limitation of 5G Media Streaming architecture and documented possible extensions in TR 26.804. |
| 870014 | Feasibility Study on Multicast Architecture Enhancements for 5G Media Streaming | Identified and evaluated potential enhancements to the 5G Media Streaming Architecture to provide multicast-broadcast media streaming services in TR 26.802. |
| 960047 | 5G Media Streaming Architecture Phase 2 | Addressed stage-2 of extensions to 5G Media Streaming Architecture |
| 1000018 | 5G Media Streaming Protocols Phase 2 | Addressed stage-3 in 5G Media Streaming by updating TS 26.512 and creating TS 26.510 |
| 870014 | Feasibility Study on Multicast Architecture Enhancements for 5G Media Streaming | Identified and evaluated potential enhancements to the 5G Media Streaming Architecture to provide multicast-broadcast media streaming services in TR 26.802. |
| 940008 | 5G Multicast-Broadcast Protocols | Initial work item to provide protocols for MBS |
|  |  |  |

3 Justification

TS 26.501 defines the 5GMS architecture, call flows, and procedures. TS 26.512 defines the 5G Media Streaming protocols. In the 5GMS\_Ph2 work item, extensions to 5G Media Streaming architecture are provided. In the 5GMS\_Pro\_Ph2, extensions to 5G Media Streaming Protocols were provided and generalized the topic of media delivery by providing TS 26.510 In addition, for MBS, the user service architecture was developed in TS 26.502 and MBS Protocols are defined in TS 26.517. It is also worth noting that 5G-MAG has defined reference tools for 5G Media Streaming and MBS. The implementation provides feedback for potential bugfixes.

However, mobile media delivery is as important as never before with everlasting growth of traffic and new functionalities provided by third-party service providers. Several potential improvement areas and potential extensions have been identified and should be studied further.

