**3GPP TSG- Meeting #**

**, , - revision of S4aI230082**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2023-04-11 |
|  |  |  |  |  |
| ***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:2. End-to-end low latency live streaming:- Inclusion of the collaboration scenarios and call flows for end-to-end low latency live streaming.- Updating the reference point to support low latency live streaming services.- Inclusion of the typical operational points. |
|  |  |
| ***Summary of change:*** | The CR addresses the above objectives by addinga) one call flow into that documents provisioning, ingest, distribution, presentation and monitoring aspects of low-latency live streaming services using CMAF Chunks.b) Updates to reference points to support provisioning, ingest, distribution, presentation and monitoring aspects of low-latency live services using CMAF Chunks.c) Typical configurable service parameters and operation points in terms of bit rates, latencies, Audience Drift Gaps, etc. |
|  |  |
| ***Consequences if not approved:*** | Work Item objectives not complete |
|  |  |
| ***Clauses affected:*** | 2, 3.1, 4.2.3, 5.3.1, 5.7.6 (new), 5.7.7 (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | **Draft CRs****Revision 1 in S4-221125 was agreed as basis for future work****Revision 2 in S4aI221371 just cleans the agreements in S4-221125 and is proposed as basis for future work during the telcos.**

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| [**S4aI221371**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI221371.zip) | [5GMSA\_Ph2] End-to-end low latency live streaming | Qualcomm incorporated | Thomas Stockhammer |

**Revisions*** none

**Presenter**: Thomas Stockhammer (Qualcomm)**Discussion**: * Thomas: Implements baseline agreed in S4-221125 only; no further changes yet. We can show updates using revision marks in a future revision of this contribution.
* Thorsten: Likes this approach.
* Thomas: Low latency can work on OTT. How to highlight the parts becoming possible using 5GMS, e.g. activating QoS?
* Thomas: Want to make use of Dynamic Policies and Service Operation Point signalling. The description in TS 26.501 at present isn’t sufficient. Idea is to focus first on the Dynamic Policies clause. Then use this to maintain latency and bit rate requirements.
* Thorsten: Chunk-based ingest can be done OTT. Service Operation Point gives guidance to Media Player or Media Session Handler which representation achieves a certain latecy, for example. If you pick one of these, what is needed to get the benefit that would make the use of 5GMS worthwhile rather than just OTT? Need more than just the DASH-IF specification for ingest.
* Thomas: Agrees. Focus initially on Service Operation Point signalling. Stage 3 then follows.

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

**S4aI221371** is **agreed.**

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| [**S4-221309**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_121_Toulouse/Docs/S4-221309.zip) | [5GMSA\_Ph2] Downlink Streaming to Media Players with Different Manifests | Qualcomm incorporated | Thomas Stockhammer |

  **Presenter:** Thomas Stockhammer (Qualcomm)**Online Discussion:*** None.

**Decision:*** Agreed as basis for further work.

**S4-221309** is **endorsed.**

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| [S4aI230004](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI230004.zip) | [5GMSA\_Ph2] End-to-end low latency live streaming | Qualcomm incorporated | Thomas Stockhammer |

**E-mail Discussion**: none **Revisions**: none**Presenter**: Thomas Stockhammer (Qualcomm); Thomas indicates the change as proposed only addresses bugs on cover page of original CR; more work is needed and to come.**Online Discussion**:* None

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

**S4aI230004** is **noted.****The revision addresses primarily the requested fixes on the cover page**

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| [S4-230080](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/TSGS4_122_Athens/Docs/S4-230080.zip) | [5GMSA\_Ph2] End-to-end low latency live streaming | Qualcomm incorporated | Thomas Stockhammer |

**Presenter**: Thomas Stockhammer **Online Discussion**:* rev2 presented.
* Richard: Picture showing cardinality would be useful.
* Thorsten: Why does this service description arrive in step 12? It is only one deployment option.
	+ Thomas: The low latency indication is part of the MPD. You only operate on available information. But we can indeed have variants.
* Frederic: Can we use it as the basis for further work?
* Iraj: I take 2 action points:
	+ Correct Media Entry point to only include the pointer to document and not the document itself
	+ Define the cardinality of service operation points wrt to one or more multiple media entry points.

