**3GPP TSG- Meeting #**

**, , - revision of S4aI230005**

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| *CR-Form-v12.2* |
| **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 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2023-02-14 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | The work item in SP-220614 asks among others for the following:3. 5GMS over 5MBS:- Adding call flows and procedures to support carriage of 5GMS streaming sessions over 5MBS.4. 5GMS hybrid services (5MBS and 5GMS):- Adding call flows and procedures to support 5GMS hybrid services (5MBS and 5GMS). |
|  |  |
| ***Summary of change:*** | The CR addresses the above objectives by adding* Architecture for 5GMS via MBS
* Reference Points
* Call Flows and Procedures for 5GMS via MBS

Call Flows and Procedures for Hybrid Services |
|  |  |
| ***Consequences if not approved:*** | Work Item objectives not complete |
|  |  |
| ***Clauses affected:*** | 2, 4.X (new), 5.X (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | **raft CR****Initial version in S4-221136 was agreed during SA4#120e as basis for future work** **This is revision 1 which combines S4-221136 and S4-221140 (also agreed as basis for future work), and does some initial cleaning. More work is still needed**

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| [**S4aI221372**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI221372.zip) | [5GMSA\_Ph2] 5GMS over 5MBS | Qualcomm incorporated | Thomas Stockhammer |

**Revisions*** none

**Presenter**: Thomas Stockhammer (Qualcomm)**Discussion**: * Thomas: Combines S4-221136 (architecture) and S4-221140 (procedures), which were agreed as the basis for further work at SA4#120-e. Basic cleaning, but no further additions yet.
* Qi: Some typos. Still lots of references to MBMS and BM-SC. Also in call flow sequence diagram.
* Thomas: Start from scratch?
* Richard: Keep existing sequence diagram and modify rather than starting from scratch.
* Thomas: Agree.

**Decision**:* Agreed as the basis for further work. Author will continue working on this contribution.

**S4aI221372** is **agreed.**

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| [**S4-221308**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_121_Toulouse/Docs/S4-221308.zip) | [5GMSA\_Ph2] 5GMS over 5MBS | Qualcomm incorporated | Thomas Stockhammer |

  **Presenter:** Thomas Stockhammer (Qualcomm)**Online Discussion:*** Frederic: Source and Release need to be updated in the cover page.
* Gunnar: In this CR, we add MBS QoE. We should mention it in the liaison statement.
* Thomas: It would be premature to say that we are doing QoE.
* Thorsten: APIs are needed. This is completely defined for MBMS.

**Decision:*** Postponed.

**S4-221308** is **postponed.****This document addresses only updates to cover page**

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| [S4aI230005](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI230005.zip) | [5GMSA\_Ph2] 5GMS over 5MBS | Qualcomm incorporated | Thomas Stockhammer |

**E-mail Discussion**: none **Revisions**: none**Presenter**: Thomas Stockhammer (Qualcomm)**Online Discussion**:* Thomas: Committed to work on this. We can maybe lets wait until next telco and see
* Charles: You mentioned in call flow description - steps 5-11 MSH acts as MBS aware application, but in other place these are shown as different entities and is inconsistent
* Thomas: Yes, we should work further to streamline this
* RIchard: Is this the one dependent on SA3 security question. Any news there? Thomas: Believe there is a CR for the upcoming meeting.

**Decision**:* Further work is required.

**S4aI230005** is **noted**.This revision is no major progress.  |

**===== CHANGE =====**

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[X] 3GPP TS 26.502: "5G Multicast-Broadcast User Service Architecture".

[Y] 3GPP TS 26.517: "5G Multicast-Broadcast User Services; Protocols and Formats".

**===== CHANGE =====(new clause, revisions against agreed S4-221136)**

## 4.X 5G Downlink Media Streaming via MBS

### 4.X.1 Architecture for 5G Downlink Media Streaming over MBS

Figure 4.X.1-1 below depicts an architecture for downlink 5G Media Streaming via MBS as defined in TS 26.502 [X] that combines the functions and reference points of the 5GMS System with those of the MBS System.



Figure 4.X.1-1: Architecture for 5G Media Streaming over MBS

This arrangement allows 5GMS-based downlink media streaming to be deployed as an MBS-Aware Application on top of MBS as defined in TS 26.502 [X].

