**3GPP TSG-SA4 Meeting #128 *S4-241151***

**Jeju, Korea (Republic Of), 20th May 2024 - 24th May 2024 *revision of S4aI240044***

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **26.512** | **CR** | **0047** | **rev** | **11** | **Current version:** | **18.1.0** |  |
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| *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:*** | [5GMS\_Pro\_Ph2] Consolidated media plane enhancements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated, Ericsson LM, Tencent, BBC | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GMS\_Pro\_Ph2 | | | | |  | ***Date:*** | | | 2024-05-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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 can be 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Media plane enhancements to the 5G Media Streaming System. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. HTTP-based contribution protocols for uplink media streaming (M4). 2. HTTP-based egest protocols for uplink media streaming (M2). 3. Low-latency ingest and egest content protocols based on CMAF and HTTP/1.1 chunked transfer coding at reference point M2. 4. Multiple media entry points provided at reference point M8. 5. Use of CMAF content to support both DASH and HLS clients.   Add HTTP/3 support at reference points M2 and M4. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Work Item scope not satisfied. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 4.10, 6.2.1.1 , 6.2.1.2, 6.2.3.1, 8, 8.1, 8.2, 8.3, 8.4 (new), 8.5 (new), 8.6 (new), 8.7 (new), 10.2, 10.3(new), 10.4 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | CR0047r4 [S4aI230174] is a merge of:   * CR0051r4 [S4-240132] (Tencent). * CR0038r3 [S4-231652] (Tencent). * CR0038r3 [S4-231652] (Tencent). * CR0047r3 [S4-231972] (Qualcomm, Ericsson). * CR0049r2 [S4-231687] (Qualcomm). * CR0050r4 [S4-231854] (Tencent). * CR0051r3 [S4-231971] (Tencent).   CR0047r5 [S4aI230174]:   * Fixed cover sheet. * Added comments from *ad hoc* meeting on 2023-11-30. * DASH‑IF to define a URN to describe its low-latency push-based content transfer protocol for ingest/egest use at 5GMS reference point M2d/M2u.   CR0047r6 [S4-240377] and CR0047r7 [S4-240508]   * Addressing some comment.   CR0047r8 [S4al240029]: withdrawn.  CR0047r9 [S4-240508, revision of S4-240570]  Correction of the uplink protocols procedures   * 8.2: minor correction * 8.3 : minor correction * 8.5 and 8.6: updating the egest procedure * 10.4: updating the contribution prodecudre   CR0047r10 [S4aI240044]:   * Replicated NOTE on HTTP/1.1 from clause 8.3 into clause 8.6.   CR0047r11 [S4-241151]:   * Takes into account the input in S4-240907 | | | | | | | | |

FIRST CHANGE

# 2 References

(Snip)

[9] Void

(Snip)

[16] Void(Snip)

[24] IETF RFC 9112: "HTTP/1.1", June 2022.

[25] IETF RFC 9110: "HTTP Semantics", June 2022.

[26] Void

[27] Void

[28] IETF RFC 9111: "HTTP Caching", June 2022.

[29] Void

[30] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3", August 2018.

[31] IETF RFC 9113: "HTTP/2", June 2022.

(Snip)

[40] ISO 23000-19: "Information technology – Coding of audio-visual objects – Part 19: Common media application format (CMAF) for segmented media".

(Snip)

[52] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL".

[QUIC] IETF RFC 9000: "QUIC: A UDP-Based Multiplexed and Secure Transport", May 2021.

[QUIC-TLS] IETF RFC 9001: "Using TLS to Secure QUIC", May 2021.

[HTTP/3] IETF RFC 9114: "HTTP/3", June 2022.

[RFC8673] IETF RFC 8673: "HTTP Random Access and Live Content", November 2019.

[CTA-5005-A] Consumer Technology Association CTA-5005-A: "Web Application Video Ecosystem – DASH-HLS Interoperability Specification".

[DASH-IF-LL] DASH-IF Guidelines: "Low-latency Modes for DASH", available here: https://dash-industry-forum.github.io/docs/CR-Low-Latency-Live-r8.pdf

NEXT CHANGE

## 4.10 Procedures of the M8d interface

This clause defines basic procedures for M8d.

No specific procedures are defined but it is expected that the 5GMSd Application Provider can provide media session entry points to a 5GMSd-Aware Application through M8d. The 5GMSd-Aware Application would then initiate the media session by providing such an entry point to the 5GMSd Client through M7d. Multiple alternative entry points of the same media service may be provided.

