**3GPP TSG- Meeting #**

**Geneva, , -** revision of S4aI250061

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| *CR-Form-v12.3* | | | | | | | | |
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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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| ***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:*** | | **Common Client Metadata**: While 3GPP and MPEG in DASH support DASH metrics, the reporting is not common to any player, for example all DASH players as well as HLS players. As an example, CTA WAVE has developed: CTA-5004: Web Application Video Ecosystem Common-Media-Client-Data (CMCD) with an excellent overview here: https://ottverse.com/common-media-client-data-cmcd/. It is worthwhile to study the benefits of integrating commonly supported metrics and client data reporting in 5GMS workflows. The focus is the integration of already defined metrics rather than developing new metrics. Examples of study include support of specific metric keys, player APIs, sending options from client to server (user plane, M5 reference point, EVEX), M3 reference point impact, as well as usage of the data in operations.  TR 26.804 has been updated with relevant key issues and conclusions in clause 7.3.1, stage-2 work has been recommended:  4. For *Common Client Metadata* as introduced in clause 5.16 and based on the conclusions in clause 6.16. | | | | | | | | |
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| ***Summary of change:*** | | for *Common Media Client Data (CMCD)* as introduced in clause 5.16 of TR 26.804:  i. Functional changes to the 5GMSd AF as outlined in clause 5.16.6.1.8,  ii. Functional changes to the 5GMSd AS as outlined in clause 5.16.6.1.9,  iii. Functional changes to the Media Player as outlined in clause 5.16.6.1.10,  iv. Functional changes to the Media Session Handler for downlink media streaming only as outlined in clause 5.16.6.1.11 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Feature not supported | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 1, 2, 3.3, 4.0.1, 4.0.14 (new), 4.2.1, 4.2.2, 4.2.3, 5.13 (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:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

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

# 1 Scope

The present document specifies the 5G Media Streaming (5GMS) architecture. The 5GMS supported services include MNO and third-party Downlink Media Streaming Services, and MNO and third-party Uplink Media Streaming Services. The 5GMS architecture supports related network and UE functions and APIs, backwards compatible functions for EUTRAN deployments (with and without MBMS) and 5G specific features.

NOTE: Support of 5G Media Streaming over MBMS with 5GC is not considered in the current version of the present document.

The 5GMS architecture is functionally divided into independent components enabling different deployments with various degrees of integration between 5G MNOs and Content Providers. It is specified as a set of extensions to TS 23.501 "System Architecture for the 5G System".

Many of the features defined in this document are motivated by the conclusions of TR 26.804 [26804].

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# 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*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System architecture for the 5G System (5GS)".

[3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[4] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[5] Void

[6] 3GPP TS 26.307: "Presentation layer for 3GPP services".

[7] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[8] 3GPP TS 26.234: "Transparent end-to-end Packet-switched Streaming Service (PSS); Protocols and codecs".

[9] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".

[10] 3GPP TS 28.530: "Management and orchestration; Concepts, use cases and requirements".

[11] 3GPP TS 28.531: "Management and orchestration; Provisioning".

[12] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[13] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[14] IETF RFC 1034: "Domain names - concepts and facilities".

[15] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[16] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[17] 3GPP TS 28.538: "Management and orchestration; Edge Computing Management".

[18] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".

[19] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[20] 3GPP TS 26.347: "Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL".

[21] 3GPP TS 26.348: "Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point".

[22] 3GPP TS 26.531: "Data collection and reporting; General description and architecture".

[23] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[24] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[25] CTA-5005: "Web Application Video Ecosystem – DASH-HLS Interoperability Specification".

[26] 3GPP TS 26.511: "5G Media Streaming (5GMS); Profiles, Codecs and Formats".

[27] ISO/IEC 23000-19: "Information Technology Multimedia Application Format (MPEG-A) – Part 19: Common Media Application Format (CMAF) for segmented media".

[28] IETF RFC 8216: "HTTP Live Streaming".

[29] ISO/IEC 23009-1: "Information Technology – Dynamic Adaptive Streaming Over HTTP (DASH) – Part 1: Media Presentation Description and Segment Formats".

[30] 3GPP TS 26.502: "5G Multicast-Broadcast User Service Architecture".

[31] Void.

[32] 3GPP TS 26.506: "5G Real-time Media Communication Architecture".

[33] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs".

[34] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

[35] IETF RFC 6749: "The OAuth 2.0 Authorization Framework", October 2012.

[26804] 3GPP TR 26.804: "Study on 5G media streaming extensions".

[29591] 3GPP TS 29.591: "Network Exposure Function Southbound Services; Stage 3".