In this case:

1. The 5GMSd AF configures the delivery of 5GMSd content to an MBS Client in the UE by provisioning an MBS User Service as defined in clause 4.5.1 of TS 26.502. In order to additionally deliver this content over one or more MBS Distribution Session, the 5GMSd AF invokes Nmb10 control plane procedures on the MBSF as specified in clause 7.2 of TS 26.502 and, as a result, content is ingested by the MBSTF from the 5GMSd AS using the pull-based object ingest procedures at reference point Nmb8 specified in clause 6.1 of TS 26.502 using pull-based object ingest.

NOTE 1: Push-based ingest into the MBSTF is not enabled in the current release.

NOTE 2: 5GMSd AS and MBS AS share similar functions and may be deployed in a single physical node.

2. The 5GMSd Client acts as MBS-Aware Application (as defined in TS 26.502 [X]) for the MBS Client. Thus, the *MBS Client* is controlled by the 5GMSd Client via the MBS-6 API (as defined in TS 26.517 [Y]).

3. The MBSTF Client receives media and other objects from the MBSTF according to the Object Distribution Method specified in clause 6.1 of TS 26.502 [X]. If an uplink is available to the MBS Client, and if Object Repair as specified in clause 4.2.6 of TS 26.502 [X] is available in the MBS System, the MBS Client uses the unicast repair delivery procedures to recover damaged media objects received from the MBSTF by interacting at reference point MBS‑4‑UC.

4. The *Media server* subfunction of the MBSTF Client provides a media server interface and shall expose the content received (and possibly repaired) by the MBS Client to the 5GMSd Client via the HTTP client-to-application interface. (This interaction is labelled MBS-7 in figure 4.X.1‑1 above.)

5. The Media Player sends requests according to the signalled object availability times in the manifest. In case a media object transmitted via an MBS Distribution Session is not received by the MBS Client by the object availability times, or if it cannot be repaired in time for consumption by the 5GMS Client, the Media Server in the MBS Client returns an error or a partial object in response to the Media Player's request for the media object, and the Media Player may instead attempt to retrieve the media object, or ranges of it, from the 5GMSd AS at reference point M4d, if available. The object shall be available for download from the 5GMSd AS for a well-defined time duration.

NOTE 3: Details on determining the availability time requirements of the application are deferred to stage 3.

The usage of existing reference points to support these scenarios is documented in the following clauses. Procedures for 5GMS via MBS are defined in clause 5.X.

### 4.X.2 Usage of 5GMS reference points for MBS-based delivery

#### 4.X.2.1 Usage of M1

Reference point M1 is used as defined in clauses 4.1 to 4.4.

In addition, the content provider shall authorize via M1 that 5GMS content may be distributed via MBS.

The translation of M1 information to MBS delivery provisioning is left to implementation.

NOTE: The 5GMS Application Provider may provision specific use-cases (high velocity, specific reception area, indoor/outdoor/mobile users) at reference point M1d. These service requirements are translated by the 5GMSd AF into specific Nmb10 calls to provision the MBSF with a service that has the correct parameters for a specific location.

#### 4.X.2.2 Usage of M2d

Reference point M2d is be used as defined in clauses 4.1 to 4.4.

#### 4.X.2.3 Usage of M3d

Reference point M3d is used as defined in clauses 4.1 to 4.4.

#### 4.X.2.4 Usage of M4d

Reference point M4d is used as defined in clauses 4.1 to 4.4.

#### 4.X.2.5 Usage of M5

Reference point M5 is used as defined in clauses 4.1 to 4.4.

In addition, for 5GMS content to be distributed via MBS:

- The 5GMS Service Access Information shall include the relevant information of the MBS Service Announcement in order to bootstrap reception of the MBS service, typically via a service identifier (i.e., the serviceId attribute of the **bundleDescription**@userServiceDescription element of the USD - see TS 26.517 [Y]). This is passed by the Media Session Handler to the MBS Client via reference point MBS-6.

 When this information is present in the Service Access Information and when the UE is MBS-capable, the 5GMSd Client shall invoke the MBS Client to initiate reception of the corresponding MBS User Service.