NEXT CHANGE

### 6.2.1 HTTP protocol version

#### 6.2.1.1 5GMS AF

Implementations of the 5GMS AF shall expose both HTTP/1.1 [24] and HTTP/2 [31] endpoints at interfaces M1 and M5, including support for the HTTP/2 starting mechanisms specified in section 3 of RFC 9113 [31]. In both protocol versions, TLS [30] shall be supported and HTTPS interactions should be used on these interfaces in preference to cleartext HTTP.

The 5GMS Application Provider may use any supported HTTP protocol version at interface M1.

The Media Session Handler may use any supported HTTP protocol version at interface M5.

All responses from the 5GMS AF that carry a message body shall include a strong entity tag in the form of an ETag response header and a modification timestamp in the form of a Last-Modified response header.

All endpoints shall support the conditional HTTP requests If-none-Match and If-Modified-Since.

#### 6.2.1.2 5GMS AS

Implementations of the 5GMS AS shall expose HTTP/1.1 [24] endpoints at interfaces M2 and M4 and may additionally expose HTTP/2 [31] endpoints at these interfaces. In both protocol versions, TLS [16] shall be supported and HTTPS interactions should be used on these interfaces in preference to cleartext HTTP.

For pull-based content ingest, the 5GMS Application Provider shall expose an HTTP/1.1-based origin endpoint to the 5GMSd AS at interface M2 and may additionally expose HTTP/2- and/or HTTP/3-based origin endpoints.

For push-based content ingest, the 5GMS Application Provider may use any supported HTTP protocol version at reference point M2.

Implementations of the 5GMS AS should expose HTTP/3 [HTTP/3] endpoints at reference point M4. In HTTP/3, the QUIC protocol [QUIC] is used for transport, and TLS [QUIC-TLS] is used for the initial handshake and key exchange.

The Media Stream Handler may use any supported HTTP protocol version at reference point M4.

NEXT CHANGE

### 6.2.3 Usage of HTTP headers

#### 6.2.3.1 General

Standard HTTP headers shall be used in accordance with clause 5.2.2 of TS 29.500 [21] for HTTP/1.1 [24], HTTP/2 [31] and HTTP/3 [HTTP/3] messages.

NEXT CHANGE

# 8 Media ingest and publish (M2) protocols

## 8.1 General

The set of content protocols supported by the 5GMS AS is listed in table 8.1-1 below:

Table 8.1-1: Supported content protocols

| Description | Term identifier | Clause |
| --- | --- | --- |
| Content ingest protocols at reference point M2d | | |
| HTTP pull-based content ingest protocol | urn:3gpp:5gms:content-protocol:http-pull or urn:3gpp:5gms:content-protocol:http-pull-ingest (see NOTE) | 8.2 |
| DASH-IF push-based content ingest protocol | <http://dashif.org/ingest/v1.2>/interface-1 or http://dashif.org/ingest/v1.2/interface-2 or urn:3gpp:5gms:content-protocol:dash-if-ingest (see NOTE) | 8.3 |
| HTTP low-latency pull-based content ingest protocol | urn:3gpp:5gms:content-protocol:http-ll-pull | 8.4 |
| Content egest protocols at reference point M2u | | |
| HTTP pull-based content egest protocol | urn:3gpp:5gms:content-protocol:http-pull | 8.5 |
| DASH-IF push-based content egest protocol | http://dashif.org/ingest/v1.2/interface-1 or http://dashif.org/ingest/v1.2/interface-2 | 8.6 |
| HTTP low-latency pull-based content egest protocol | urn:3gpp:5gms:content-protocol:http-ll-pull | 8.7 |
| NOTE: Term identifier deprecated in this version of the present document. | | |

## 8.2 HTTP pull-based content ingest protocol

The following provisions shall apply if IngestConfiguration.protocol is set to urn:3gpp:5gms:content-protocol:http-pull or to the deprecated value urn:‌3gpp:‌5gms:‌content-protocol:‌http-pull in the Content Hosting Configuration,

- media resources shall be ingested by the 5GMSd AS from the 5GMSd Application Provider using HTTP [25].

NOTE 0: Any supported HTTP protocol version may be used for HTTP pull-based content ingest at reference point M2d.

- The IngestConfiguration.mode property shall be set to PULL, indicating that a Pull-based protocol is used.

- The IngestConfiguration.baseURL property shall point at the 5GMSd Application Provider's origin server, as specified in table 7.6.3.1‑1, and may indicate the use of HTTPS [30].

