**3GPP TSG- Meeting # *r02***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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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:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** | S4 |
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| ***Work item code:*** |  |  | ***Date:*** |  |
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| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | Satisfy the objectives of the AMD\_PRO\_MED Work Item as documented in item 2.c in clause 4 of SP-250265. |
|  |  |
| ***Summary of change:*** | New annexes to introduce Coded Multi-Source Media Format (CMMF) for the purposes of enabling media delivery from multiple service locations within the 5GMS System. These annexes include:a. A new annex that specifies CMMF’s use within the 5GMS System.b. A new annex that provides examples of Media Entry Points containing CMMF configuration information required to be communicated to 5GMS Clients and examples of Content Hosting/Publishing Configurations that implement CMMF within the 5GMS network. |
|  |  |
| ***Consequences if not approved:*** | Objectives of the Work Item not completely satisfied. |
|  |  |
| ***Clauses affected:*** | Annex H (new), Annex I (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 26.510 CR 0016, TS 26.512 CR 0086, TS 26.501 CR 111 |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | S4-250952: New CR.S4-251109: Refactored and new material added to address concerns from Qualcomm and BBC. NotedS4al250099: Refactored. Noted.S4-251282: Updated to address comments received from BBC.S4-251508: Updated to address comments received from BBC and Qualcomm.S4al250128: Editorial changes and updated references to work being completed as part of a new ETSI WI to revise ETSI TS 103 973. |

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# 2 References

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[103973] ETSI TS 103 973: "Coded Multisource Media Format (CMMF) for Content Distribution and Delivery", October 2024.

===== CHANGE =====

## 3.3 Abbreviations

…

CMMF Coded Multisource Media Format

…

EFDT Extended File Delivery Table

…

TOI Transport Object Identifier

…

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Annex H (normative):
Media streaming in the 5GMS System using CMMF

# H.1 Introduction

Coded Multi-source Media Format (CMMF) as specified in ETSI TS 103 973 [103973] is an extensible container format designed to facilitate the management and interchange of audio-visual media and metadata in one or more coded representations (e.g., encoded with Application Layer Forward Error Correction, linear, network, or channel codes). The coded media representations supported by CMMF enable the efficient use of multi-source, multipath, and multi-access connectivity for network-delivered applications.

This annex specifies the use of multi-source object coding using CMMF within the 5GMS System.

# H.2 Downlink media streaming from multiple service locations using CMMF

## H.2.1 General

CMMF as specified in ETSI TS 103 973 [103973] may be employed to enable efficient media streaming when concurrently using multiple service locations exposed by the 5GMSd AS at reference point M4d and/or by the 5GMSd Application Provider at reference point M2d or M13d. Media resources (e.g., CMAF segments) shall first be encoded into one or more CMMF transport resources using the profile specified in clause H.2.3.1, either by the 5GMSd Application Provider or by using Content Preparation in the 5GMSd AS. These CMMF transport resources shall be made available to 5GMSd Clients from one or more reference point M4d and/or M13d service locations. A CMMF Media Access Client of the Media Player in the 5GMSd Client shall then request and download these CMMF transport resources from the service locations in parallel. The CMMF Media Access Client decodes the received CMMF transport resources, recovering the media resource required for playback and presents this to its Media Playback and Content Decryption Platform.

The remainder of this annex specifies requirements necessary to enable downlink media streaming from multiple reference point M4d service locations using CMMF within the 5GMS System. Further discussion of reference points M8d and M13d for use in streaming media with CMMF are omitted since they are out of scope.

## H.2.2 Procedures for downlink media streaming from multiple service locations using CMMF

### H.2.2.1 Provisioning (M1d) and configuration (M3d) interfaces for downlink media delivery using CMMF

#### H.2.2.1.1 Overview

This clause defines all procedures and APIs used to provision and configure the 5GMS System to use CMMF for the purposes of downlink media delivery from multiple service locations.

#### H.2.2.1.2 Content Hosting

To provision CMMF downlink media streaming in the 5GMSd AF, the 5GMSd Application Provider shall use the Content Hosting Provisioning (M1) API specified in clause 7.6, following the Content Hosting provisioning (M1) procedures specified in clause 4.3.3.

To configure CMMF downlink media streaming in the 5GMSd AS, the 5GMSd AF shall use the Content Hosting Configuration (M3) API specified in clause 9.4, following the Content Hosting configuration (M3) procedures specified in clause 4.5.4.

When Content Hosting is provisioned, a service location exposed by the 5GMSd AS at reference point M4d shall host CMMF transport resources, each comprising a unique representation or variant of the media resources to be streamed. Each CMMF transport resource shall be uniquely addressable.