**Editor’s Note**: Prioritization among the following work topics may be applied based on support and discussion

1. **Common Client Metadata:** While 3GPP and MPEG in DASH support DASH metrics, the reporting is not common to any player, for example all DASH players as well as HLS players. As an example, CTA WAVE has developed: CTA-5004: Web Application Video Ecosystem Common-Media-Client-Data (CMCD) with an excellent overview here: <https://ottverse.com/common-media-client-data-cmcd/>. It is worthwhile to study the benefits of integrating commonly supported metrics and client data reporting in 5GMS work flows. The primary focus is the integration of already defined metrics rather than developing new metrics. Examples of study include support of specific metric keys, player APIs, sending options from client to server (user plane, M5 Reference point, EVEX), M3 Reference Point impact, as well as usage of the data in operations. A study of creating a common harmonized reporting framework and studying the interaction of different frameworks may be included.
	* **Explicit Supporters**: Qualcomm, Dolby, CMCC, AT&T, Telecom Italia, Comcast, Orange, BBC, EBU, Tencent
2. **Common Server-and Network-Assisted Streaming:** MPEG-DASH supports Server and Network Assisted DASH (SAND). Certain profiles of SAND had been adopted in TS 26.247, but the industry has generalized the concepts in SAND in efforts such asContent Steering (see ETSI TS 103 998), Web Application Video Ecosystem Common-Media-Server-Data (CMSD), or Addressable Resource Index (ARI) Tracks in MPEG. The study and integration of these technologies into the Media Delivery and MBS/MBMS workflows is of significant interest, in particular also in combination with existing QoS mechanisms.
	* **Explicit Supporters**: Qualcomm, Dolby, AT&T, Comcast, Tencent
3. **Multi-Access and Multi-CDN Delivery**: Content distributors often use multiple Content Delivery Networks (CDNs) to distribute their content to the end-users. As an example, they may upload a copy of their catalogue to each CDN, or more commonly have all CDNs pull the content from a common origin. In an advanced version, different copies may be provided on CDNs, and technologies such as Coded Multisource Media Format (CMMF) use FEC to beneficially make use of multiple CDNs. Different client implementations may then beneficially use the content on multiple CDNs, potentially guided by the service or network provider. In addition, formats and techniques for generating content for multiple CDN delivery such as MPEG-DASH part 9 (ReAP) may be taken into account in the study. Further extensions include the ability that a client may use multiple access networks at the same time. Study of integration of different technologies into Media Delivery is of relevance to address content provisioning, content hosting, impacts on user plane M4 and reference points M5 as well as potential benefits in terms of quality and resource usage. Note that multi-access related aspects are not expected to rely on SA2 Rel-19 study results, but rely on pre Rel-19 functionalities.
	* **Explicit Supporters**: Qualcomm, Dolby, AT&T, Orange, Samsung Electronics Co. Ltd., Huawei Technologies Co Ltd.
4. **Modem-Usage Optimized Media Streaming:** In Rel-18, basic support for Background Data Traffic is added. Resources in Media delivery are constrained and media delivery typically also results in power consumption as the radio is always connected. In order to better support streaming services, requests and access to the modem and the resources should be well balanced. Enhancements to Background Data Traffic to support preload as well as functionality of what is defined in W3C Managed Media Source Extension to minimize active network connections are important for good streaming services. Further study is encouraged.
	* **Explicit Supporters**: Qualcomm, Dolby, Comcast, BBC, EBU, Tencent
5. **DRM and Conditional Access**: DRM and Conditional Access are typically supported by third-party streaming services. However, in case streaming is done through MBS or MBMS, a more careful management of the keys needs to be checked. Scalability of key delivery is an issue. The support for DRM encrypted content in Unicast/Multicast and Broadcast is relevant. Integration of Content Protection interfaces in the provisioning, for example using CPIX backend interfaces as well as for M4/M5 reference APIs is of high relevance for the industry and should accordingly be studied.
	* **Explicit Supporters**: Qualcomm, Telecom Italia, Comcast, Rohde&Schwarz, Huawei Technologies Co Ltd.
6. **In-session Unicast Repair for MBS Object Delivery**: For live and low-latency live services using the object streaming mode in MBS, in certain cases the transmission of an object is not successful. In this case, unicast repair for individual clients can improve the service quality. However, the timing of such requests needs to be carefully studied on order to avoid network overloads or significant latencies in the delivery. A study to extend MBS User Services and Object streaming to address in session repair is of relevance.
	* **Explicit Supporters**: Qualcomm, Telecom Italia, Comcast, Orange, BBC, SWR, EBU, Rohde&Schwarz, Huawei
7. **MBS User Service and Delivery Protocols for eMBMS**: The MBS user service architecture and protocol follows the modern design philosophies of 5G System with RESTful APIs, network-based service architecture and separation of user services and transport. At the same time, eMBMS and enTV as used for LTE-based 5G Broadcast support a transparent delivery mode. While interworking in between MBMS and MBS is addressed in TS 23.247, the interworking on user service level is not addressed. In order for MBMS and LTE-based 5G broadcast to leverage MBS User Service technologies, a study is warranted to identify the gaps to fully support this functionality.
	* **Explicit Supporters**: Qualcomm, Comcast, SWR, EBU, Rohde&Schwarz
8. **Selected MBMS Functionalities not supported in MBS**: In completing TS 26.502 and TS 26.517, it is obvious that only a subset of the MBMS functionalities is supported. While many MBMS functionalities are likely not important to be supported for MBS, a careful analysis of supported features in MBMS and their potential relevance for MBS should be completed and recommendations should be derived as to which ones to migrate for MBS and how to do this is for successful MBS User Services.
	* **Explicit Supporters**: Qualcomm, Comcast, SWR, EBU, Rohde&Schwarz, Huawei Technologies Co Ltd.
9. **DASH/HLS Interoperability**: DASH/HLS interoperability is a key issue to support highly scalable distribution systems for CDN-based distribution as well as for MBS/MBMS distribution. Offering common CMAF segments promises to address these issues. However, detailed nuances need to be identified to ensure optimized delivery and CTA WAVE has provided detailed guidelines in [CTA-5005-A](https://shop.cta.tech/products/web-application-video-ecosystem-dash-hls-interoperability-specification-cta-5005-a) to support this matter. Studying these guidelines and understanding the impact to 5GMS as well as MBS/MBMS distribution is of relevance. In addition formats and techniques supporting DASH/HLS interoperability such as MPEG-DASH part 9 (ReAP) may be taken into account in the study.
	* **Explicit Supporters**: Qualcomm, Telecom Italia, Comcast, Orange, BBC, EBU, Rohde&Schwarz, Huawei Technologies Co Ltd., Tencent
10. **Further harmonization of RTC and Streaming for Advanced Media Delivery**: In Rel-18 and with the creation of TS 26.510, Media Delivery across Media Streaming and Real-time communication was harmonized. However, not all functionalities from TS 26.512 are yet commonly available for RTC as well. Study of further harmonization is encouraged to fully implement common Media Delivery functions.
	* **Explicit Supporters**: Qualcomm, CMCC, Comcast, Samsung Electronics Co. Ltd., NTT, InterDigital Communications
11. **Issues identified by Market Representation Partners**, in particular 5G-MAG: With there Reference Tools development in 5G-MAG for MBMS, 5GMS and MBS, 5G-MAG may have identified some specific problems collected in <https://github.com/5G-MAG/Standards/issues>. While some of the issues are purely related to bug fixes, some of the issues may need study and new functionalities. It is vital to support the industry and MRPs in deploying 3GPP technologies.
	* **Explicit Supporters**: Qualcomm, Comcast, BBC, Dolby, EBU
12. **Improved QOS support**: SA2 has added with Rel-18 a number of features, which may be beneficial for Media Streaming. These functions may require interactions with NEF for activation. Examples documented in TS 23.501 are L4S (cl 5.37.3), PDU Set handling (cl 5.37.5), QoS Monitoring (cl 5.45). There are likely other functions, which can be good for media streaming. The impact and usefulness of selected features is preferably be studied. The functions identified in this context may be studied in one or more of the above work topics. Note that no dependency is expected on ongoing SA2 Rel-19 study results, but rely on pre Rel-19 functionalities.
	* **Explicit Supporters**: Ericsson LM, Huawei Technologies Co Ltd., Qualcomm, BBC, InterDigital Communications
13. **MEQ: not yet discussed**

