**3GPP TSG- Meeting #**

**, , - revision of S4-251502**

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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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| ***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 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:*** | | In [TR 26.804](https://www.3gpp.org/ftp/Specs/archive/26_series/26.804/26804-j01.zip), the analysis in clause 5.19.7 provides the following summary:  This Key Issue has considered the integration of different technologies into the 5G Media Streaming System that allow downlink media streaming applications to efficiently access content located across multiple content sources/endpoints. These technologies include:  - DNS-based switching,  - MPEG-DASH client-side switching,  - Content steering driven switching,  - SAND4M multi-source/endpoint delivery (to a limited extent), and  - CMMF-based multi-source/endpoint delivery.  In almost all cases, these technologies may be employed over-the-top of the 5GMS System using methods outside the scope of 5GMS (with the exception that the 5GMS Client is underspecified regarding multi-source/endpoint operation). However, explicit support for multi-source/endpoint media delivery throughout the 5GMS System is recommended through the following changes to 5GMS specifications.  This clause addresses the MPEG-DASH client side switching, Content steering with DASH, and SAND4M | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add a clause in Annex G for using DASH for multiple service locations. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Feature not supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, G.4 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 26.510 CR 0016  TS 26.512 CR 0086  TS 26.512 CR 0093 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | This revision takes into account comments received by BBC in <https://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_133-e/Inbox/Drafts/MBS/S4-251502_BBC.docx> | | | | | | | | |

## ===== CHANGE =====

# 2 References

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[40] ISO/IEC 23000-19: "Information technology – Multimedia application format (MPEG‑A) – Part 19: Common media application format (CMAF) for segmented media".

[103998] ETSI TS 103 998, "Content Steering for DASH".

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## 3.2 Abbreviations

…

DANE DASH-Aware Network Element

…

## ===== CHANGE =====

# G.4 DASH content distribution using multiple service locations

## G.4.1 Overview

This clause defines the requirements and recommendations to support content distribution from multiple service locations at reference point M4d in DASH-based downlink media streaming according to clause 5.2.6 of TS 26.501 [2]. This clause G.4 focuses on:

- Client-side switching

- Content Steering for DASH

- SAND for Multi-network access mode (SAND4M)

The focus in this clause is on media resources and transport resources that conform to DASH Segments as specified in ISO/IEC 23009‑1 [32]. Object encoding is not considered in this clause.

In particular, the base URL concept and service locations as defined in [32] are leveraged to support multiple service locations. A service location in MPEG-DASH is defined as "a collection of network resources that share commonalities and can be referred to by a common label". The BaseURL element may be used to specify one or more common locations for DASH Segments and other resources. Service locations are labels for base URLs, indicated in the MPD by an attribute of the BaseURL element.

Clause 5.6 of [32] specifies how to apply base URLs to each relative URL in the MPD to construct an absolute URL suitable for retrieving transport objects containing media resources, as well as specifying rules for handling multiple alternative base URLs, one of the key aspects to support multiple service locations in the 5GMS System.

## G.4.2 General Content Preparation requirements to support multiple service locations

### G.4.2.1 Introduction

This clause specifies general requirements for preparing DASH content to make it suitable for distribution via different service locations in the 5GMS System, in particular the configuration information required by the 5GMSd AS in order to perform any necessary content preparation. Two different variants are supported:

1. DASH content ingested by the 5GMSd AS through reference point M2d, including a provided DASH MPD, already includes different base URLs with service location tags. The content preparation needs to provide a mapping of the service locations in the MPD to the provisioned service locations on the 5GMSd AS. For details refer to clause G.4.2.2.

2. DASH content ingested through reference point M2d conforms to TS 26.511 [35] or at least CMAF per ISO/IEC 23000‑19 [40], and the 5GMSd AS creates an MPD that includes multiple service locations based on the provisioning information and the content preparation information. For details refer to clause G.4.2.3.

The following assumptions are common to both scenarios:

1. Multiple service locations have been provisioned at reference point M1d as distinct distribution configurations using the Content Hosting Provisioning (M1) API specified in clause 7.6 and following the Content Hosting provisioning (M1) procedures specified in clause 4.3.3.