#### H.2.2.1.3 Content Preparation

To provision Content Preparation of CMMF transport resources in the 5GMSd AF, the 5GMSd Application Provider shall use the Content Preparation Templates Provisioning (M1) API specified in clause 7.4, following the Content Preparation Template provisioning (M1) procedures specified in clause 4.3.5.

To configure Content Preparation of CMMF transport resources in the 5GMSd AS, the 5GMSd AF shall use the Content Preparation Templates Configuration (M3) API specified in clause 9.3, following the Content Preparation Template configuration (M3) procedures specified in clause 4.5.3.

When Content Preparation is provisioned to encode media resources into CMMF transport resources, a CMMF Encoder (as specified in clauses 4.2.1 and 4.3.3 of ETSI TS 103 973 [103973]) is instantiated and configured in the 5GMSd AS by means of a Content Preparation Template. The following Content Preparation Template requirements apply:

- A Content Preparation Template used to encode media resources (e.g., audio segments, video segments, etc.) shall create CMMF transport resources whose bitstreams conform to the profile specified in clause H.2.3.1.

- Depending on the Content Hosting Configuration, the CMMF Encoder may be a single input, single output or a single input, multiple output process. A media resource (e.g., audio segment, video segment, etc.) made available to the 5GMSd AS at reference point M2d or M10d shall be ingested into the CMMF Encoder where it is encoded and packaged as one or more CMMF transport resources (each a unique CMMF representation or variant of the media resource), and those transport resources shall be made available at service locations exposed by the 5GMSd AS at reference point M4d.

- CMMF transport resources shall be accessible via URLs that allow for the appropriate mapping between CMMF resource URLs used at service locations exposed by the 5GMSd AS at reference point M4d and their corresponding media resource URLs used for media ingest at reference points M2d or M10d. This mapping shall be determined using a member of the DistributionConfiguration.pathRewriteRules array specified in table 8.8.3.1‑1 of TS 26.510 [56].

NOTE: Differences between the URLs of media resources and their associated CMMF transport resources are restricted to differences in the path part of the URL between and including the leading "/" and the final "/" owing to restrictions imposed by the definition of the PathRewriteRule data type.

The Content Preparation Template for CMMF-enabled downlink media delivery is specified in clause H.2.3.2.

### H.2.2.2 Media Streaming (M4d) interface for downlink media delivery using CMMF

To serve CMMF transport resources to a CMMF Media Access Client at reference point M4d, the 5GMSd AS shall use the media streaming (M4) interface specified in clause 10.3A.3, following the media streaming (M4d) procedures specified in clause 4.6.3.

A media resource required by the Media Playback and Decryption Platform for immediate or delayed consumption shall be obtained by a CMMF Access Client downloading one or more CMMF transport resources (either partially or in full) where each CMMF transport resource is typically downloaded from a different service location exposed at reference point M4d.

If recovery of a media resource from a set of downloaded CMMF transport resources fails, the CMMF Media Access Client may attempt to acquire the media resource using an alternate method (for example, by retrieving the original media resource directly from a single service location exposed by the 5GMSd AS at reference point M4d).

### H.2.2.3 Media Session Handling (M5d) interface for media delivery using CMMF

To perform media session handling for a media streaming session using CMMF, the Media Session Handler shall use the APIs specified in clause 11, following the Media Session Handling (M5) procedures specified in clause 4.7.

In cases where the Service Access Information for media streaming includes one or more Media Player Entries, at least one of these Media Player Entries shall be a URL to a CMMF Media Entry Point as specified in clause H.2.3.3.

### H.2.2.4 UE Media Player interface (M7d/M11d) for downlink media delivery using CMMF

To control a Media Player during a media streaming session using CMMF, the 5GMSd-Aware Application or Media Session Handler shall use the Media Stream Handler (M7/M11) APIs specified in clause 13, following the UE Media Player (M7d) procedures specified in clause 4.9.

### H.2.2.5 Media Player requirements and recommendations

A Media Player shall configure and use a CMMF Media Access Client upon receiving a CMMF Media Entry Point as specified in clause H.2.3.3. At a minimum, the CMMF Media Access Client shall support the following:

- Translation of media resource (e.g., CMAF segment) URLs and the corresponding URLs pointing to CMMF transport resources containing encoded representations or variants of those media resources that are available from service locations exposed by the 5GMSd AS at reference point M4d. This mapping is provided by the CMMF Media Entry Point.

- Decoding a received CMMF transport resource or jointly decoding multiple partially received CMMF transport resources that conform to the profile specified in clause H.2.3.1.

- Recovery of media resources (e.g., CMAF segments) and delivery of these media resources to the Media Playback and Encryption Platform.