When the 5GMSd AS receives a request for a media resource at interface M4d that cannot be satisfied from its content cache, the request shall be transformed into a corresponding HTTP GET request directed to the 5GMSd Application Provider's origin server via interface M2d as follows:

1. The prefix of the request URL indicated in the Distribution‌Configuration.‌baseURL of the applicable Content Hosting Configuration is replaced with that of the corresponding Ingest‌Configuration‌.baseURL.

NOTE 1: It is the responsibility of the 5GMSd AF to assign unique M4d base URLs to each provisioned Content Hosting Configuration so as to ensure that this substitution is unambiguous.

2. The path rewrite rules (if provisioned in DistributionConfiguration.PathRewriteRules) are applied in strict order to the remainder of the request URL (i.e., the path segments following Distribution‌Configuration.‌baseURL). The requestPathPattern of the first matching path rewrite rule is replaced with the corresponding mappedPath.

In the case where the 5GMSd Application Provider's origin server issues an HTTP 3xx redirect at reference point M2d pointing to another location, the 5GMSd AS shall issue an equivalent HTTP redirect to the Media Player via reference point M4d whose location is a dynamically generated M4d endpoint. Requests to this location shall be rewritten by the 5GMSd AS to the target location of the M2d redirection.

NOTE 2: This explicit handling of HTTP redirects received by the 5GMSd AS at reference point M2d ensures that it is not bypassed by the Media Player. The general concept underlying this is commonly referred to as a "reverse mapping rule" by HTTP reverse proxies.

## 8.3 DASH-IF push-based content ingest protocol

The following provisions shall apply if IngestConfiguration.protocol is set to http://dashif.org/‌ingest/‌v1.2‌/interface-1 or http://dashif.org/‌ingest/‌v1.2/‌interface-2 or to the deprecated value urn:‌3gpp:‌5gms:‌content-protocol:‌dash-if-ingest in the Content Hosting Configuration,

* Media resources shall be published by the 5GMSd Application Provider to the 5GMSd AS as specified by the DASH‑IF Live Media Ingest specification [3].

NOTE: The protocol in [3] is specified for use with HTTP/1.1 [24] only.

- The IngestConfiguration.mode property shall be set to PUSH, indicating that a push-based protocol is used.

- The IngestConfiguration.baseURL property shall be set by the 5GMSd AF to the base URL that is to be used by the 5GMSd Application Provider to upload the DASH segments and MPD(s) to the 5GMSd AS at reference point M2d.

## 8.4 HTTP low-latency pull-based content ingest protocol

The provisions specified in clause 8.2 shall apply if IngestConfiguration.protocol is set to urn:3gpp:5gms:content-protocol:http-ll-pull.

In addition, if HTTP/1.1 [24] is used by at reference point M2d,

- The requesting 5GMSd AS shall make partially received media segments available immediately for retrieval by 5GMS Clients at reference point M4d instead of waiting until the full segment is received.

- the 5GMSd Application Provider should use HTTP chunked transfer coding as defined in section 7.1 of [24]. In this case, the requesting 5GMSd AS shall accept chunked HTTP/1.1 response messages and shall make partially received media segments (i.e., HTTP Chunks) available immediately for retrieval by 5GMS Clients at reference point M4d instead of waiting until the full segment is received.

- If the DASH-IF Low Latency mode as defined in [DASH-IF-LL] is used, then the content is packaged as a series of CMAF Segments [40]. Further, each CMAF Segment is typically subdivided into one or more multiple CMAF Chunks to support low-latency content generation. In order to minimize the latency, according to [3], each HTTP Chunk should contain at most one CMAF Chunk.

NOTE: Usage of HTTP/2.0 at reference point M2d is for future study.

## 8.5 HTTP pull-based content egest protocol

If EgestConfiguration.‌protocol is set to urn:3gpp:5gms:content-protocol:http-pull-egest in the Content Publishing Configuration, media resources shall be retrieved by the 5GMSu Application Provider from the 5GMSu AS at reference point M2u using HTTP [25]. Media segments contributed to the 5GMSu AS by the 5GMSu Client shall be processed according to the Content Preparation Template(s) specified in the corresponding Content Publishing Configuration (if any) prior to making them available at reference point M2u.

In this case:

- The EgestConfiguration.‌mode property shall be set to PULL, indicating that a pull-based protocol is used.