### G.4.2.2 Pre-configured service locations

In this case, content ingested by the 5GMSd AS through reference point M2d, including a provided DASH MPD, already includes different base URLs with service location tags. The content preparation needs to replace the base URLs of each service location in the provided MPD with a provisioned service location on the 5GMSd AS, and to make a modified MPD available to the 5GMS Client via reference point M4d.

The ingested Media Presentation is described by an MPD that shall indicate the following parameters for each service location:

1. (Required) A BaseURL element including a @serviceLocation attribute that fulfils the requirements for a service location as specified in ISO/IEC 23009-1 [32]. If this service location is to be exposed by the 5GMSd AS at reference point M4d, it shall be associated with a Distribution Configuration provisioned in the 5GMSd AF Content Hosting Configuration by matching its @serviceLocaton attribute value with the value of a DistributionConfiguration.distributionId property (see clause 8.8.3.1 of TS 26.510 [56]).

2. (Optional) An @availabilityTimeOffset attribute adjusting the Segment availability time for this service location.

3. (Optional) An @availabilityComplete attribute indicating whether all Segments of all associated Representations are complete at the adjusted availability start time.

4. (Optional) A @timeShiftBufferDepth attribute indicating, for a DASH Media Presentation of type dynamic, the duration of the smallest timeshift buffer for which Segments of any Representation are guaranteed to remain available.

5. (Optional) A @rangeAccess attribute indicating whether or not partially available Segments may be accessed with an HTTP byte range request.

- In the case where the attribute value indicates that partially available Segments may be accessed with an HTTP byte range request, if a Media Player makes a byte-range request against a partially available Segment, and the first-byte position of that range request is non-zero, and the Media Player desires a continuously aggregating/live response, then it should signal this using the convention of RFC 8673 [61]. Specifically, it should use a last-byte value of 9007199254740991. When responding to Segment requests through this service location, the 5GMSd AS shall return an HTTP 206 (Partial Content) aggregating response instead of responding with a 200 (OK) response and a Content-Length response header after waiting for the end of the Segment to become available.

- Otherwise, the Media Player should not expect a response corresponding to the requested byte range.

Based on this information, the 5GMSd AS offers DASH content associated with its provisioned service locations accordingly to the 5GMS Client via reference point M4d.

### G.4.2.3 Configuration of service locations in the 5GMSd AS

In this case, content ingested by the 5GMSd AS through reference point M2d conforms to TS 26.511 [35] or at least CMAF per ISO/IEC 23000‑19 [40], and the 5GMSd AS creates an MPD that includes multiple service locations based on the provisioning information and the content preparation information. The ingested content may be described by an MPD conforming to a DASH profile for CMAF content as specified in ISO/IEC 23009‑1 [32].

In order to create an MPD for M4d distribution using the provisioning information as well as the CMAF content annotation, the content preparation information shall include:

1. A mapping of included CMAF tracks to one or multiple service locations.

2. Relevant attributes to configure each service location by providing the relevant values for the BaseURL element. For details of each of the attributes, refer to clause G.4.2.2.

Based on this information, the 5GMSd AS offers DASH content associated with its provisioned service locations accordingly to the 5GMS Client via reference point M4d.

## G.4.3 Client-side switching between service locations

### G.4.3.1 Introduction

For client-side switching, DASH content is offered from multiple service locations, but switching between them, for example based on throughput estimation, error behaviour, etc. is a decision made on the client side.

### G.4.3.2 DASH content offering requirements and recommendations

A 5GMSd AS offering a DASH Media Presentation with multiple service locations shall provide a service offering that conforms to a DASH Media Profile for CMAF content as defined in ISO/IEC 23009-1 [32], with the following additional requirements:

1. For each Representation that represents a CMAF track, all BaseURL elements shall be associated with this Representation whereby the value of the element is the base URL provided in the template and the value of the @serviceLocation attribute shall be set to the distributionBaseURL of the corresponding service location provisioned in a Distribution Configuration of the Content Hosting Configuration.

2. For each base URL, the associated parameters specified in clause G.4.2.2 may be set as well.

3. The resources shall be made available by the 5GMSd AS at reference point M4d according to the configuration for each base URL.