## H.2.3 Protocols and formats for downlink media streaming using CMMF

### H.2.3.1 HTTP-based CMMF delivery conformance profile

CMMF transport resources communicated within the 5GMS System shall conform to ETSI TS 103 973 [103973].

NOTE: A normative reference to a HTTP-based CMMF delivery conformance profile providing a minimum set of requirements that must be supported and based on ETSI TS 103 973 [103973] will be added when available.

### H.2.3.2 Content Preparation Template for downlink media streaming using CMMF

This aspect is for future study.

NOTE: A normative reference to a compliant CMMF Content Preparation Template and HTTP-based CMMF delivery conformance profile based on ETSI TS 103 973 [103973] will be added when available.

### H.2.3.3 CMMF Media Player Entry

A CMMF Media Player Entry shall be a CMMF Extended File Delivery Table (EFDT) as specified in clause D.2.3 of ETSI TS 103 973 [103973] comprising:

- A media presentation or a pointer to a media presentation (e.g., URL to a MPD for DASH, URL to a video file, etc.) and

- Any necessary CMMF configuration information required by the CMMF Media Access Client to download CMMF transport resources, decode them, and recover the associated media resource(s) (e.g., CMAF segments).

In the case where the media presentation (e.g., MPD for DASH, HLS playlist, etc.) referenced by a CMMF Media Entry Point is a document containing pointers to media resources (e.g., URLs to CMAF segments), the reference (e.g., URL) to the Media Presentation Entry Point shall be listed within the EFDT as TOI=”0”. The CMMF Media Player Entry shall provide a mapping between each of the URLs contained within the media presentation description and the URLs of the CMMF transport resources containing encoded representations or variants of those media resources that are available from service locations exposed by the 5GMSd AS at reference point M4d. For the EFDT, this mapping is provided as TOI values greater than 0. The EFDT may also include media and CMMF transport resource availability information, including availability information for media and CMMF transport resources that may be available after the EFDT is made available to the CMMF Media Access Client. The CMMF Media Access Client may use this information to download relevant CMMF transport resources at appropriate times. Details are left for implementation.

Example CMMF Media Player Entries referencing a single video file and a DASH MPD can be found in clause I.2.

When Content Preparation is provisioned within the 5GMS System to encode media resources (e.g., CMAF segments) into CMMF transport resources, URLs of the CMMF transport resources provided in the EFDT shall be formatted in such a way that they can be mapped back to the URLs of their corresponding media resources (e.g., CMAF segment) by the 5GMSd AS so that the media resource may be ingested at reference point M2d. As specified in clause H.2.2.1.3, the URL format of these CMMF transport resources is determined by the provisioned Content Hosting Configuration (see the definition of DistributionConfiguration.PathRewriteRules specified in table 8.8.3.1-1 of TS 26.510 [56]).

NOTE: A normative reference to a CMMF Media Entry Point specifically for HTTP media streaming protocols (e.g., MPEG-DASH, HLS, etc.) based on ETSI TS 103 973 [103973] will be added when available.

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Annex I (informative):
Examples of downlink media streaming using CMMF

# I.1 General

This annex provides examples of CMMF Media Player Entries and Content Hosting Configurations that support the delivery of CMMF-encoded media within the 5GMS System.

# I.2 CMMF Media Player Entry examples

## I.2.1 General

This clause provides examples showing how CMMF configuration information required by a 5GMS Client may be communicated within a CMMF Media Player Entry as specified in clause H.2.3.3. When applicable, a general example of a media asset is used, described by the DASH MPD shown in listing I.2.1-1, and notionally hosted by a hypothetical 5GMSd Application Provider at the URL https://example.com/manifest.mpd.

Listing I.2.1-1: Example MPD

|  |
| --- |
| <?xml version="1.0"?><MPD profiles="urn:3GPP:PSS:profile:DASH10" type="static" minBufferTime="PT10S" mediaPresentationDuration="PT2H" availabilityStartTime="2010-04-01T09:30:47Z" availabilityEndTime="2010-04-07T09:30:47Z"  xsi:schemaLocation="urn:mpeg:dash:schema:mpd:2011 3GPP-Rel10-MPD.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:mpeg:dash:schema:mpd:2011"> <ProgramInformation moreInformationURL="http://www.example.com"> <Title>Example</Title> </ProgramInformation> <Period start="PT0S"> <AdaptationSet mimeType="video/3gpp"> <ContentComponent contentType="video"/> <ContentComponent contentType="audio" lang="en"/> <Representation codecs="s263, samr" bandwidth="256000" id="256"> <BaseURL>"rep1"</BaseURL> <SegmentList duration="1000" timescale="100"> <Initialization sourceURL="seg-init.3gp"/> <SegmentURL media="seg-1.3gp"/> <SegmentURL media="seg-2.3gp"/> <SegmentURL media="seg-3.3gp"/> </SegmentList> </Representation> <Representation codecs="mp4v.20.9, mp4a.E1" bandwidth="128000" id="128"> <BaseURL>"rep2"</BaseURL> <SegmentList duration="10"> <Initialization sourceURL="seg-init.3gp"/> <SegmentURL media="seg-1.3gp"/> <SegmentURL media="seg-2.3gp"/> <SegmentURL media="seg-3.3gp"/> </SegmentList> </Representation> </AdaptationSet> </Period> <Period start="PT30S"> <SegmentTemplate duration="10" initialization="seg-init-$RepresentationId$.3gp" media="http://example.com/$RepresentationId$/$Number$.3gp"/> <AdaptationSet mimeType="video/3gpp" codecs="mp4v.20.9, mp4a.E1"> <ContentComponent contentType="video"/> <ContentComponent contentType="audio" lang="en"/> <Representation bandwidth="256000" id="1"/> <Representation bandwidth="128000" id="2"/> </AdaptationSet> </Period></MPD> |