- The 5GMS Service Access Information shall include relevant information from the MBS Service Announcement in order for the Media Session Handler to:

i) Collect metrics of the MBS User Service from the MBS Client and report them to the 5GMSd AF using an appropriate metrics reporting scheme.

ii) Collect media consumption information from the MBS Client and submit it to the 5GMSd AF in 5GMS consumption reports.

#### 4.X.2.6 Usage of M6d

Reference point M6d is used as defined in clauses 4.1 to 4.4.

#### 4.X.2.7 Usage of M7d

Reference point M7d is used as defined in clauses 4.1 to 4.4.

#### 4.X.2.8 Usage of M8d

Reference point M8d is used as defined in clauses 4.1 to 4.4.

### 4.X.3 Usage of MBS reference points and interfaces

#### 4.X.3.1 Usage of Nmb10

The 5GMSd AF provisions MBS User Services in the MBSF as defined in clauses 5.3 of TS 26.502 [X].

#### 4.X.3.2 Usage of Nmb8

The MBSTF ingests content from the 5GMSd AS using the pull-based ingest method.

#### 4.X.3.3 Usage of MBS User Services and Distribution Methods

The MBS User Service Announcement as defined in TS 26.502 is used to advertise the availability of 5GMS content delivered via MBS.

A *Generic application service* (as defined in clause 5.7 of TS 26.346 [19]) is provisioned in the BM‑SC and the application service entry point instance is a downlink 5GMS streaming manifest, for example a DASH MPD or HLS playlist.

NOTE: The support of multiple manifests for the same media streaming session is not covered in 5GMS. Hybrid DASH/HLS is supported in eMBMS. Usage together with 5GMS is left to implementation.

#### 4.X.3.4 Usage of MBS-6

The MBSF Client operates according to the procedures defined in clause 6.3 of TS 26.347 [20] at reference point MBMS-API-C when communicating with the 5GMSd Client.

The MBSF Client exposes information to the Media Session Handler to manage the reception of MBS User Services.

The Media Session Handler configures the MBSF Client for reception reporting.

The MBSF Client provides reception reports to the Media Session Handler.

#### 4.X.3.5 Usage of MBS-7

The MBSTF Client operates according to the procedures defined in clause 7 of TS 26.347 [20] at reference point MBMS-API-U when communicating with the 5GMSd Client.

The MBSTF Client provides the streaming manifest, as well as updates of the manifest, to the 5GMSd Client and implements policies for hybrid services based on clause 7 of TS 26.347 [20].

The MBSTF Client exposes fully- and partially-received media objects to the Media Player in the 5GMSd Client.

**===== CHANGE ===== (new clause, revisions against agreed S4-221140)**

## 5.X 5GMS via MBS

### 5.X.1 General

This clause defines procedures for different use cases and scenarios when 5GMS is using MBS for delivery as introduced in clause 4.X.

### 5.X.2 Procedures for 5GMS content delivered exclusively via MBS

In this case, 5GMS media data is exclusively delivered via MBS, i.e. media content is not delivered via reference point M4d, but only via MBS User Services. MBS-4-UC may be used. The 5GMSd Client acts as an MBS-Aware Application.

The call flow in Figure 5.X.2 1 extends the call flow defined in clause 5.3.2 to address the delivery of 5GMS media data exclusively via MBS. Aspects specific to this use-case are indicated in bold.



Figure 5.X.2-1: High-level procedure for DASH content delivery via MBS

Prerequisites (step 0):

- The 5GMSd Application Provider has provisioned the 5G Media Streaming System, including content ingest **and the authorization to distribute 5GMS content via MBS**.

- **The 5GMS AF has informed the MBSF about the availability of 5GMS content** by provisioning an MBS service **and has obtained relevant information from the MBS Service Announcement (such as the MBS service identifier).**

- The MBSF is ingesting content **from the 5GMS AS**, using either pull mode or push mode.

- The MBSF has broadcast the MBS Service Announcement, **including an indication that the content is 5GMS content**.

Steps:

1: The 5GMSd-Aware Application triggers the Service Announcement procedure and the 5GMS Service and Content Discovery procedure at reference point M8.

2: A media content item is selected.

3: The 5GMSd-Aware Application triggers the 5GMSd Client to start media playback. The Media Player Entry documents are provided to the 5GMSd Client.