### G.4.3.3 Media Player requirements and recommendations

A Media Player supporting multiple service locations shall request content from an alternative base URL declared in the MPD (using a BaseURL element) if the endpoint of one service location fails.

### G.4.3.4 Examples (informative)

Listing G.4.3.4-1 provides an example for which two service locations are specified in the MPD.

Listing G.4.3.4-1 MPD with multiple service locations

|  |
| --- |
| <?xml version="1.0" encoding="UTF-8"?>  **<MPD**  xmlns:xsi=*"http://www.w3.org/2001/XMLSchema-instance"*  xmlns=*"urn:mpeg:dash:schema:mpd:2011"*  xsi:schemaLocation=*"urn:mpeg:dash:schema:mpd:2011 DASH-MPD.xsd"*  type=*"dynamic"*  minimumUpdatePeriod=*"PT2S"*  timeShiftBufferDepth=*"PT30M"*  availabilityStartTime=*"2014-10-17T17:17:05Z"*  minBufferTime=*"PT4S"*  profiles=*"urn:mpeg:dash:profile:isoff-live:2011"*  publishTime=*"2014-10-17T17:17:05Z"***>**  **<BaseURL** serviceLocation=*"cdn1"***>**http://cdn1.example.com/**</BaseURL>**  **<BaseURL** serviceLocation=*"cdn2"***>**http://cdn2.example.com/**</BaseURL>**  **<Period** id=*"1"***>**  *<!-- Video -->*  **<AdaptationSet**  mimeType=*"video/mp4"*  codecs=*"avc1.4D401F"*  frameRate=*"30000/1001"*  segmentAlignment=*"true"*  startWithSAP=*"1"***>**  **<BaseURL>**video/**</BaseURL>**  **<SegmentTemplate** timescale=*"90000"* initialization=*"$Bandwidth$/init.mp4v"* media=*"$Bandwidth$/$Time$.mp4v"***>**  **<SegmentTimeline>**  **<S** t=*"0"* d=*"180180"* r=*"432"***/>**  **</SegmentTimeline>**  **</SegmentTemplate>**  **<Representation** id=*"v0"* width=*"320"* height=*"240"* bandwidth=*"250000"***/>**  **<Representation** id=*"v1"* width=*"640"* height=*"480"* bandwidth=*"500000"***/>**  **<Representation** id=*"v2"* width=*"960"* height=*"720"* bandwidth=*"1000000"***/>**  **</AdaptationSet>**  *<!-- English Audio -->*  **<AdaptationSet** mimeType=*"audio/mp4"* codecs=*"mp4a.40"* lang=*"en"* segmentAlignment=*"0"* startWithSAP=*"1"***>**  **<SegmentTemplate** timescale=*"48000"* initialization=*"audio/en/init.mp4a"* media=*"audio/en/$Time$.mp4a"***>**  **<SegmentTimeline>**  **<S** t=*"0"* d=*"96000"* r=*"432"***/>**  **</SegmentTimeline>**  **</SegmentTemplate>**  **<Representation** id=*"a0"* bandwidth=*"64000"***/>**  **</AdaptationSet>**  *<!-- French Audio -->*  **<AdaptationSet** mimeType=*"audio/mp4"* codecs=*"mp4a.40"* lang=*"fr"* segmentAlignment=*"0"* startWithSAP=*"1"***>**  **<SegmentTemplate** timescale=*"48000"* initialization=*"audio/fr/init.mp4a"* media=*"audio/fr/$Time$.mp4a"***>**  **<SegmentTimeline>**  **<S** t=*"0"* d=*"96000"* r=*"432"***/>**  **</SegmentTimeline>**  **</SegmentTemplate>**  **<Representation** id=*"b0"* bandwidth=*"64000"***/>**  **</AdaptationSet>**  **</Period>**  **</MPD>** |

## G.4.4 Switching between service locations using Content Steering for DASH

### G.4.4.1 Introduction

Content steering provides a deterministic capability for a content distributor to switch the content source that a media player uses, either at presentation start-up or at any point during the presentation, by means of a remote steering service. specified This clause defines the requirements and recommendations to support content distribution at reference point M4d in DASH-based downlink media streaming in combination with Content Steering as specified in [103998].