## I.2.2 Single file EFDT example

The following example shows an EFDT where a single MP4 file is delivered using CMMF from three service locations exposed by the 5GMSd AS at reference point M4d.

Listing I.2.2-1: Single MP4 CMMF EFDT example

|  |
| --- |
| <?xml version="1.0" encoding="UTF-8"?><FDTInstance xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:ETSI:CMMF:2023:FDT" xsi:schemaLocation="urn:ETSI:CMMF:2023:FDT extendedFDT.xsd" Expires="2010-04-07T09:30:47Z" Complete="true" ContentType="video/mp4 codecs="mp4v.20.9, mp4a.E1" FEC-OTI-FEC-Encoding-ID="1"> <File Content-Location="https://example.com/video.mp4" TOI="0" Content-Length="64000"> <EncodedObjects type="source" complete="true"> https://example.com/video.mp4 </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/cmmf-a/video.mp4 </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/cmmf-b/video.mp4 </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/cmmf-c/video.mp4 </EncodedObjects> </File></FDTInstance> |

|  |
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## I.2.3 Example EFDT referencing a DASH MPD

The following example shows an EFDT where the contents of the presentation described by the MPD shown in listing I.2.1-1 are delivered using CMMF. It is assumed that CMMF transport resources for the media resources referenced within the MPD are accessible from three service locations exposed by the 5GMSd AS at reference point M4d.

In this example, a CMMF Media Access Client uses the EFDT shown in listing I.2.4-1 combined with the MPD shown in listing I.2.1-1 as the Media Player Entry. The EFDT includes a reference to the MPD (File element with TOI 0) and references to all segments referenced within the MPD are mapped to CMMF transport resources assigned TOI values 1 through 16.

Listing I.2.3-1: CMMF EFDT example

|  |
| --- |
| <?xml version="1.0" encoding="UTF-8"?><FDTInstance xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:ETSI:CMMF:2023:FDT" xsi:schemaLocation="urn:ETSI:CMMF:2023:FDT extendedFDT.xsd" Expires="2010-04-07T09:30:47Z" Complete="true" FEC-OTI-FEC-Encoding-ID="1"> <File TOI="0" Content-Location="https://example.com/manifest.mpd"> <EncodedObjects type="source" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/manifest.mpd </EncodedObjects> <EncodedObjects type="source" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/manifest.mpd </EncodedObjects> <EncodedObjects type="source" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/manifest.mpd </EncodedObjects> </File> <File TOI="1" Content-Location="https://example.com/rep1/seg-init.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/rep1/seg-init.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-a /seg-init.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-b /seg-init.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-c /seg-init.3gp </EncodedObjects> </File> <File TOI="2" Content-Location="https://example.com/rep1/seg-1.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/rep1/seg-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-a /seg-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-b /seg-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/rep1/cmmf-c /seg-1.3gp </EncodedObjects> </File> ... <File TOI="8" Content-Location="https://example.com/rep2/seg-3.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/rep2/seg-3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/rep2/cmmf-a /seg-3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/rep2/cmmf-b /seg-3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/rep2/cmmf-c /seg-3.3gp </EncodedObjects> </File> <File TOI="9" Content-Location="https://example.com/seg-init-1.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/seg-init-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/cmmf-a /seg-init-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/cmmf-b /seg-init-1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/cmmf-c /seg-init-1.3gp </EncodedObjects> </File> <File TOI="10" Content-Location="https://example.com/1/1.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/1/1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/1/cmmf-a/1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/1/cmmf-b/1.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/1/cmmf-c/1.3gp </EncodedObjects> </File> ... <File TOI="16" Content-Location="https://example.com/2/3.3gp"> <EncodedObjects type="source" complete="true"> https://example.com/2/3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-a.com-provider-service.ms.as.3gppservices.org/2/cmmf-a/3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-b.com-provider-service.ms.as.3gppservices.org/2/cmmf-b/3.3gp </EncodedObjects> <EncodedObjects type="cmmf" complete="true"> https://distribution-c.com-provider-service.ms.as.3gppservices.org/2/cmmf-c/3.3gp </EncodedObjects> </File></FDTInstance> |