**Decision**: Revised to 287. 287 will go to the plenary.**S4-230287 was endorsed at SA4#122.**This version addresses1. Aligned with 18.1.0
2. Further small bug fixes

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| --- | --- | --- | --- |
| [**S4aI230082**](https://www.3gpp.org/ftp/TSG_SA/WG4_CODEC/3GPP_SA4_AHOC_MTGs/SA4_MBS/Docs/S4aI230082.zip) | [5GMSA\_Ph2] End-to-end low latency live streaming | Qualcomm Incorporated, BBC, Tencent | Thomas Stockhammer |

**E-mail Discussion**: none**Revisions**: none**Presenter**: Thomas Stockhammer**Online Discussion**:* It was commented that this document was submitted after the deadline, however other submissions also came late (including -084).
* Iraj: does the note on cardinality exist as is from previous meeting?
* Thomas: it has not changed, however has updated diagram.

**Decision**: Agreed as a basis for further work.**S4aI230082** is **endorsed**. |

**===== 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] DASH-IF: "IOP Guidelines v5, Low-latency Modes for DASH", available here: <https://dash-industry-forum.github.io/docs/CR-Low-Latency-Live-r8.pdf>

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

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**5GMS System:** An assembly of Application Functions, Application Servers and interfaces from the 5G Media Streaming architecture that support either downlink media streaming services or uplink media streaming services, or both.

NOTE 1: The components of a 5GMS System may be provided by an MNO as part of a 5GS and/or by a 5GMS Application Provider.

**5GMS Application Provider:** A party that interacts with functions of the 5GMS System and supplies a 5GMS-Aware Application that interacts with functions of the 5GMS System.

**5GMS-Aware Application:** Application in the UE, provided by the 5GMS Application Provider, that contains the service logic of the 5GMS application service, and interacts with other 5GMS Client and Network functions via the interfaces and APIs defined in the 5GMS architecture.

NOTE 2: Functionality of the 5GMS-Aware Application is outside the scope of this specification.

NOTE 3: A 5GMS-Aware Application associated with the delivery of either a downlink or uplink related 5GMS service is referred to as a 5GMSd-Aware Application or a 5GMSu-Aware Application, respectively.

**5GMS Client:** A UE function that is either a 5GMSd Client or a 5GMSu Client, or both.

**5G Media Streaming Client for downlink (5GMSd Client):** UE function that includes at least a 5G Media Streaming Player and a Media Session Handler for downlink streaming and that may be accessed through well-defined interfaces/APIs.

**5G Media Streaming Client for uplink (5GMSu Client):** Originator of 5GMSu service that includes at least a Media Streamer and a Media Session Handler for uplink streaming and that may be accessed through well-defined interfaces/APIs.

**5GMSu Media Streamer:** UE function that enables uplink delivery of streaming media content to an Application Server function of the 5GMS Application Provider, and which interacts with both the 5GMSu-Aware Application for media capture and subsequent streaming, and the Media Session Handler for media session control.

NOTE 4: The 5GMSu Media Streamer receives a Media Streamer Entry to initiate an uplink streaming session.

NOTE 5: The 5GMSu Media Streamer captures the media on the provided input devices. The 5GMSu Media Streamer exposes some basic controls such as capture, pause, and stop to the 5GMSu-Aware Application.

**Dynamic policy:** A Dynamic PCC Rule (c.f. TS 23.503[4]) for an uplink or downlink application flow during a media session.

**Egest Session**: An uplink media streaming session from the 5GMSu AS towards the 5GMSu Application Provider.

**Ingest Session:** Asession to upload the media content into a 5GMSd AS.

**Policy Template:** A collection of (semi-static) PCF/NEF API parameters which are specific to the 5GMS Application Provider and also the resulting PCC Rule.