### G.4.4.2 DASH content offering requirements and recommendations

A 5GMSd AS offering a DASH Media Presentation to be used with Content Steering shall offer a Media Presentation according to the requirements in clause 4.3.2.

In addition, the 5GMSd AS shall:

- add Content Steering signalling in the DASH MPD as specified in clause 5 of ETSI TS 103 998 [103998], and

- support the functionalities of a DASH Steering Server as specified in clause 6 of ETSI TS 103 998 [103998].

### G.4.4.3 Media Player requirements and recommendations

A Media Player supporting Content Steering for DASH shall implement the normative DASH client steering behaviour specified in clause ??? of ETSI TS 103 998 [103998].

### G.4.4.4 Examples (informative)

Listing G.4.4.4-1 provides an example in which three service locations are specified in the MPD. In this example, some content representations are available from service location cdn1, a subset is available from service location cdn2, and complementary content is available from service location cdn3.

Listing G.4.4.4-1 MPD with multiple service locations and Content Steering

|  |
| --- |
| <MPD  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  xmlns="urn:mpeg:dash:schema:mpd:2011"  type="dynamic" minimumUpdatePeriod="PT10s"  timeShiftBufferDepth="PT600S"  minBufferTime="PT2S"  profiles="urn:3GPP:PSS:profile:DASH10"  publishTime="2014-10-17T17:17:05Z"  availabilityStartTime="2014-10-17T17:17:05Z">  <Location>http://www.example.com/MPD2.mpd</Location>  **<ServiceDescription** id=*"420"***>**  **<ContentSteering** defaultServiceLocation=*"cdn1"* queryBeforeStart=*"true"***>**  https://com-example.ms.as.3gppservices.org/steering**</ContentSteering>**  **</ServiceDescription>**  <Period id="1" start="PT0S">  <SegmentTemplate media="./$RepresentationID$/$Number$.m4s" initialization="$RepresentationID$-init.mp4"/>  <!–- Video 720p -->  <AdaptationSet mimeType="video/mp4" codecs="hvc1.1.2.L93.B0" startWithSAP="1" maxWidth="1280" maxHeight="720" frameRate="30" profile="urn:3GPP:video:op:h265-720p-HD">  <BaseURL **serviceLocation="cdn2"**>http://example.com/cdn2</BaseURL>  <SegmentTemplate timescale="30" duration="60"/>  <Representation id="v2048" bandwidth="2048000">  <BaseURL **serviceLocation="cdn1"**>http://example.com/cdn1</BaseURL>  </Representation>  <Representation id="v1024" bandwidth="1024000"/>  <Representation id="v512" bandwidth="512000"/>  <Representation id="v128" bandwidth="128000"/>  </AdaptationSet>  <!–- Video HDR -->  <AdaptationSet mimeType="video/mp4" codecs="hvc1.2.4.L113.B0" startWithSAP="1" maxWidth="1920" maxHeight="1080" frameRate="30" profile="urn:3GPP:video:op:h265-Full-HD-HDR">  <BaseURL **serviceLocation="unicast"**>http://example.com/suc</BaseURL>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:MatrixCoefficients" value="9"/>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:TransferCharacteristics" value="16"/>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:ColourPrimaries" value="9"/>  <SegmentTemplate timescale="30" duration="60"/>  <Representation id="8M" bandwidth="8192000">  <Representation id="6M" bandwidth="6144000"/>  <Representation id="4M" bandwidth="4096000"/>  <Representation id="2M" bandwidth="2048000"/>  </AdaptationSet>  <!–- Audio English -->  <AdaptationSet mimeType="audio/mp4" codecs="mp4a.40.2" segmentAlignment="true" startWithSAP="1" language="en">  <BaseURL **serviceLocation="cdn2"**> http://example.com/cdn2</BaseURL>  <SegmentTemplate timescale="20" duration="40"/>  <Representation id="a128" bandwidth="128000">  <BaseURL **serviceLocation="cdn1"**> http://example.com/cdn1</BaseURL>  </Representation>  <Representation id="a64" bandwidth="64000">  </AdaptationSet>  <!–- Audio Spanish -->  <AdaptationSet mimeType="audio/mp4" codecs="mp4a.40.2" segmentAlignment="true" startWithSAP="1" language="es">  <BaseURL **serviceLocation="cdn3"**> http://example.com/cdn3</BaseURL>  <SegmentTemplate timescale="20" duration="40"/>  <Representation id="a128" bandwidth="128000">  <Representation id="a64" bandwidth="64000">  </AdaptationSet>  </Period>  </MPD> |