## ===== 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.

**client data:** Static or dynamic data available in the 5GMS Client that may be of value to the 5GMS Application Provider for operational and/or analytics purposes.

**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 Entry Point:** A Media Player Entry for downlink media streaming or a Media Streamer Entry for uplink media streaming intended to be consumed by a 5GMS Media Stream Handler.

**Media Player Entry:** A document or a pointer to a document that defines a downlink media streaming presentation e.g. MPD for DASH content or URL to a video clip file intended to be consumed by a 5GMSd Media Player.

**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 intended to be consumed by a 5GMSu Media Streamer.

**media delivery session identifier:** A unique identifier assigned by the Media Session Handler to a media streaming session for the purpose of correlating UE data exposed as events.

**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 Stream Handler to follow the service requirements and associated with a Service Operation Point.

**Service Operation Point**: An abstract set of parameters and/or parameter ranges defining service requirements for media streaming that may be supported by a Dynamic Policy in the 5GMS System and described as part of a Service Description or provided as information to the Media Stream Handler.

**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.

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### 4.0.2 Content hosting

The content hosting feature is applicable to downlink media streaming only. It provides a service equivalent to a Content Delivery Network (CDN) deployed inside or outside the Trusted DN. High-level procedures for this feature are defined in clause 5.4.



Figure 4.0.2‑1: High-level arrangement for content hosting feature

When a 5GMSd Application Provider has provisioned the content hosting feature for downlink media streaming:

1. Media content is either retrieved by a network-side component of the 5GMS System from a media origin at the 5GMSd Application Provider (pull-based content ingest) or else it is published to a network-side component of the 5GMS System by the 5GMSd Application Provider (push-based content ingest).

2. The network-side component of the 5GMS System may cache this content for a configurable period of time.

3. Network-side components of the 5GMS System may manipulate the content according to rules provisioned in Content Preparation Templates (see clause 4.0.4).

4. The 5GMSd Client in the UE subsequently retrieves the (possibly manipulated) media content as part of a downlink media streaming session. The security of the content served to the 5GMSd Client by network-side components of the 5GMS System may be guaranteed by a provisioned Server Certificate.

In addition, the use of content hosting by 5GMSd Clients is logged by the 5GMS System and, if suitably provisioned, is exposed by it to subscribing 5GMSd Application Providers in the form of events. This information is equivalent to that contained in CDN access logs (see also clause 4.0.12).

In addition, the 5GMSd Client may be configured to report *client data* to the 5GMS network services in band with media requests. This allows a media player to communicate mutually beneficial media-related information to a content serving endpoint as part of regular media requests. A media player may be instructed through a configuration API on how exactly to report. The reported client data may be used by the 5GMS network services for several purposes as described in clause 5.16.1.2 of TR 26.804 [26804]. The use cases which in-band client data reporting enables are broad – including robust pre-fetching of content, analytics solutions, forensic debugging, delivery optimisation, alerting and monitoring systems, low latency optimisations, server-side switching, research analytics and content steering decision-making.

Client data reporting can be considered as a supplementary reporting mechanism for media client data, operating alongside consumption reporting (see clause 4.0.8) and QoE metrics reporting (clause 4.0.9).

Figure 4.0.2-1 provides a high-level arrangement for in-band client data reporting in the context of the content hosting feature; procedures and call flows are defined in clause 5.13.



Figure 4.0.2‑1: High-level arrangement for client data in-band reporting feature

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### 4.2.1 Standalone – Non-Roaming

The 5GMSd Application Provider uses 5GMSd functions for downlink streaming services. It provides a 5GMSd-Aware Application on the UE the ability to make use of 5GMSd Client and network functions using 5GMSd interfaces and APIs.

The architecture in Figure 4.2.1-1 below represents the specified 5GMSd functions within the 5G System (5GS) as defined in TS 23.501 [2]. Three main functions are defined:

- **5GMSd AF:** An Application Function similar to that defined in TS 23.501 [2] clause 6.2.10, dedicated to 5G Downlink Media Streaming.

- **5GMSd AS:** An Application Server dedicated to 5G Downlink Media Streaming.

NOTE 0: When a 5GMSd AS ingests content directly from a 5GMSu AS, the 5GMSd AS plays the role of a 5GMSu Application Provider. For more details of this scenario, see clause A.15.3.

- **5GMSd Client:** A UE internal function dedicated to 5G Downlink Media Streaming. The 5GMSd Client is a logical function and its subfunctions may be distributed within the UE according to implementation choice.