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# I.3 Provisioning Session and Content Hosting Configuration examples

## I.3.1 General

This clause provides examples of provisioning the 5GMS System to deliver media resources using CMMF from multiple service locations exposed by the 5GMSd AS at reference point M4d. It is assumed within these examples that the CMMF Media Access Client extends functionality of the DASH Access Client (in particular the Downloader sub-function) specified in clause 13.2.1 to enable download and decoding of media resources encoded within CMMF transport resources.

## I.3.2 Example of media delivery from multiple service locations using CMMF

### I.3.2.1 Overview

This example shows how CMMF can be used in a basic deployment where a single Provisioning Session is configured by the 5GMSd Application Provider to expose multiple service locations. This example assumes the 5GMSd Application Provider provisions the system in the following manner:

1. A 5GMSd AS is provisioned to ingest media resources at reference point M2d.

2. Media resources ingested at reference point M2d are encoded into CMMF transport resources by the 5GMSd AS using an appropriate CMMF Content Preparation Template as specified in clause H.2.3.2.

3. As part of the Service Access Information, a CMMF Media Player Entry is provided as specified in clause H.2.3.3.

This implementation example is illustrated in figure I.3.2.1-1.



Figure I.3.2.1-1: Basic deployment example for 5GMSd AS ingest, content preparation, and delivery using CMMF

The following clauses describe how the 5GMS APIs and protocols are used to realize this example.

### I.3.2.2 Provisioning Session provisioning

A Provisioning Session is created by the 5GMSd Application Provider using the *create Provisioning Session* resource operation specified in clause 5.2.2.3 and the API specified in clause 8.2 of TS 26.510 [56]. Example values of the provisioning session API parameters used are shown in table I.3.2.2-1.

Table I.3.2.2-1: Example ProvisioningSession resource parameters

|  |  |  |
| --- | --- | --- |
| Property name | Property value | Assigned by |
| provisioningSessionId | provisioning.session.a | Media AF |
| provisioningSessionType | MS\_DOWNLINK | Media Application Provider |
| externalServiceId | com.‌provider.‌service |
| appId | dash.downlink.streaming |
| NOTE: Values for provisioningSessionId, externalServiceId, and appId are notional and may not reflect actual values. |

### I.3.2.3 Content Preparation Templates provisioning

The 5GMSd Application Provider provisions one CMMF encoder Content Preparation Template within the provisioning.session.a Provisioning Session using the *create Content Preparation Template* resource operation specified in clause 5.2.5.2 and the API defined in clause 8.5 of TS 26.510 [56]. The following is assumed:

-

- Content Preparation is triggered upon the receipt of a pull-based request to the 5GMSd AS at a service location exposed at reference point M4d.

- The path of the requested resource is available to the Content Preparation Template associated with the service location that received the request.

- Media resources (e.g., video segments, audio segments, etc.) are ingested by the 5GMSd AS at reference point M2d and encoded into CMMF transport resources according to the Content Preparation Template.

- Upon completion of the CMMF encoding operation, the resulting CMMF transport resource is made available for caching by the 5GMSd AS and/or delivery to the requesting 5GMSd Client at the service location where the request was received.

Upon successful provisioning of the Content Preparation Template, the 5GMSd AF returns the cmmf.‌content.‌preparation.‌template Content Preparation Template ID to the Media Application Provider.

### I.3.2.4 Server Certificates provisioning

The 5GMSd Application Provider provisions the Server Certificates for the Provisioning Session using the *create Server Certificate* resource operation specified in clause 5.2.4.2 and the API defined in clause 8.4 of TS 26.510 [56]. The Server Certificates assume a canonical domain name as specified in clause 6.0.2.2. Example values for the certificates generated by the 5GMSd AF are provided in table I.3.2.4-1.

Table I.3.2.4-1: Example Server Certificate parameters

|  |  |  |
| --- | --- | --- |
| CN | subjectAltName | certificateId |
| \*.com-provider-service.ms.as.3gppservices.org | \*.com-provider-service.ms.as.3gppservices.org | server.certificate.a |

### I.3.2.5 Content Hosting provisioning and configuration

The 5GMSd Application Provider provisions the Content Hosting Configuration for each Provisioning Session using the *create Content Hosting Configuration* resource operation specified in clause 5.2.8.2 and the API defined in clause 8.8 of TS 26.510 [56].