The Content Steering message is provided to the Media Player by the DASH Steering Server instantiated in the 5GMSd. The example in listing G.4.4.4‑1, it indicates a single service location that hosts one Representation is available; the HDR video and the Spanish language are available as well from service location cdn3.

**Listing G.4.4.4‑1: Example DASH Content Steering Message indicating availability of content from 5GMSd AS service locations**

|  |
| --- |
| {  "VERSION": 1,  "TTL": 5,  "RELOAD-URI": "https://com-example.ms.as.3gppservices.org/steering"  "PATHWAY-PRIORITY": ["cdn2","cdn3","cdn1"]  } |

In case the 5GMSd AS fails to pre-populate content for service location cdn2, it recommends switching to cdn1 or cdn3.

**Listing 5.12.2.2.2-3: Example DASH Content Steering Message indicating non-availability of content from 5GMSd AS service locations**

|  |
| --- |
| {  "VERSION": 1,  "TTL": 5,  "RELOAD-URI": "https://com-example.ms.as.3gppservices.org/steering"  "PATHWAY-PRIORITY": ["cdn1","cdn3"]  } |

## G.4.5 Switching between service locations using SAND4M

### G.4.5.1 Introduction

3GPP DASH as specified in clause 13.10 of 3GPP TS 26.247 [26247], defines the *Server-Assisted Network Delivery* (SAND) functionality that enables SAND for Multi-network support (SAND4M), and specifies required and recommended functionalities for both a DASH-Aware Network Element (DANE) and a DASH client. In the context of the 5GMS System, the DANE is mapped to the 5GMSd AS and the DASH client is realised by the 5GMSd Client.

Specifically, the following cases are relevant in the context of multiple service locations:

- Not all resources announced in the presentation manifest (e.g. MPEG-DASH MPD) are always accessible on all access networks, e.g. certain resources are unavailable when the UE is for example in a roaming scenario.

- Even on a particular access network, resources may not be available all the time.

- Networks may have different availability times.

- Networks go down dynamically and may re-appear.

- The DANE may issue preferences for one network.

- Information about the dynamic availability of resources from different service locations may be established via in-band and/or out-of-band channels.

### G.4.5.2 DASH content offering requirements and recommendations

A 5GMSd AS offering a DASH Media Presentation to be used with SAND4M shall offer a Media Presentation according to the requirements in clause 4.3.2.

In addition, the 5GMSd AS shall support the functionalities of a DANE for SAND4M specified in clause 13.10.2 of TS 26.247 [26247].

### G.4.5.3 Media Player requirements and recommendations

A Media Player supporting SAND4M with multiple service locations shall implement the DASH client functionalities of SAND4M specified in clause 13.10.3 of TS 26.247 [26247].

### G.4.5.4 Examples (informative)

Listing G.4.5.4-1 provides an example for which three service locations are specified in the MPD. In this example, some content representations are available on service location cdn1, a subset is available from service location cdn2, and complementary content is available from service location cdn3.