**Policy Template Id**: Identifies the desired policy template, which is used by 5GMSd AF to select the appropriate PCF/NEF API towards the 5G System so that the PCF can compile the desired PCC Rule.

**Media Player Entry:** a document or a pointer to a document that defines a media presentation e.g. MPD for DASH content or URL to a video clip file.

**Media Session Handler:** UE function that communicates with the 5GMS AF in order to establish and control the delivery of a streaming media session in the downlink or uplink direction, and which also exposes APIs to the 5GMS-Aware Application and to the Media Player (for downlink streaming) or the Media Streamer (for uplink streaming).

**Media Streamer Entry:** A pointer (e.g. in the form of a URL) that defines an entry point of an uplink media streaming session.

**media streaming session:** A session initiated by a 5GMS-Aware Application that involves one or more media streams being delivered between the 5GMS AS and the 5GMS Client via reference point M4.

**presentation entry:** A document or a pointer to a document that defines an application presentation e.g. an HTML5 document as defined in e.g. TS 26.307 [6].

**Provisioning Session:** a data structure supplied at interface M1 by a 5GMS Application Provider that configures the 5GMS features relevant to a set of 5GMS-Aware Applications.

**5GMSd Media Player:** UE function that enables playback and rendering of a media presentation based on a media player entry and exposing some basic controls such as play, pause, seek, stop to the 5GMSd-Aware Application.

NOTE 6: A 5GMSd Media Player is expected to include a Media Access Client, Media Decoders, Media rendering/presentation, and possibly also a DRM Client , a Consumption Measurement and Logging Client and a Metrics Measurement and Logging Client.. The 5GMSd Media Player's Media Access Client receives a Media Player Entry. The 5GMSd Media Player renders the media on the provided output devices, such as a display in case of video.

NOTE 7: The 5GMSd Media Player is functionally similar to the combination of a TS 26.247 [7] 3GP-DASH client and a TS 26.234 [8] PSS media decoder and renderer.

**Service Access Information**: Set of parameters and addresses that are needed by a 5GMS Client to activate the reception of a downlink media streaming session or the transmission on an uplink media streaming session, perform dynamic policy invocation, consumption reporting and/or metrics reporting, and request AF-based network assistance.

**Service and Content Discovery:** Functionality and procedures provided by a 5GMSd Application Provider to a 5GMS-Aware Application that enables the end user to discover the available streaming service and content offerings and select a specific service or content item for access.

NOTE 8: The Service and Content Discovery functionality and procedures are outside the scope of this specification.

**Service Announcement**: Procedures conducted between the 5GMS-Aware Application and the 5GMS Application Provider such that the 5GMS-Aware Application is able to obtain 5GMS Service Access Information, either directly or in the form of a reference to that information.

**Service Data Flow:** As defined in TS 23.503 [4] ("An aggregate set of packet flows carried through the UPF that matches a service data flow template").

**Service Data Flow Description:** A set of parameters and/or parameter ranges used by the 5GMS AF to create a Service Data Flow Template.

**Service Description**: A set of parameters and/or parameter ranges describing the requirements of the streaming service used by the Media Player to follow the service requirements and associated with a Service Operation Point.

**Service Operation Point**: A set of parameters and/or parameter ranges and used by the 5GMS AF to determine dynamic policies and QoS parameters based on the Service Description.

**third party player:** Part of an application that uses APIs to exercise selected 5GMSd functions to play back media content.

NOTE 9: Such APIs are for example defined in TS 26.307 [6] when using the Media Source Extensions for media playback. This type of player is downloaded by or built into an application, or it is downloaded with the Presentation Entry (e.g. as a JavaScript library).

**third party uplink streamer:** Part of an application that uses APIs to exercise selected 5GMSu functions to capture and stream media content.

NOTE 10: This type of streamer is typically implemented as downloadable software.