Configuring the Content Hosting Configuration in the 5GMSd AS is performed according to:

- The example base URL of the 5GMSd Application Provider’s origin server is https://origin.media-application-provider.com.

The 5GMSd Application Provider provides the Media Player Entry URL to the 5GMSd-Aware Application via reference point M8d. Based on this, the 5GMSd Client can download the Media Player Entry from a service location exposed by the 5GMSd AS at reference point M4d. Example Media Player Entry documents are provided in clause I.2.2.

Table I.3.2.5-1 provides example values for the Content Hosting Configuration parameters.

Table I.3.2.5-1: Content Hosting Configuration resource parameters

|  |  |  |
| --- | --- | --- |
| Property name | Property value | Assigned by |
| name | content-hosting-configuration-a | 5GMSd Application Provider |
| ingestConfiguration |
|  | mode | PULL | 5GMSd Application Provider |
|  | protocol | urn:3gpp:‌5gms:‌content-protocol:‌http-pull |
|  | baseURL | https://origin.media-application-provider.com |
| distributionConfiguration |
|  | affinityGroup | affinity.group.a | 5GMSd Application Provider |
|  | contentPreparation‌TemplateId | cmmf.content.preparation.template |
|  | certificateId | server.certificate.a |
|  | canonical‌DomainName | distribution-a.com-provider-service.ms.as.3gppservices.org | 5GMSd AF |
|  | baseURL | https://distribution-a.com-provider-service.ms.as.3gppservices.org |
|  | pathRewriteRule |
|  |  | requestPathPattern | cmmf-a/ | 5GMSd Application Provider |
|  |  | mappedPath |  |
| distributionConfiguration |
|  | affinityGroup | affinity.group.b | 5GMSd Application Provider |
|  | contentPreparation‌TemplateId | cmmf.content.preparation.template |
|  | certificateId | server.certificate.a |
|  | canonical‌DomainName | distribution-b.com-provider-service.ms.as.3gppservices.org | 5GMSd AF |
|  | baseURL | https://distribution-b.com-provider-service.ms.as.3gppservices.org |
|  | pathRewriteRule |
|  |  | requestPathPattern | cmmf-b/ | 5GMSd Application Provider |
|  |  | mappedPath |  |
| distributionConfiguration |
|  | affinityGroup | affinity.group.c | 5GMSd Application Provider |
|  | contentPreparation‌TemplateId | cmmf.content.preparation.template |
|  | certificateId | server.certificate.a |
|  | canonical‌DomainName | distribution-c.com-provider-service.ms.as.3gppservices.org | 5GMSd AF |
|  | baseURL | https://distribution-c.com-provider-service.ms.as.3gppservices.org |
|  | pathRewriteRule |
|  |  | requestPathPattern | cmmf-c/ | 5GMSd Application Provider |
|  |  | mappedPath |  |

### I.3.2.6 End-to-end URL mapping

Table I.3.2.6-1 provides an example of the end-to-end mapping for requests initiated by the Media Player for a subset of the URLs provided in the example MPD shown in listing I.2.1-1 where the CMMF Media Access Client uses the corresponding URL mapping provided in the EFDT shown in listing I.2.2.3-1.

Table I.3.2.6-1: End-to-End URL mapping example

|  |  |  |
| --- | --- | --- |
| MPD URL | M4d Request URLs | M2d Request URL |
| rep1/seg-1.3gp | https://distribution-a.com-provider-service.‌ms.as.3gppservices.org/rep1/cmmf-a/seg-1.3gp | https://origin.media-application-provider.com/‌rep1/seg-1.3gp |
| https://distribution-b.com-provider-service.‌ms.as.3gppservices.org/rep1/cmmf-b/seg-1.3gp |
| <https://distribution-c.com-provider-service>.‌ms.as.3gppservices.org/rep1/cmmf-c/seg-1.3gp |
| http://example.com/1/1.3gp | https://distribution-a.com-provider-service.‌ms.as.3gppservices.org/1/cmmf-a/1.3gp | https://origin.media-application-provider.com/‌1/1.3gp |
| https://distribution-b.com-provider-service.‌ms.as.3gppservices.org/1/cmmf-b/1.3gp |
| https://distribution-c.com-provider-service.‌ms.as.3gppservices.org/1/cmmf-c/1.3gp |

## I.3.3 Example of media delivery from multiple service locations using CMMF and 5GMSd AS service chaining at reference point M10d

### I.3.3.1 Overview

This example shows how CMMF can be used in a deployment where 5GMSd AS service chaining at reference point M10d is provisioned. This example assumes the 5GMSd Application Provider provisions the system in the following manner:

1. A 5GMSd AS is provisioned to serve as an origin shield intended to reduce requests for content at reference point M2d. Furthermore, the creation of CMMF transport resources from ingested content at reference point M2d using Content Preparation is performed within this 5GMSd AS.