4: If the 5GMS-Aware Application has received only a reference to the Service Access Information (see step 1), the Media Session Handler interacts with the 5GMSd AF to acquire the whole Service Access Information. **This includes relevant information from the MBS Service Announcement (such as the MBS service identifier) in order to bootstrap reception of the MBS service.**

**5-11: The Media Session Handler acts as an MBS-Aware Application and initiates service acquisition. For details, see TS 26.347 [18]. This establishes a transport session for the MPD and the Content.**

NOTE: The MPD and Initialization Segment(s) are forwarded by the MBS Client to the Media Server to enable their subsequent delivery to the Media Player upon request.

12: The Media Session Handler provides the MPD URL to the Media Player either directly or through the 5GMSd-Aware Application.

13: The Media Player is invoked to start media access and playback.

14: The Media Player retrieves the Media Player Entry resource (an MPD) from the proxy Media Server.

15: The Media Player processes the retrieved MPD. It determines, for example, the number of transport sessions needed for media acquisition. The Media Player should be able to use the MPD information to initialize the media pipelines for each media stream (see step 18). When DRM is used (see step 17) the MPD should also contain sufficient information to initialize the DRM client.

16: The Media Player notifies the Media Session Handler about the start of a new downlink media streaming session. The notification may include parameters from the MPD.

17: Optional: The Media Player acquires any necessary DRM information, for example a DRM License.

18: The Media Player configures the media playback pipeline.

19: The Media Player retrieves initialization segment(s) referenced by the MPD.

**20-25: Content is delivered using DASH-over-MBS. Session Announcement updates are provided to the MBS Client as necessary. MPD updates and Segments are pushed to the media server. The Media Player retrieves media segments from the proxy Media Server according to the MPD and forwards them to the appropriate media rendering pipeline.**

### 5.X.3 5GMS Consumption Reporting procedures for MBS

In this case, 5GMS consumption reporting is used to report consumption of 5GMSd content via an MBS service.

NOTE: MBS consumption reporting is disabled in this case.

The call flow in Figure 5.X.3‑1 extends the call flow defined in clause 5.6.1 to address consumption reporting. Aspects specific to this use-case are indicated in bold.



Figure 5.X.3-1: Consumption reporting for 5GMS via MBS

Prerequisites (step 0):

- The 5GMSd Application Provider has provisioned the 5G Media Streaming System, including content ingest, consumption reporting **and the permission to distribute 5GMS content via MBS**.

- The MBSF is ingesting content **from the 5GMS AS**, using either pull mode or push mode.

- MBS media delivery is established.

- Consumption reporting is established.

Steps:

The user preferences relating to consumption reporting may be changed:

1: The 5GMSd-Aware Application selects/changes the user preferences.

2: The Media Player transmits consumption reporting user preferences to the Media Session Handler.

The first phase is initialisation.

3: The 5GMSd-Aware Application is started.

4: A media content item is selected.

5: The 5GMSd-Aware Application triggers the Media Session Handler to start content playback. The Media Player Entry is provided.

6: If the 5GMS-Aware Application has received only a reference to the Service Access Information, the Media Session Handler interacts with the 5GMSd AF to acquire the whole Service Access Information. **This includes a client consumption reporting configuration** including parameters such as reporting frequency.

**7: The MBS service is initiated.**

8: The Media Session Handler triggers consumption reporting in the Media Player.

9: The Media Session Handler starts the Media Player with the Media Player Entry.

The second phase is media playback.

When media is playing, the consumption reporting parameters may be updated by the 5GMSd AF.

10: The Media Session Handler acquires updated Service Access Information from the 5GMSd AF including updated consumption reporting parameters.

When media is playing:

**11:** Media content is accessed through different networks, **possibly via MBS** or unicast.

12: The Media Player transmits information about the media streaming resources consumed to the Media Session Handler, **including the source of the media**.

13: The Media Session Handler regularly sends consumption report(s) to the 5GMSd AF, **including information about the delivery network from which the media was acquired**.

**14: The Media Player provides an update to the Media Session Handler about the consumed media streaming resources, for example a change in the delivery network.**

The last phase is to stop the media:

15: The 5GMSd-Aware Application triggers the Media Session Handler to stop content playback.

16: The Media Session Handler stops the Media Player.

17: The Media Session Handler stops consumption reporting in the Media Player.

18: The Media Session Handler may send final consumption report(s) to the 5GMSd AF.