- The EgestConfiguration.‌baseURL property shall be set by the 5GMSu AF to the base URL on the 5GMSu AS where it will publish media segments, presentation manifests and metadata for retrieval by the 5GMSu Application Provider at reference point M2u.

- The EgestConfiguration.‌entryPoint.‌relativePath property shall point at a Media Entry Point document below this base URL, as specified in table 7.12.2-1, and may indicate the use of HTTPS [30]. This document describes the location of media content and associated metadata exposed by the 5GMSu AS at reference point M2u which are expected to be pulled by the 5GMSu Application Provider.

In the absence of content preparation, the 5GMSu AS shall publish media resources by replacing the prefix contribution‌Configurations[ ].‌baseURL of its URL at M4u with that of the corresponding egestConfiguration.‌baseURL.

## 8.6 DASH-IF push-based content egest protocol

If EgestConfiguration.‌protocol is set to http://dashif.org/‌ingest/‌v1.2/‌interface-1 or http://dashif.org/‌ingest/‌v1.2/‌interface-2 in the Content Publishing Configuration, media resources shall be published by the 5GMSu AS to the 5GMSu Application Provider at reference point M2u as specified in the DASH‑IF Live Media Ingest specification [3]. Media segments contributed to the 5GMSu AS by the 5GMSu Client shall be processed according to the Content Preparation Template(s) specified in the corresponding Content Publishing Configuration (if any) prior to publishing them at reference point M2u.

NOTE 1: The protocol in [3] is specified for use with HTTP/1.1 [24] only.

NOTE 2: A 5GMSu AS implementation that advertises support for the egest of content at reference point M2u using interface 2 of the DASH-IF Live Media Ingest specification [3] is required to produce a suitable DASH presentation manifest.

In this case:

- The EgestConfiguration.‌mode property shall be set to PUSH, indicating that a push-based protocol is used.

- The EgestConfiguration.‌baseURL property shall be set by the 5GMSu Application Provider to the base URL that is to be used by the 5GMSu AS to upload media segments and presentation manifests to the 5GMSu Application Provider at reference point M2u.

If the 5GMSu Application Provider has provisioned an egest Media Entry Point, and if such document has been contributed to or produced by 5GMSu AS, the 5GMSu AS shall publish this document to the URL formed by the concatenation of EgestConfiguration.‌baseURL with EgestConfiguration.‌entryPoint.‌relativePath, as specified in table 7.12.2-1. This URL may indicate the use of HTTPS [30].

In the absence of any content preparation, each media resource uploaded at reference point M4u shall be published to the 5GMSu Application Provider at the URL formed by replacing the prefix contribution‌Configurations[ ].‌baseURL of its URL at M4u with that of the corresponding egestConfiguration.‌baseURL.

## 8.7 HTTP low-latency pull-based content egest protocol

The following provisions shall apply if EgestConfiguration.protocol is set to urn:3gpp:5gms:content-protocol:http-ll-pull the following provisions shall apply.

The content shall be packaged as a series of CMAF Segments [40]. Each CMAF Segment shall be subdivided into multiple one or more CMAF Chunks.

In addition:

- If HTTP/1.1 [24] is used at reference point M2u, partially available media segments may be accessed by the 5GMSu Application Provider using an HTTP byte range request, as specified in section 14 of RFC 9110 [25]. If the 5GMS Application Provider makes a byte-range request for a partially available media segment (the first media segment it retrieves) and the first-pos of that range is non-zero and the 5GMS Application Provider is expecting an aggregating response, then the 5GMS Application Provider should signal that expectation following the convention of IETF RFC 8673 [RFC8673]. Specifically, it should use a last-pos value of 9007199254740991. In this case, the 5GMSu AS is required to respond with a 206 (Partial Content) HTTP response without a Content-length response header instead of waiting for the end of the segment and responding with a 200 (OK) HTTP response code.

NEXT CHANGE

## 10.2 DASH distribution

In the case of DASH distribution, M4d is relevant for the distribution as shown in figure 10.2-1.



Figure 10.2-1: M4d usage for DASH distribution

For DASH-based distribution according to TS 26.247 [4] and ISO/IEC 23009-1 [32], two main formats are of relevance:

1) The Media Presentation Description (MPD) that is processed in the DASH Access Client.

2) The Segment formats that are passed through the DASH Access Client and processed in the Media Playback and Content Decryption Platform. Note that the DASH Access Client may parse Segments to extract, for example, In-band Events or producer reference times.

Other resources may be referenced in the MPD, for example DRM related information.

