**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:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***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>   |  |  |  |  | | --- | --- | --- | --- | | [**S4aI250119**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI250119.zip) | [AMD\_PRO-MED] Multiple Service Locations with DASH | Qualcomm Incorporated | Thomas Stockhammer |   **E-mail Discussion**: none  **Revisions**: <https://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Inbox/Drafts/S4aI250119_BBC.docx>  **Presenter**: Thomas Stockhammer  **Online Discussion**: (September 3/4/5 2025)  Jason: this addresses the multilocation for DASH content that  is described in MPD. It says object encoding is not considered. Should we defined this annex to just added multilocation with single MPD?  Thomas: Yes. Annex G tells how to use DASH. I didn’t add the object encoding about DASH and I can remove it. This just show how to use DASH with multilocation.  Richard: the examples for content steering and SAND4M, provides example of hd and SD, the woding in the main text can be improved to show the use of this.  Jason: is 4.2.2 any additional requirement to the DASH spec?  Thomas: we can remove the optional things.  Jason: there is no way to steer content for different service location more than content hosting.  Thomas: the MPD is content preparation template, and defines where the content go.  **Decision**:  [S4aI250119](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI250119.zip) is **revised to  [Parked for now]**. | | | | | | | | |

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

# 2 References

…

[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 based on 127r02 =====

### 10.3A.1 General

This clause extends clauses 10.2 and 10.3 to provide Media Access Client capabilities that allow for content distribution using multiple service locations exposed by the 5GMSd AS at reference point M4d. These capabilities may be used independently or in combination.

Necessary information required by the Media Access Client to use multiple service locations exposed by the 5GMSd AS at reference point M4d during a media streaming session may be provided within a Media Player Entry (or a document pointed to by a Media Player Entry) and/or by a content steering service. Service locations provided in the Media Player Entry and/or by a content steering service may be distinguishable and identifiable via their base URLs.

A Media Access Client that supports content distribution from multiple service locations should support the following:

- Identification of the base URL(s) of the service location(s) to be used and the construction of the absolute URL(s) for the transport resources that apply to the media resource(s) to be acquired.

- Acquire transport resources associated with a media resource from one or more service locations.

- Recover or reconstitute media resources from the acquired transport resources and make them available to the Media Playback and Content Decryption Platform (as specified in TS 26.511 [35]) for immediate or delayed consumption.

Additional Media Access Client capabilities, depending on the method(s) used to acquire media resources from one or more service locations, are provided below.

A Media Access client accessing multiple service locations should take into account that the throughput estimation for one service location may not accurately predict the throughput estimated on another service location.

## ===== CHANGE based on 127r02 =====

### 10.3A.3 Media Access Client capabilities to support concurrent use of multiple service locations for content distribution

The Media Access Client of the 5GMSd Client may have the ability to acquire media resources from more than one service location in parallel (i.e., through simultaneous use of multiple service locations). When using multiple service locations concurrently, the Media Access Client of the 5GMSd Client should have the additional capabilities:

- The ability to select more than one service location to be used to acquire transport resources. For example, the service locations selected have the highest priority for usage based on the contents of the Media Player Entry or signalling from a content steering service; the Media Access Client selects the service locations using internal logic, or all the identified service locations are used. In another example, the video transport resources and the audio transport resources may be offered on different service locations, and the Media Player needs to access both service locations in parallel to provide a full media experience.

- The ability to acquire more than one transport resource simultaneously, where each may be the original or a transformed (e.g., encoded) representation of the media resource, from the identified service locations. This may include downloading (either partially or in full) transport resources from more than one reference point M4d service locations simultaneously.

## ===== 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].

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.

For content hosting,

- To provision DASH 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 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.

## 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.

To provision Content Preparation of DASH 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 DASH 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.

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 shall 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 shall the base URLs of each service location in the provided MPD with a provisioned service location on the 5GMSd AS, shall make the modified MPD available to the 5GMS Client via reference point M4d.

The ingested Media Presentation is described by an MPD that shall include 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]).

In addition, the BaseURL may include optional additional parameters

1. An @availabilityTimeOffset attribute adjusting the Segment availability time for this service location.

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

3. 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.

4. 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, taking into account the optional parameters provided above, if provided.

### 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 a mapping of included CMAF tracks to one or multiple service locations.

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 with DASH and client-side switching shall support the general requirements for the media access client as defined in clause 10.3A.1 and the Media Access Client capabilities to support switching between multiple service locations during content distribution as defined in clause 10.3A.2.

In order to support service offerings, for which different Representations and/or Adaptation Sets are offered on different service locations, and the Representations are expected to the be played together, the Media Player should support the Media Access Client capabilities to support concurrent use of multiple service locations for content distribution as defined in clause 10.3A.2.

### 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=*"dist1"***>**http://distribution-1.com-provider-service.ms.as.3gppservices.org**</BaseURL>**  **<BaseURL** serviceLocation=*"dist2"***>**http://distribution-2.com-provider-service.ms.as.3gppservices.org**</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 support the normative DASH client steering behaviour specified in clause 7 of ETSI TS 103 998 [103998].

- shall support the media player requirements and recommendations in clause G.4.3.3.

- shall support the Media Access Client capabilities to support content steering for content distribution as defined in clause 10.3A.4 where the content steering service is the Content Steering server as provided in the MPD according to clause G.4.43.

### 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 dist1, a subset is available from service location dist2, and complementary content is available from service location dist3.

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>distribution-1.com-provider-service.ms.as.3gppservices.org/MPD2.mpd</Location>  <Location>distribution-2.com-provider-service.ms.as.3gppservices.org/MPD2.mpd</Location>  <Location>distribution-3.com-provider-service.ms.as.3gppservices.org/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="dist2"**>http://distribution-2.com-provider-service.ms.as.3gppservices.org</BaseURL>  <SegmentTemplate timescale="30" duration="60"/>  <Representation id="v2048" bandwidth="2048000">  <BaseURL **serviceLocation="dist1"**> http://distribution-1.com-provider-service.ms.as.3gppservices.org</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="dist2"**>http://distribution-2.com-provider-service.ms.as.3gppservices.org</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="dist3"**>http://distribution-3.com-provider-service.ms.as.3gppservices.org</BaseURL>  <SegmentTemplate timescale="20" duration="40"/>  <Representation id="a128" bandwidth="128000">  <BaseURL **serviceLocation="dist3"**>http://distribution-3.com-provider-service.ms.as.3gppservices.org</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="dist2"**>http://distribution-2.com-provider-service.ms.as.3gppservices.org</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 dist3.

**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": ["dist2","dist3","dist1"]  } |

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": ["dist1","dist3"]  } |

## 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**

|  |
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| <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> |