2. Two 5GMSd AS instances are provisioned to serve 5GMSd Clients from exposed service locations at reference point M4d. Both 5GMSd AS instances are configured to ingest CMMF transport resources (unique to their exposed service locations) from the 5GMSd AS serving as the origin shield at reference M10d.

2. Media resources ingested at reference point M2d are encoded into CMMF transport resources using an appropriate CMMF Content Preparation Template as specified in clause H.2.3.1.

3. A CMMF Media Player Entry as specified in clause H.2.3.3.

This implementation example is illustrated in figure I.3.3.1-1.



Figure I.3.3.1-1: Centralized 5GMSd AS content preparation and ingest deployment example

The following clauses describe how the 5GMS APIs and protocols are used to realize this example.

### I.3.3.2 Provisioning Session provisioning

Three provisioning sessions are created by the 5GMSd Application Provider using the *create Provisioning Session* resource operation specified in clause 5.2.2.3 and the API specified in clause 8.2 of TS 26.510 [56]. Example values for the three Provisioning Session parameters used are shown in table I.3.3.2-1.

Table I.3.3.2-1: ProvisioningSession resource parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Property name | Provisioning Session A(Trusted DN) | Provisioning Session B(Trusted DN) | Provisioning Session C(External DN) | Assigned by |
| provisioningSessionId | provisioning.session.a | provisioning.session.b | provisioning.session.c | Media AF |
| provisioningSession‌Type | MS\_DOWNLINK | MS\_DOWNLINK | MS\_DOWNLINK | Media Application Provider |
| externalServiceId | com.‌provider.‌service.a | com.‌provider.‌service.b | com.‌provider.‌service.c |
| appId | dash.downlink.streaming | dash.downlink.streaming | dash.downlink.streaming |
| NOTE: Values for provisioningSessionId, externalServiceId, and appId are notional and may not reflect actual values. |

### I.3.3.3 Content Preparation Templates provisioning

The 5GMSd Application Provider provisions one CMMF encoder Content Preparation Template within the provisioning.session.a Provisioning Session using the *create Content Preparation Template* resource operation specified in clause 5.2.5.2 and the API defined in clause 8.5 of TS 26.510 [56]. The following is assumed:

- Content Preparation is triggered upon the receipt of a pull-based request at reference point M10d.

- The path of the requested resource is available to the Content Preparation Template.

- Media resources (e.g., video segments, audio segments, etc.) are ingested by the 5GMSd AS at reference point M2d and encoded into CMMF transport resources by the Content Preparation Template.

- A sub-path URL added by the 5GMSd Client in the M4d request URL is used to determine which CMMF transport resource representation of the media resource is generated. For the purposes of this example, the Content Preparation Template generates representation "CMMF-B" if the URL contains the sub-path cmmf-b is received, and it generates representation "CMMF-C" if the URL contains the sub-path cmmf-c is received.

- Upon completion of the CMMF encoding operation, the CMMF transport resource is made available for caching by the 5GMSd AS and/or delivery to the requesting entity.

Upon successful provisioning of the Content Preparation Template, the 5GMSd AF returns the cmmf.‌content.‌preparation.‌template Content Preparation Template ID to the Media Application Provider.

### I.3.3.4 Server Certificates provisioning

The 5GMSd Application Provider provisions the Server Certificates for each Provisioning Session using the *create Server Certificate resource* operation specified in clause 5.2.4.2 and the API defined in clause 8.4 of TS 26.510 [56]. The Server Certificates assume a canonical domain name as specified in clause 6.0.2.2. Example values for the certificates generated by the 5GMSd AF are provided in table I.3.3.4-1.

Table I.3.3.4-1: Server Certificates

|  |  |  |  |
| --- | --- | --- | --- |
| provisioningSessionId | CN | subjectAltName | certificateId |
| provisioning.session.a | \*.com-provider-service-a.‌ms.as.‌3gppservices.org | \*.com-provider-service-a.‌ms.as.‌3gppservices.org | server.‌certificate.a |
| provisioning.session.b | \*.com-provider-service-b.‌ms.as.‌3gppservices.org | \*.com-provider-service-b.‌ms.as.‌3gppservices.org | server.‌certificate.b |
| provisioning.session.c | \*.com-provider-service-c.‌ms.as.‌3gppservices.org | \*.com-provider-service-c.‌ms.as.‌3gppservices.org | server.‌certificate.c |

### I.3.3.5 Content Hosting provisioning and configuration

The 5GMSd Application Provider provisions the Content Hosting Configuration for each Provisioning Session using the *create Content Hosting Configuration* resource operation specified in clause 5.2.8.2 and the API defined in clause 8.8 of TS 26.510 [56].