The Segment formats for DASH Streaming in the context of 5G Media Streaming are defined in TS 26.511 [35] based on the CMAF encapsulation. The DASH Access Client downloads the Segments from the 5GMSd AS based on the instructions in the MPD and the instructions from the 5GMSd-Aware Application through M7d (see clause 13 for details).

The interface between the DASH Access Client and the Media Playback and Content Decryption Platform as well as the 5GMSd Client requirements for media codecs are documented in TS 26.511 [35].

The following requirements apply at reference point M4d:

1) The Media Presentation Description (MPD) and Segments shall conform to an MPD according to ISO/IEC 23009-1 [32] or TS 26.247 [4].

2) The Segment formats should conform to CMAF addressable resources as well as to the requirements in TS 26.511 [35].

3) The Media Presentation should conform to the 5G Media Streaming DASH Interoperability Point as defined in clause 7.3.11 of TS 26.247 [4].

A 5GMSd Client shall support the 5G Media Streaming DASH Interoperability Point as defined in TS 26.247 [4], clause 7.3.11. A 5GMSd Client may support additional DASH profiles and interoperability points.

The MPD may contain a one or several ServiceDescription elements that include operational parameters. The MPD may also include multiple configurations for the media (different codecs, different content protection, different resolutions, etc.), for example for playback under different operating policies. The handling of this information is documented in clause 13.2.

If the media segment formats conform to CMAF addressable resources as defined ISO/IEC 23000-19 [27], the same CMAF content may then be provided for DASH and HLS. In order to support common deployment, the media segment content should conform to CTA‑5005‑A [CTA-5005-A].

NEXT CHANGE

## 10.3 HTTP low-latency content distribution

When low-latency distribution of media content at reference point M4d is provisioned, then the following provisions shall apply:

- The 5GMSd AS shall make partially received media segments available immediately for retrieval by 5GMS Clients at reference point M4d instead of waiting until the full segment is received.

- the 5GMSd AS should use HTTP chunked transfer coding as defined in section 7.1 of [24]. In this case, the 5GMSd client shall accept chunked HTTP/1.1 response messages.

- If the DASH-IF Low Latency mode as defined in [DASH-IF-LL] is used as identifed by a profile indicator in the MPD as "http://www.dashif.org/guidelines/low-latency-live-v5", then the content is be packaged as a series of CMAF Segments [40]. Further, each CMAF Segment is typically subdivided into one or more multiple CMAF Chunks to support low-latency content generation. In order to minimize the latency, according to [3], each HTTP Chunk should contain at most one CMAF Chunk.

- At reference point M4d, the Media Player may access partially available media segments using an HTTP byte range request, as specified in section 14 of RFC 9110 [25], for details see for example [DASH-IF-LL] on Resynchronization Points. If the Media Player makes a byte-range request for a partially available media segment (the first media segment it retrieves) and the first-pos of that range is non-zero and the Media Player is expecting an aggregating response, then the Media Player should signal that expectation following the convention of IETF RFC 8673 [RFC8673]. Specifically, it should use a last-pos value of 9007199254740991. In this case, the 5GMSd AS is required to respond with a 206 (Partial Content) HTTP response without a Content-length response header instead of waiting for the end of the segment and responding with a 200 (OK) HTTP response code.

NEXT CHANGE

## 10.4 Contribution protocols

### 10.4.1 General

The contribution protocols supported by the 5GMSu AS at reference point M4u are listed in table 10.4.1-1 below:

Table 10.4.1-1: Supported contribution protocols at reference point M4u

|  |  |  |
| --- | --- | --- |
| Description | Term identifier | Clause |
| DASH-IF push-based content ingest protocol | http://dashif.org/ingest/v1.2/interface-1 | 10.4.2 |

### 10.4.2 DASH-IF push-based contribution protocol

If streamingAccess.‌entryPoints.‌protocol is set to http://dashif.org/ingest/v1.2/interface-1 in the Service Access Information, media resources shall be streamed to the 5GMSu AS as specified by the DASH‑IF Live Media Ingest specification Interface-1 [3]. The content shall conform to at least one of the conformance profiles listed in streamingAccess.profiles, if any.

The content uploaded to the 5GMSu AS using this protocol is processed according to the Content Preparation Template(s) specified in the corresponding Content Publishing Configuration (if any), and the result is made available to the 5GMSu Application Service Provider at reference point M2u using the egest protocol indicated in EgestConfiguration as specified in clause 8.

END OF CHANGES