### 5.X.4 5GMS Metrics Reporting procedures for MBS

In this case, 5GMS metrics reporting is used to report 5GMS and MBS metrics to the 5GMSd AF.

NOTE: MBS metrics reporting is disabled in this case.

The call flow in Figure 5.X.4‑1 extends the call flow defined in clause 5.5.3 to address metrics reporting. Aspects specific to this use-case are indicated in bold.



Figure 5.X.4-1: Metrics reporting for 5GMS via MBS

Prerequisites (step 0):

- The 5GMSd Application Provider has provisioned the 5G Media Streaming System, including content ingest, metrics reporting **and the permission to distribute 5GMS content via MBS**.

- The MBSF is ingesting content **from the 5GMS AS**, using either pull mode or push mode.

- MBS media delivery is established.

- Metrics reporting is established.

Steps:

The user preferences relating to metrics reporting may be changed:

1: The 5GMSd-Aware Application selects/changes the user preferences.

2: The Media Player transmits metrics reporting user preferences to the Media Session Handler.

The first phase is initialisation.

3: The 5GMSd-Aware Application is started.

4: A media content item is selected.

5: The 5GMSd-Aware Application triggers the Media Session Handler to start content playback. The Media Player Entry is provided.

6: If the 5GMS-Aware Application has received only a reference to the Service Access Information, the Media Session Handler interacts with the 5GMSd AF to acquire the whole Service Access Information. **This includes a client metrics reporting configuration** including parameters such as reporting frequency.

**7: The MBS service is initiated.**

8: The Media Session Handler **triggers metrics collection by the MBS Client** and by the Media Player.

9: The Media Session Handler starts the Media Player with the Media Player Entry.

The second phase is media playback.

When media is playing, the metrics reporting parameters may be updated by the 5GMSd AF.

10: The Media Session Handler acquires updated Service Access Information from the 5GMSd AF including updated metrics reporting parameters.

When media is playing:

**11:** Media content is accessed through different networks, **possibly via MBS** or unicast.

**12: The Media Player provides DASH metrics to the Media Session Handler.**

**13: The MBS Client provides MBS metrics to the Media Session Handler using MBS-API-C.**

14: The Media Session Handler regularly sends metrics report(s) to the 5GMSd AF, **including information about the delivery network from which the media was acquired**.

The last phase is to stop the media:

15: The 5GMSd-Aware Application triggers the Media Session Handler to stop content playback.

16: The Media Session Handler **stops metrics collection in the MBS Client** and the Media Player.

17: The Media Session Handler stops metrics reporting.

18: The Media Session Handler may send final metrics report(s) to the 5GMSd AF.

### 5.X.5 Procedures for Hybrid Services: 5GMS content delivery via 5G System and MBS

#### 5.X.5.1 General

Hybrid services refer to the case for which a basic service is available on MBS and at the same time on unicast. The service on unicast may be richer and extended and may provide additional user experiences. For the hybrid use cases, the content is statically provisioned on different delivery networks.

Hybrid services predominantly refer to the case for which the delivery manifest differentiates between resources accessible on unicast via M4d and resources accessible through MBS, in this case through MBS-API-U.

These resources are differentiated in the delivery manifest through different DNs, for example different Base URLs in DASH MPDs, or in HLS by providing different pathways. The 5GMS Client, in particular the Media Player in collaboration with the Media Session Handler and the MBS Client, dynamically selects the delivery network from which to acquire media content according to reception conditions, user preferences or other policies. Content is provisioned such that the 5GMS Client is able to provide a seamless user experience when switching between different delivery networks.

The call flow in Figures 5.X.5-1, 5.X.5 2 and 5.X.5 3 extends that defined in clause 5.6.1 to address generic hybrid use cases. Specific additional use cases are presented in the remainder of clause 5.X.5.



Figure 5.X.5-1: High-level procedure for hybrid delivery of DASH content

Steps:

1: The 5GMSd Application Provider triggers 5GMS provisioning and permits hybrid distribution of the media content.

2: As a consequence, the 5GMSd AF provisions MBS delivery. The MBS Delivery Session is set up.and the BM SC informs the 5GMS AF about the content ingest endpoints.