Configuring the Content Hosting Configuration in each 5GMSd AS is performed according to:

- The example base URL of the Media Application Provider’s origin server is https://origin.media-application-provider.com.

- The creation of the Content Hosting Configuration for Provisioning Session provisioning.session.a is completed prior to the creation of the Content Hosting Configuration for Provisioning Sessions provisioning.session.b and provisioning.session.c.

The 5GMSd Application Provider provides the Media Player Entry URL to the 5GMSd-Aware Application via reference point M8d. Based on this, the 5GMSd Client can download the Media Player Entry from a service location exposed by the 5GMSd AS at reference point M4d. Example Media Player Entry documents are provided in clause I.2.2.

Table I.3.3.5-1 provides example values for the Content Hosting Configuration API parameters for all three Provisioning Sessions.

Table I.3.3.5-1: ContentHostingConfiguration resource parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Property name | ProvisioningSession A | ProvisioningSession B | Provisioning Session C | Assigned by |
| name | content-hosting-configuration-a | content-hosting-configuration-b | content-hosting-configuration-c | 5GMSd Application Provider |
| ingestConfiguration |
|  | mode | PULL | PULL | PULL | 5GMSd Application Provider |
|  | protocol | urn:3gpp:‌5gms:‌content-protocol:‌http-pull | urn:3gpp:‌5gms:‌content-protocol:‌http-pull | urn:3gpp:‌5gms:‌content-protocol:‌http-pull |
|  | baseURL | https://origin.‌media-application-provider.com | https://‌distribution-a.‌com-provider-service-a.‌ms.as.‌3gppservices.org | https://‌distribution-a.‌com-provider-service-a.‌ms.as.‌3gppservices.org |
|  | distributionConfiguration |
|  | contentPreparation‌TemplateId | cmmf.content.‌preparation.‌template |  |  | 5GMSd Application Provider |
|  | certificateId | server.‌certificate.a | server.‌certificate.b | server.‌certificate.c |
|  | canonical‌DomainName | distribution-a.‌com-provider-service-a.‌ms.as.‌3gppservices.org | distribution-a.‌com-provider-service-b.‌ms.as.‌3gppservices.org | distribution-a.‌com-provider-service-c.‌ms.as.‌3gppservices.org | 5GMSd AF |
|  | baseURL | https://‌distribution-a.‌com-provider-service-a.‌ms.as.‌3gppservices.org | https://‌distribution-a.com-provider-service-b.ms.as.‌3gppservices.org | https://‌distribution-a.‌com-provider-service-c.‌ms.as.‌3gppservices.org |
|  | pathRewriteRule |
|  |  | requestPathPattern | (cmmf-[b-c]/)$ |  |  | 5GMSd Application Provider |
|  |  | mappedPath |  |  |  |

### I.3.3.6 End-to-end URL mapping

Table I.3.3.6-1 provides an example of the end-to-end mapping for requests initiated by the Media Player for a subset of the URLs provided in the example MPD shown in listing I.2.1-1 where the CMMF Media Access Client uses the corresponding URL mapping provided in the EFDT shown in listing I.2.2.3-1.

Table I.3.3.6-1: End-to-End URL mapping example

|  |  |  |  |
| --- | --- | --- | --- |
| MPD URL | M4d Request URL | M10d Request URL | M2d Request URL |
| rep1/seg-1.3gp | https://distribution-a.com-provider-service-b.‌ms.as.3gppservices.org/rep1/cmmf-b/seg-1.3gp | https://distribution-a.com-provider-service-b.‌ms.as.3gppservices.org/rep1/cmmf-b/seg-1.3gp | https://‌origin.media-application-provider.com/‌rep1/seg-1.3gp |
| https://distribution-a.‌com-provider-service-c.‌ms.as.3gppservices.org/‌rep1/cmmf-c/seg-1.3gp | https://distribution-a.‌com-provider-service-c.‌ms.as.3gppservices.org/‌rep1/cmmf-c/seg-1.3gp |
| http://example.com/1/1.3gp | https://distribution-a.‌com-provider-service-b.‌ms.as.3gppservices.org/‌1/cmmf-b/1.3gp | https://distribution-a.‌com-provider-service-b.‌ms.as.3gppservices.org/‌1/cmmf-b/1.3gp | https://‌origin.media-application-provider.com/‌1/1.3gp |
| https://distribution-a.‌com-provider-service-c.ms.as.3gppservices.org/‌1/cmmf-c/1.3gp | https://distribution-a.‌com-provider-service-c.‌ms.as.3gppservices.org/‌1/cmmf-c/1.3gp |