5GMSd AF and 5GMSd AS are Data Network (DN) functions and communicate with the UE via the User Plane Function (UPF) using the N6 reference point as defined in TS 23.501 [2].

Functions in trusted DNs are trusted by the operator's network as illustrated in Figure 4.2.3-5 of TS 23.501 [2]. Therefore, AFs in trusted DNs may directly communicate with relevant 5G Core functions.

Functions in external DNs, i.e. 5GMSd AFs in external DNs, may only communicate with 5G Core functions via the NEF using N33.

NOTE 1: The 5GMS architecture may be applied to an EPS although such an application is not specified in the present document and is left to the discretion of deployments and implementations.



Figure 4.2.1-1: Downlink 5G Media Streaming within 5G System

NOTE 2: The functions indicated by the yellow filled boxes are in scope of stage 3 specifications for 5GMS. The functions indicated by the grey boxes are defined in 5G System specifications. The functions indicated by the blue boxes are neither in scope of 5G Media Streaming nor 5G System specifications.

The architecture in Figure 4.2.1-2 below represents the media architecture connecting UE internal functions and related network functions.



Figure 4.2.1-2: Media architecture for unicast downlink media streaming

NOTE 3: As described in the NOTE of Figure 4.1-2, the functions indicated by the yellow filled boxes are in scope of stage 3 for 5GMSd. The functions indicated by the grey boxes are defined in 5GS. The interfaces indicated by solid lines are in scope of stage 3 for 5GMSd. The interfaces indicated by dashed lines are defined in 5GS. The interfaces indicated by dotted lines are neither in scope of 5GS nor 5GMSd, but are considered as part of informative call flows.

NOTE 4: Red ovals indicate API provider functions.

NOTE 5: The 5GMSd AF may also interact with the NEF for NEF-enabled API access. However, within Release 16, the NEF is only used by the 5GMSd AF to interact with the Policy and Charging Function (PCF) in 5GMS specifications.

NOTE 6: Some information might also be exchanged between 5GMSd entities and the OAM, although the OAM is not explicitly shown in the architecture.

The following functions are defined:

- 5G Media Streaming Client for downlink (**5GMSd Client**) on the UE: Receiver of 5GMS downlink media streaming service that may be accessed through well-defined interfaces/APIs. Alternatively, the UE may be implemented in a self-contained manner such that interfaces M6d and M7d are not exposed at all.

- The 5GMSd Client contains two subfunctions:

- **Media Session Handler:** A function on the UE that communicates with the 5GMSd AF in order to establish, control and support the delivery of a media session, and may perform additional functions such as consumption and QoE metrics collection and reporting. The Media Session Handler may expose APIs that can be used by the 5GMSd-Aware Application. The Media Session Handler may be launched by a 3GPP-defined Service URL (see clause 4.10).

- **Media Player:** A function on the UE that communicates with the 5GMSd AS in order to stream media content in real time or download media content in non-real time (e.g., for later consumption) and that may provide APIs to the 5GMSd-Aware Application for media playback and to the Media Session Handler for media session control.

- **5GMSd-Aware Application:** The 5GMSd Client is typically controlled by an external media application, e.g. an App, which implements external application or content service provider specific logic and enables a media session to be established. The 5GMSd-Aware Application is not defined within the 5G Media Streaming specifications, but the function makes use of 5GMSd Client and network functions using 5GMSd interfaces and APIs.

- **5GMSd AS:** An Application Server which hosts 5G media functions. Note that there may be different realizations of the 5GMSd AS, including the distribution of 5GMSd AS functionality between different physical hosts, for example in a Content Delivery Network (CDN).

The 5GMSd AS supports the following features:

i. **Content Hosting**, including:

- Ingesting media content from a 5GMSd Application Provider at reference point M2d.

- Caching media content to reduce the need to ingest the same content repeatedly at reference point M2d.

- A generic framework for content preparation.

- Geographic restrictions on content access by the Media Player at reference point M4d ("geofencing").

- Domain Name aliasing at reference point M4d.

- Support for server certificates at reference point M4d.

- URL path rewriting at reference point M4d.

- URL signing at reference point M4d.

ii. **Processing of client data**received from the Media Player at reference point M4d, including:

- Reformatting and aggregation of the received information and reporting it to the 5GMSd AF via reference point M3d.

- Proactively requesting media segments from the 5GMSd Application Provider at reference point M2d based on the received information, if this optional feature is supported.

NOTE 6a: The features of the 5GMSd AS cater primarily for media streaming content. However, many of these features may also be used to support the delivery of other types of content, for example web content.