3: The 5GMSd AS modifies the Media Player Entry (typically a media presentation manifest) under the direction of the 5GMSd AF to indicate that content is available either on a the MBS Client's local Media Server or on 5GMSd AS.

4: The modified presentation manifest and the ingest endpoints are provided to the 5GMSd Application Provider. The manifest may also be updated by the 5GMSd Application Service Provider.

5: The media content is announced to the 5GMSd-Aware Application and the application requests the entry points for the service.

6: The 5GMSd AS begins ingesting content from the 5GMSd Application Provider and the BM SC may, in turn, begin ingesting this content from the 5GMSd AS.



Figure 5.X.5-2: High-level procedure for hybrid delivery of DASH content (continued)

7: The BM SC starts one or more MBS Delivery Sessions.

8: The media content is selected by the 5GMSd-Aware Application.

9: The application initiates the media streaming session through Media Session Handler.

10: The Media Session Handler initiates the MBS streaming services.

11: The media session handler through the information from the MBS Client informs the 5GMSd-Aware Application that the service is ready.



Figure 5.X.5-3: High-level procedure for hybrid delivery of DASH content (continued)

12: The 5GMSd-Aware Application starts media playback.

13: The Media Player Entry (typically a media presentation manifest ) is acquired by the Media Player. It may be available from the local Media Server (populated by the MBS Client) or from the 5GMSd AS, or even from both.

14: The Media Player processes the Media Player Entry and identifies that content is available from different data networks (the local Media Server and the 5GMSd AS).

15: Under the control of the 5GMSd-Aware Application, the Media Player selects the content and different content options.

16: The Media Player continuously checks with the Media Session Handler - and possibly forwarded to the MBS Client if the MBS User Service data is available - how to use the different content. This depends on the hybrid scenario. Different policies may be considered.

17: The Media Player requests initialization information either from the local Media Server or from the 5GMSd AS. The Media Player repeats this step for each required initialization segment.

18: The Media Player receives the initialization information.

19: The Media Player requests media segments according to the Media Player Entry, either from the local Media Server or from the 5GMSd AS.

20: The Media Player receives media segments and puts the information into the appropriate media rendering pipeline.

 Steps 13-20 are repeated according to the Media Player Entry information.

#### 5.X.5.2 Interactive service

In a specific hybrid scenario, an interactive service may be provided via 5GMS while the main media content resources are delivered via MBS exclusively. In this case, the following instantiations apply:

- In step 2, the media presentation manifest (MPD) only points to content in the local Media Server.

- Step 13 as well as steps 17-20 are all terminated on the local Media Server.

#### 5.X.5.3 Session continuity

In a specific hybrid scenario, the service is made available via both 5GMS and MBS delivery networks, but only one Representation of each Adaptation Set is provided via MBS. In this case, the following instantiations apply:

- In step 2, one Representation of each Adaptation Set is distributed via MBS.

- As long as the streaming service is accessible over MBS, the Media Player selects the media content in step 13 as well as steps 17-20 from the local Media Server; content is not available from the 5GMSd AS.

- If the streaming service becomes unavailable via MBS, the Media Player switches to accessing the media content in step 13 as well as steps 17-20 from the 5GMSd AS.

- Once the streaming service becomes available again via MBS, the Media Player switches back to accessing the media content in step 13 as well as steps 17-20 from the local Media Server.

#### 5.X.5.4 Time-shifted viewing

In a specific hybrid scenario, the service is made available via both 5GMS and MBS delivery networks, but only one Representation of each Adaptation Set is provided via MBS. The content is retained by the 5GMS AS for a period of time to support time shifted access. In this case, the following instantiations apply:

- In step 2, one Representation is of each Adaptation Set is distributed via MBS.

- If the streaming service is accessible via MBS and the user is consuming content at the live edge, the Media Player selects the media content in the step 13 as well as steps 17-20 from the local Media Server; content is not available from the 5GMSd AS.

- If the user switches to time-shift viewing mode or streaming service becomes unavailable via MBS, the Media Player switches to accessing the media content in the step 13 as well as steps 17-20 from the 5GMSd AS.

- Once the streaming service becomes available again via MBS and the user returns to the live edge, the Media Player switches back to accessing the media content in the step 13 as well as steps 17-20 from the local Media Server.