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

### 4.2.3 Service Access Information for Downlink Media Streaming

The Service Access Information is the set of parameters and addresses which are needed by the 5GMSd Client to activate and control the reception of a downlink streaming session, and to report service/content consumption and/or QoE metrics.

The Service Access Information may be provided together with other service announcement information using M8d. Alternatively, the 5GMSd Client fetches the Service Access Information from the 5GMSd AF. Regardless of how it is provided, the Service Access Information contains different information, depending on the collaboration model between the 5GMS System and the 5GMSd Application Provider, and also depending on offered features. Baseline parameters are listed in Table 4.2.3‑1 below:

Table 4.2.3-1: Parameters of baseline service access information

|  |  |
| --- | --- |
| Parameters | Description |
| Provisioning Session identifier | Unique identification of the M1d Provisioning Session. |

When the content hosting feature is activated for a downlink streaming session, the parameters from Table 4.2.3-1a below can additionally be present.

Table 4.2.3-1a: Streaming Access parameters

|  |  |
| --- | --- |
| Parameters | Description |
| Media Player Entries | A set of pointers to documents that each define an equivalent media presentation (see NOTE), e.g. MPD for DASH content or URL to a video clip file.Each member of the set may specify additional details to aid selection by the MBMS Client, including content type, profile indicators and precedence. |
| Service Operation Points | Sets of media streaming parameters, such as bit rate and target latency, each set being associated with a provisioned Policy Template and with a Service Description in a Media Player Entry document. |
| NOTE: An equivalent media presentation is one which has the same content but may result in a different Quality of Experience. |

When the consumption reporting feature is activated for a downlink streaming session, the parameters from Table 4.2.3‑2 below are additionally present.

Table 4.2.3-2: Parameters for consumption reporting configuration

|  |  |
| --- | --- |
| Parameters | Description |
| Reporting interval | Identifies the interval between consumption reports being sent by the Media Session Handler. |
| Server address  | A list of 5GMSd AF addresses where the consumption reports are sent by the Media Session Handler. |
| Sample percentage | The proportion of clients that shall report media consumption.If not specified, all clients shall send reports. |
| Location reporting | Identify whether the Media Session Handler provides location data to the 5GMSd AF (in case of MNO or trusted third parties) |

When the dynamic policy invocation feature is activated for a downlink streaming session the parameters from Table 4.2.3‑3 below are additionally present.

Table 4.2.3-3: Parameters for dynamic policy invocation configuration

|  |  |
| --- | --- |
| Parameters | Description |
| Server address | A list of 5GMSd AF addresses (in the form of opaque URLs) which offer the APIs for dynamic policy invocation sent by the 5GMS Media Session Handler. |
| Valid Policy Template Ids | A list of Policy Template identifiers which the 5GMSd Client is authorized to use. |
| Service Data Flow Methods | A list of recommended Service Data Flow description methods (descriptors), e.g. 5-Tuple, ToS, 2-Tuple, etc, which should be used by the Media Session Handler to describe the Service Data Flows for the traffic to be policed. |
| External reference | Additional identifier for this Policy Template, unique within the scope of its Provisioning Session, that can be cross-referenced with external metadata about the streaming session. |

When the metrics collection and reporting feature is activated for a downlink streaming session, one or more parameter sets for metrics configuration, according to Table 4.2.3‑4, are additionally present. Each metrics configuration set contains specific settings valid for that configuration, which is typically metric scheme dependent, and collection and reporting shall be done separately for each set.