Additional study areas may be added with lower priority if time permits.

The work item is primarily addressing user plane aspects for segmented media delivery. This was one of the open issues from Rel-18 5GMS\_Pro\_Ph2 that an M2/M4/M7 specification is expected to be available that provides interop consideration around Content Delivery Protocols features and general technologies in segmented media streaming formats and the IP/PDU 5G System Layer. So generally, it addresses study of the definition of user plane (M2, M4, M7) to support the above functionalities, but also identify what needs to be ported from legacy TS 26.512. The relation to Media Session Handling is included, but enhancements of Media Session Handling as defined in TS 26.510 is not the primary focus of this study. As a further note, the study also addresses topics related to MBS/MBMS, which initially may be considered orthogonal to user plane aspects of segmented media delivery. However, generally MBS/MBMS and unicast user plane issues are preferably be handled jointly with unicast as MBS/MBMS is considered a "transparent" transport pipe. Many of the functionalities on the M2/M4/M7 user plane are expected to be available as well for MBS/MBMS delivered media.

4 Objective

The objective of this study is in the context of the above potential improvements and extensions, referred to as key topics. Specifically, for each of the above key topics, the following objectives are identified:

1. Document the above key topics

a) Common Client Metadata

b) Common Server-and Network-Assisted Streaming

c) Multi-Access and Multi-CDN Delivery

d) Modem-Usage Optimized Media Streaming

e) DRM and Conditional Access

f) In-session Unicast Repair for MBS Object Delivery

g) MBS User Service and Delivery Protocols for eMBMS

h) Selected MBMS Functionalities not supported in MBS

i) DASH/HLS Interoperability

j) Further harmonization of RTC and Streaming for Advanced Medial Delivery

k) Issues identified by Market Representation Partners

l) Improved QOS support

in more detail, in particular how they relate to the 3GPP Media Delivery Architecture and/or the MBS User Service Architecture.

2. Study collaboration scenarios between the 5G System and Application Provider for each of the key topics.

3. Based on existing architectures, develop one or more deployment architectures that address the key topics and the collaboration models.

4. Map the key topics to basic functions and develop high-level call flows.

5. Identify the issues that need to be solved.

6. Provide candidate solutions including call flows, protocols and APIs for each of the identified issues.

7. Coordinate work with other 3GPP groups e.g. SA2, SA3, SA5, SA6 and others as needed.

8. Coordinate work with external organizations such as DASH-IF, CTA WAVE, ISO/IEC JTC29 WG3 (MPEG Systems), 5G-MAG, or IETF, as needed.

9. Identify gaps and recommend potential normative work for stage-2 and stage-3, including which existing specifications would be impacted and/or if any new specifications would preferably be developed.

5 Expected Output and Time scale

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
|  |  |  |  |  |  |

|  |
| --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 26.802 | MBS User Service Enhancements and Extensions | SA#106(Dec 24) | Individual CRs for each of the key topics may be provided. |
| 26.804 | Advanced Media Delivery | SA#106(Dec 24) | Individual CRs for each of the key topics may be provided. |

6 Work item Rapporteur(s)

Thomas Stockhammer, Qualcomm Incorporated, tsto@qti.qualcomm.com, General & for topics ….

[Iraj Sodagar, Tencent, irajs@live.com, for topics …]

7 Work item leadership

SA4

8 Aspects that involve other WGs

SA2 for architectural discussions

SA3 for security related discussions

CT3/CT4 for network reference points

9 Supporting Individual Members

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| **Supporting IM name** |
| Qualcomm Incorporated |
| Dolby France SAS |
| China Mobile Com. Corporation |
| AT&T |
| Telecom Italia |
| Comcast |
| ATEME |
| Orange |
| Samsung Electronics Co. Ltd. |
| NTT |
| BBC |
| ZTE |
| SWR |
| EBU |
| Rohde &Schwarz |
| China Unicom |
| Huawei Technologies Co Ltd. |
| Ericsson LM |
| Tencent |
| InterDigital, Europe, Ltd. |