#### 5.X.5.5 Content or component replacement

In a specific hybrid scenario, the service is made available via both 5GMS and MBS delivery networks, but only one Representation of selected Adaptation Sets is provided via MBS. Some Adaptation Sets are only available via 5GMS. In another case, two or more content alternatives may exist for a period of time, but only one alternative is provided over MBS.

In this case, the following instantiations apply:

- In step 2, the MPD is generated to define the different content alternatives.

- If the streaming service is accessible over MBS and the user watches content available on broadcast, the Media Player selects the media content in step 13 as well as steps 17-20 from the local Media Server; content is not available from the 5GMSd AS.

- If the user switches content or content components, the Media Player switches to accessing the media content in the step 13 as well as steps 17-20 from the 5GMSd AS. If only a component is replaced, the Media Player accesses media content from the local Media Server and the 5GMSd AS at the same time.

### 5.X.6 Procedures for dynamic provisioning of 5GMS content delivery via MBS

#### 5.X.6.1 General

In this scenario the same content is distributed via MBS and via a 5GMS System. The resources of the MBS system are statically configured. MBS-based distribution may, for example, be used only for services in high demand, and the resources and quality of the service distributed through broadcast may be adjusted according to demand. Demand may be identified through 5GMS Consumption Reporting.

The call flow in Figures 5.X.6 1 and 5.X.6 2 extends that defined in clause 5.6.1 to address generic use cases for broadcast-on-demand. Specific additional use cases are presented in the remainder of clause 5.X.6.



Figure 5.X.6.1-1: High-level procedure for DASH content delivered via MBS on-demand

Steps:

1: The 5GMS Application Provider provisions one or more MBS services and permits broadcast distribution of the media content.

2: As a consequence, the 5GMSd AF provisions MBS delivery and the BM SC informs the 5GMS AF about the resources it will use to ingest media content.

NOTE: This step may happen later, up to (and possibly as part of) step 15, for example only when demand is identified.

3: The media content is announced to the 5GMSd-Aware Application and the application request the entry points for the service.

4: The 5GMSd AS starts to ingest content from the 5GMSd Application Provider.

5: Consumption Reporting is applied for the 5GMSd session.

Media playback initially uses unicast 5G Media Streaming:

6: The media content is selected by the 5GMSd-Aware Application.

7: The 5GMSd-Aware Application triggers the start of media playback by the Media Player.

8: The media presentation manifest (e.g. DASH MPD) is requested by the Media Player from the 5GMSd AS.

9: The Media Player processes the media presentation manifest and identifies that the media content is available on the 5GMS AS

10: The Media Player, under the control of the application, selects the media content and different content options.

11: Media content is received from the 5GMSd AS via reference point M4d.

12: The Media Player informs the Media Session Handler about the consumed media content.

13: The Media Session Handler sends consumption reports to the 5GMSd AF.

Subsequently, media playback switches to MBS:

14: By analysing the consumption reports submitted to it in the previous step, the 5GMSd AF identifies a high level of demand for the service.

15: Additional MBS delivery sessions are provisioned to add delivery of the service via MBS.

16: The BM SC starts ingesting media content from the 5GMSd AS.

17: MBS delivery starts.

18: The 5GMSd AF informs the Media Session Handler that MBS delivery is initiated and provides the Service Success Information.

19: MBS content reception is initiated by the Media Session Handler.

20: Once the service is ready, the content delivered on MBS is used by the Media Player. Consumption reporting continues. Specific cases may use different policies, similar to the hybrid case in clause 5.X.5.



Figure 5.X.6.1-2: High-level procedure for DASH content delivered via MBS-on-demand (continued)

#### 5.X.6.2 Operation modes

At least the following operation modes are supported based on the general procedures in clause 5.X.6.1:

1. Every 5GMS media service is mapped to exactly one MBS User Service. Whether the MBS User Service is announced and delivered or not depends on service demand. The MBS Delivery Session is adjusted dynamically - for example the Delivery Session is disabled, or the bit rate is changed - depending on service demand and/or content requirements.

2. A set of MBS User Services and MBS Delivery Sessions is defined in the initial provisioning. 5GMS media services are dynamically mapped to statically configured MBS User Services based on demand and content requirements.

3. Components of the 5GMS User Service, for example audio service components for different languages, are assigned dynamically to MBS delivery depending on demand.