Table 4.2.3-4: Parameters for each metrics configuration set

|  |  |
| --- | --- |
| Parameters | Description |
| Scheme | The scheme associated with this metrics configuration set. A scheme may be associated with 3GPP or with a non-3GPP entity. If not specified, a default 3GPP metrics scheme shall apply.Metrics schemes shall be uniquely identified by URIs. |
| Server address | A list of 5GMSd AF addresses to which metric reports shall be sent for this metrics configuration set. |
| DNN | The Data Network Name (DNN) which shall be used when sending metrics report for this metrics configuration set.If not specified, the default DNN shall be used. |
| Slice scope | A list of network slice(s) for which metrics collection and reporting shall be executed for this metrics configuration set.If not specified, the metrics collection and reporting shall be done for all network slices. |
| Reporting interval | The sending interval between metrics reports for this metrics configuration set.If not specified, a single final report shall be sent after the streaming session has ended. |
| Sample percentage | The proportion of streaming sessions that shall report metrics for this metrics configuration set.If not specified, reports shall be sent for all sessions. |
| Streaming source filter | A list of content URL patterns for which metrics reporting shall be done for this metrics configuration set.If not specified, reporting shall be done for all URLs. |
| Metrics | A list of metrics which shall be collected and reported for this metrics configuration set.For progressive download and DASH streaming services, the listed metrics are associated with the 3GPP metrics scheme and shall correspond to one or more of the metrics as specified in clauses 10.3 and 10.4, respectively, of TS 26.247 [7].In addition, for the 3GPP metrics scheme as applied to DASH streaming, the quality reporting scheme and quality reporting protocol as defined in clauses 10.5 and 10.6, respectively, of [7] shall be used.If not specified, a complete (or default if applicable) set of metrics will be collected and reported. |

When 5GMSd AF-based Network Assistance is activated for a downlink streaming session the parameters from Table 4.2.3‑5 below shall be additionally present.

Table 4.2.3-5: Parameters for 5GMSd AF-based Network Assistance configuration

|  |  |
| --- | --- |
| Parameters | Description |
| Server address | 5GMSd AF address that offers the APIs for 5GMSd AF-based Network Assistance, accessed by the 5GMSd Media Session Handler. The server address shall be an opaque URL, following the 5GMS URL format. |

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

### 5.3.1 Domain model

The M1d baseline domain model is depicted in Figure 5.3.1-1 overleaf. It consists of a Provisioning Session, which contains at least one of the following:

- A Content Hosting Configuration,

- A Consumption Reporting Configuration which defines consumption measurement, logging, collection and reporting functionality,

- A Policy Template,

- A Metrics Reporting Configuration which defines QoE metrics measurement, logging, collection and reporting functionality,

- An *Edge Resources Configuration* specifying the requirements for edge processing as defined in TS 23.548 [15] and TS 23.558 [16] in support of the Provisioning Session, including eligibility criteria that indicate the circumstances in which edge computing is to be used for Media Streaming sessions associated with this Provisioning Session and parameters indicating the tolerance of the application for relocation of the Edge AS, or

- An *Event Data Processing Configuration* which contains data manipulation instructions to be performed on UE data by the Data Collection AF including, but not limited to, reporting format conversion, data normalisation, domain-specific anonymisation of data and (dis)aggregation of data into exposed events. This entity includes one or more *Data Access Profiles*, each one defining a specific access level for controlling the event information exposed to an event consumer.

Each Provisioning Session is uniquely identified within the 5GMS System by a Provisioning Session identifier.

When a certain 5GMS feature is selected, the 5GMSd AF compiles the resulting Service Access Information so that the 5GMSd Client can access the services via M4d and/or M5d.



Figure 5.3.1-1: M1d provisioning domain model

Editor’s Note: Update diagram adding the details of the cardinality of the Media Player Entries, Service Description and Operation Point needs to be done. This to be completed once the details of the Multiple Entry Points is completed. For example, can the Service Operation Points be of the Streaming Access Parameters? If so then Available Service Operation Points may be passed to the Media Player after Step 5, and not after step 12 The domain model probably belongs earlier on in clause 4, before this clause about downlink Service Access Information.

Basic issue to be implemented:

* + Every Entry Point may have assigned one or multiple Service Descriptions.
	+ Different Entry points may share a service description.
	+ Every Service Description is assigned to one Operation Point

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

### 5.7.6 Dynamic Policy selection based on Service Operation Point signalling

This clause provides an extension to the general call flow in clause 5.2.3 in order to address the usage of Service Descriptions and Service Operation Points in downlink 5G Media Streaming services. Details are shown in figure 5.7.6‑1.



