**3GPP TSG SA WG4 127 Meeting S4-240462**

**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,** **Sony Europe B.V., Xiaomi**

**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

|  |
| --- |
| **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 implementations of both 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.

primary focus of this WIthe delivery of objects in the media plane, i.e. at reference points M2, M4 and M7 of the Media Delivery architectureOidentified in the feasibility study is the need for a that addresseserabilityscdpforThis points to the furthertmediaissuesadditionalies to a generalised media plane technical specificationmsh(as specified in TS 26.510) identified in TR 26.804tomshare

T5GMS\_Pro\_Ph2 feasibility becausemedia-

**Editor’s Note**: Red text will be moved to work plan.

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 workflows. The 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, ATEME
2. **Common Server-and Network-Assisted Streaming:** MPEG-DASH supports Server and Network Assisted DASH (SAND). Certain profiles of SAND were 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 (WAVE) specification for Common Media Server Data (CMSD), or Addressable Resource Index (ARI) Tracks in MPEG. The study and integration of these technologies into the Media Delivery System 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, ATEME, Sony Europe B.V.
3. **Multi-CDN and Multi-Access Media Delivery**: Content distributors often use multiple Content Delivery Networks (CDNs) to distribute their content to tend-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 deployments, technologies such as Coded Multisource Media Format (CMMF) use Application Layer FEC techniques to stripe different subsets of content across 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. Further extensions include the ability for a client to use multiple access networks at the same time to support media delivery. Study of integration of different technologies into the Media Delivery System is of relevance to address content provisioning, content hosting, impacts on user plane reference points M2 and M4, and on media session handling at reference point M5 as well as potential benefits in terms of quality and resource usage.

NOTE: Multi-access related aspects rely on pre Rel-19 functionalities are not expected to rely on SA2 Rel-19 study results.

* + **Explicit Supporters**: Qualcomm, Dolby, AT&T, Orange, Samsung Electronics Co. Ltd., Huawei Technologies Co Ltd., ATEME
1. **Modem Usage Optimized Media Streaming:** In Rel-18, basic support for Background Data Transfer is added. UE power resources are constrained and media delivery typically also results in power consumption if 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 Transfer to support preload as well as functionality of what is defined in W3C Managed Media Source Extension to minimize active network connections are relevant topics to study with the aim of limiting battery consumption in the UE resulting from media delivery.
	* **Explicit Supporters**: Qualcomm, Dolby, Comcast, BBC, EBU, Tencent
2. **DRM and Conditional Access**: DRM and Conditional Access are commonly used 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 -encrypted content in Unicast/Multicast and Broadcast is relevant. Integration of Content Protection interfaces in the provisioning, for example using CPIX back-end interfacesis of high relevance for the industry and should accordingly be studied. The impacts of these on media plane (reference points M2 and M4) as well as the media session handling APIs (reference points M3, M5) should also be studied.
	* **Explicit Supporters**: Qualcomm, Telecom Italia, Comcast, Rohde&Schwarz, Huawei Technologies Co Ltd.
3. **In-session Unicast Repair for MBS Object Distribution**: For live and low-latency live services using the Object Distribution Method in MBS, in certain cases the transmission of an object is not successful. In this case, unicast repair for individual MBS Clients can improve the service quality. However, the timing of such requests needs to be carefully studied in 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 Technologies Co Ltd., ATEME
4. **MBS User Service and Delivery Protocols for eMBMS**: The MBS User Service architecture and protocol follows the modern design philosophies of the 5G System with separation of user services from transport, a service-based architecture and RESTful APIs. 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, interworking between these two systems at the 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, ATEME
5. **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 in Rel-17. While many MBMS functionalities are likely not important to be supported for MBS, a systematic analysis of MBMS User Services features and their potential relevance for MBS should be completed and recommendations made on which ones to migrate to MBS User Services specifications and how best to achieve this.
	* **Explicit Supporters**: Qualcomm, Comcast, SWR, EBU, Rohde&Schwarz, Huawei Technologies Co Ltd., ATEME
6. **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 that can be consumed by both DASH and HLS media players 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 impacts on the 5GMS System 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.
	* **Explicit Supporters**: Qualcomm, Telecom Italia, Comcast, Orange, BBC, EBU, Rohde&Schwarz, Huawei Technologies Co Ltd., Tencent
7. **Further harmonization of RTC and Streaming for Advanced Media Delivery**: With the creation of TS 26.510 in Rel-18, Media delivery across the 5G Media Streaming (5GMS) System and the Real-time media Communication (RTC) System 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
8. **Issues identified by Market Representation Partners**, in particular 5G-MAG: Through the development in 5G-MAG of reference implementations for MBMS, 5GMS and MBS, 5G-MAG is identifying specific problems which are 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 require study by SA4 and the development of new functionalities in the relevant technical specifications. It is vital to support the industry and MRPs in deploying 3GPP technologies.
	* **Explicit Supporters**: Qualcomm, Comcast, BBC, Dolby, EBU
9. **Improved QoS support**: In Rel-18, SA2 has defined a number of new features in the 5G System, especially in the PCF, from which media delivery may benefit. Examples documented in TS 23.501 include the use of Explicit Congestion Notification (ECN) to support Low Latency, Low Loss, Scalable Throughput (L4S) services (clause 5.37.3), PDU Set handling (clause 5.37.5) and QoS Monitoring (clause 5.45), and there are likely others. The impact and usefulness of selected features is preferably studied. The functions identified in this context may be studied in one or more of the above work topics.

NOTE: 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
1. **Impact and opportunities of QUIC for segmented content delivery**: Since the finalisation of the QUIC protocol by the IETF in May 2021, there has been significant deployments of QUIC driven by the usage of HTTP/3 for streaming services. In the IETF, the working group on Media Over QUIC (MOQ) is working towards an extensible protocol for publishing media for ingest and distribution. While QUIC is mostly used today as the underlying protocol of HTTP/3, there is still open questions as to how media segments are delivered over QUIC streams when using HTTP/3 but also considering other QUIC-based protocols such as MOQ. Considering different types of media application, e.g. multi-stream use cases, will be of interest. Studying the various strategies for delivering segmented content over QUIC streams will also bring insights for the network management aspects. For instance, findings in this domain may be relevant for the ongoing study in SA2 called FS\_XRM\_Ph2 (SP-231671) whose deliverable is available as TR 23.700-70.
	* **Explicit Supporters**: Xiaomi, ?

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

4 Objective

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

1. Document the following additional Key Issues aa:

a) Common Client Metadata.

b) Common Server-and Network-Assisted Streaming.

c) Multi-CDN and Multi-Access Media Delivery.

d) Modem Usage Optimized Media Streaming.

e) DRM and Conditional Access.

f) In-session Unicast Repair for MBS Object Distribution.

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.

m) Impact and opportunities of QUIC for segmented content delivery

2. Study collaboration scenarios between the Application Service Provider and the 5G System and 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, DVB 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

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| --- |
| **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 3, 5, 6, 7, 8, 9, 10, 11 and 12.

Iraj Sodagar, Tencent, irajs@live.com, for topics 1, 2, 4 and 9.

Emmanouil Potetsianakis, Xiaomi, emmanouil@xiaomi.com for topic 13.

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