Listing G.4.5.4-1 MPD with multiple service locations

|  |
| --- |
| <MPD  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  xmlns="urn:mpeg:dash:schema:mpd:2011"  type="dynamic" minimumUpdatePeriod="PT10s"  timeShiftBufferDepth="PT600S"  minBufferTime="PT2S"  profiles="urn:3GPP:PSS:profile:DASH10"  publishTime="2014-10-17T17:17:05Z"  availabilityStartTime="2014-10-17T17:17:05Z">  <Location>http://www.example.com/MPD2.mpd</Location>  <Period id="1" start="PT0S">  <SegmentTemplate media="./$RepresentationID$/$Number$.m4s" initialization="$RepresentationID$-init.mp4"/>  <!–- Video 720p>  <AdaptationSet mimeType="video/mp4" codecs="hvc1.1.2.L93.B0" startWithSAP="1" maxWidth="1280" maxHeight="720" frameRate="30" profile="urn:3GPP:video:op:h265-720p-HD">  <BaseURL **serviceLocation="cdn2"**>http://example.com/cdn2</BaseURL>  <SegmentTemplate timescale="30" duration="60"/>  <Representation id="v2048" bandwidth="2048000">  <BaseURL **serviceLocation="cdn1"**>http://example.com/cdn1</BaseURL>  </Representation>  <Representation id="v1024" bandwidth="1024000"/>  <Representation id="v512" bandwidth="512000"/>  <Representation id="v128" bandwidth="128000"/>  </AdaptationSet>  <!–- Video HDR>  <AdaptationSet mimeType="video/mp4" codecs="hvc1.2.4.L113.B0" startWithSAP="1" maxWidth="1920" maxHeight="1080" frameRate="30" profile="urn:3GPP:video:op:h265-Full-HD-HDR">  <BaseURL **serviceLocation="unicast"**>http://example.com/suc</BaseURL>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:MatrixCoefficients" value="9"/>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:TransferCharacteristics" value="16"/>  <EssentialDescriptor schemeIdUri="urn:mpeg:mpegB:cicp:ColourPrimaries" value="9"/>  <SegmentTemplate timescale="30" duration="60"/>  <Representation id="8M" bandwidth="8192000">  <Representation id="6M" bandwidth="6144000"/>  <Representation id="4M" bandwidth="4096000"/>  <Representation id="2M" bandwidth="2048000"/>  </AdaptationSet>  <!–- Audio English>  <AdaptationSet mimeType="audio/mp4" codecs="mp4a.40.2" segmentAlignment="true" startWithSAP="1" language="en">  <BaseURL **serviceLocation="cdn2"**> http://example.com/cdn2</BaseURL>  <SegmentTemplate timescale="20" duration="40"/>  <Representation id="a128" bandwidth="128000">  <BaseURL **serviceLocation="cdn1"**> http://example.com/cdn1</BaseURL>  </Representation>  <Representation id="a64" bandwidth="64000">  </AdaptationSet>  <!–- Audio Spanish>  <AdaptationSet mimeType="audio/mp4" codecs="mp4a.40.2" segmentAlignment="true" startWithSAP="1" language="es">  <BaseURL **serviceLocation="cdn3"**> http://example.com/cdn3</BaseURL>  <SegmentTemplate timescale="20" duration="40"/>  <Representation id="a128" bandwidth="128000">  <Representation id="a64" bandwidth="64000">  </AdaptationSet>  </Period>  </MPD> |

The SAND message is provided to the Media Player by the DANE instantiated in the 5GMSd AS. The example in listing G.4.5.4‑1, indicates that only a service location that hosts one Representation is available; the HDR video and the Spanish language are available as well from service location cdn3. The SAND message indicates that service location cdn2 is available in the 5GMSd AS.

**Listing G.4.5.4‑1: Example SAND message indicating availability of content in 5GMSd AS**

|  |
| --- |
| <SAND>  <Status baseURL="http://example.com/cdn2">  <ResourceStatus status="cached"/>  </Status>  <Status baseURL="http://example.com/cdn1">  <ResourceStatus status="unavailable"/>  </Status>  <Status baseURL="http://example.com/cdn3">  <ResourceStatus status="available"/>  </Status>  </SAND> |

In case the 5GMSd AS fails to pre-populate content for service location cdn2, it recommends switching to service location cdn1 or cdn3.

**Listing 5.12.2.2.2-3: Example SAND message indicating non-availability of content in 5GMSd AS**

|  |
| --- |
| <SAND>  <Status baseURL=" http://example.com/cdn2">  <ResourceStatus status="unavailable"/>  </Status>  <Status baseURL="http://example.com/cdn1">  <ResourceStatus status="available"/>  </Status>  <Status baseURL="http://example.com/cdn3">  <ResourceStatus status="available"/>  </Status>  </SAND> |