Figure 5.7.6-1: High-level procedure for DASH content for Operation Point handling

Prerequisites:

- The 5GMSd Application Provider has provisioned the content hosting feature in the 5G Media Streaming System.

- The 5GMSd-Aware Application has received the Service Announcement from the 5GMSd Application Provider.

Extended Steps:

1: Policy Templates are provisioned in the 5GMSd AF.

12: The Media Player informs the 5GMS-Aware Application about the set of Service Descriptions associated with the Media Player Entry document for the content selected in step 3.

13: The 5GMSd-Aware Application selects one of the available Service Descriptions.

14: The Media Player provides Service Operation Point parameters associated with the selected Service Description to the Media Session Handler.

15: The Media Session Handler selects a Dynamic Policy based on the provided Service Operation Point parameters, using an identifier to correlate the two.

21: The Media Player provides Service Description metrics to the Media Session Handler.

22: The Media Session Handler sends Service Operation Point measurements and events to the 5GMSd AF.

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

### 5.7.7 Use of Service Operation Point signalling to optimise delivery of low-latency live media streaming services (informative)

#### 5.7.7.1 5GMS System acts as a CDN

In this case, the specific aspects are as follows:

1) A provisioning agreement is struck between the 5GMSd Application Provider and the operator of the 5GMS System in the form of one or several Service Operation Points and/or Policy Templates. (Service Operation Points may be derived from Policy Templates if the latter are omitted, or *vice versa*.)

2) DASH or HLS content is provided externally. The content is published to the 5GMS System for distribution over downlink media streaming.

3) Content is ingested by the 5GMSd AS at reference point M2d such that the latency requirements can be met.

4) The 5GMS System distributes the ingested content according to the agreed Service Operation Points, i.e. meeting bit rate and latency requirements.

5) The Service Operation Point metrics collated by the 5GMSd AF are used by the 5GMS System to determine whether the agreed Service Operation Point has been satisfied, or whether the Policy Templates need to be adjusted so that it can be satisfied.

For low-latency streaming where the 5GMS System acts as a CDN, the basic call flow documented in clause 5.7.6 is extended as follows

Extended Steps:

1: Policy Templates suitable for supporting low-latency media streaming are provisioned in the 5GMSd AF.

2: Media ingest supports a low-latency protocol, e.g. segment content is provided in chunks.

14: 5GMSd-Aware Application selects a low-latency Service Description.

17: The Media Player configures itself for low-latency playback based on the low-latency Service Description selected in step 14.

21: The Media Player operates in a low-latency media delivery mode.

#### 5.7.7.2 5GMSd AS deployed in an external DN

In this case, the specific aspects are as follows:

1) A provisioning agreement is struck between the 5GMS Application Provider and the operator of the 5GMS System in the form of one or several Service Operation Points and/or Policy Templates. (Service Operation Points may be derived from Policy Templates if the latter are omitted, or *vice versa*.)

2) The 5GMSd AS external.

3) Content ingest by the 5GMSd AS is out of scope.

4) The 5GMS System distributes the content according to the agreed Service Operation Points, i.e. meeting bit rate and latency requirements.

5) The Service Operation Point metrics collated by the 5GMSd AF are used by the 5GMS System to determine whether the agreed Service Operation Point has been satisfied, or whether the Policy Templates need to be adjusted so that it can be satisfied.

For low-latency streaming where the 5GMSd AS is deployed in an external DN, the basic call flow documented in clause 5.7.6 is extended as follows

Extended Steps:

1: Policy Templates suitable for supporting low-latency media streaming are provisioned in the 5GMSd AF.

14: 5GMSd-Aware Application selects a low-latency Service Description.

17: The Media Player configures itself for low-latency playback based on the low-latency Service Description selected in step 14.

21: The Media Player operates in a low-latency media delivery mode.