- **5GMSd Application Provider:** External application or content-specific media functionality, e.g., media creation, encoding and formatting that uses 5GMSd interfaces to stream media to 5GMSd-Aware Applications.

- **5GMSd AF:** An Application Function that provides various control functions to the Media Session Handler on the UE and/or to the 5GMSd Application Provider. It may relay or initiate a request for different Policy or Charging Function (PCF) treatment or interact with other network functions via the NEF. If configured, it may also handle aggregated client data submitted by the 5GMSd AS.

NOTE 7: There may be multiple 5GMSd AFs present in a deployment and residing within the Data Network, each exposing one or more APIs.

The following interfaces are defined for 5G Downlink Media Streaming:

- M1d (5GMSd Provisioning API): External API, exposed by the 5GMSd AF which enables the 5GMSd Application Provider to provision the usage of the 5G Media Streaming System for downlink media streaming and to obtain feedback.

- M2d (5GMSd Ingest API): Optional External API exposed by the 5GMSd AS used when the 5GMSd AS in the trusted DN is selected to host content for the streaming service.

- M3d: Internal API used by a 5GMSd AF to configure and manage a 5GMSd AS instance.

- M4d (Media Streaming APIs): APIs exposed by a 5GMSd AS to the Media Player to stream media content in real time or download media content in non-real time.

- M5d (Media Session Handling API): APIs exposed by a 5GMSd AF to the Media Session Handler for media session handling, control, reporting and assistance that also include appropriate security mechanisms, e.g. authorization and authentication.

- M6d (UE Media Session Handling APIs): APIs exposed by a Media Session Handler to the Media Player for client-internal communication, and exposed to the 5GMSd-Aware Application enabling it to make use of 5GMS functions. This API may be supported by a 3GPP-defined Service URL (see clause 4.10).

- M7d (UE Media Player APIs): APIs exposed by a Media Player to the 5GMSd-Aware Application and Media Session Handler to make use of the Media Player.

- M8d: (Application API): application interface used for information exchange between the 5GMSd-Aware Application and the 5GMSd Application Provider, for example to provide Service Access Information to the 5GMSd-Aware Application. This API is external to the 5G System and not specified by 5GMS.

NOTE 8: Non-Standalone, Roaming, Non-3GPP Access and EPC-5GC interworking aspects are FFS.

The following subfunctions are identified as a part of a more detailed breakdown of the 5GMSd AS for stage 3 specifications:

- Adaptive Bit Rate (ABR) Encoder, Encryption and Encapsulator.

- Manifest (e.g. MPD) Generator and Segment (e.g. DASH) Packager.

- Origin Server.

- CDN Server (e.g. Edge Servers).

- DRM Server (e.g. DRM License Server).

- Service Directory.

- Content Guide Server.

- Replacement content server (e.g. Ad content server).

- Manifest Proxy, i.e. MPD modification server.

- App Server.

- Session Management Server.

A breakdown of 5GMSd functions in the UE is provided in clause 4.2.2 below.

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

### 4.2.2 5GMSd UE functions

The UE may include many detailed subfunctions that can be used individually or controlled individually by the 5GMSd-Aware Application. This clause breaks down several relevant identified subfunctions for which stage 3 specification is available.

NOTE: This UE architecture is logical; the realization of reference points M6 and M7 inside the logical 5GMS Client is subject to implementation choice.

The 5GMSd-Aware Application itself may include many functions that are not provided by the 5GMSd Client or by the 5G UE. Examples include service and content discovery, notifications and social network integration. The 5GMSd-Aware Application may also include functions that are equivalent to ones provided by the 5GMSd Client and may only use a subset of the 5GMSd client functions. The 5GMSd-Aware Application may act based on user input or may for example also receive remote control commands from the 5GMSd Application Provider through M8d.

With respect to Media Player functions, Figure 4.2.2-1 below shows more detailed functional components of a UE for media player functions to access the 5GMSd AS.



Figure 4.2.2-1: Downlink 5G Media Streaming UE functions (Media Player centric)

The following subfunctions are identified as part of a more detailed breakdown of the Media Player function:

- **Media Access Client:** Accesses media content, such as DASH-formatted media segments, for immediate or delayed consumption.

- **Media Decapsulation:** Extracts the elementary media streams for decoding and provides media system related functions such as time synchronization, capability signalling, accessibility signalling, etc.

- **Consumption Measurement and Logging Client:** Performs the measurement and logging of content consumption-related information in accordance with the Consumption Reporting Configuration part of provisioning data, supplied by the 5GMSd Application Provider to the 5GMSd AF, and forwarded by the 5GMSd AF to the Media Player via the Media Session Handler.

- I**n-band client data reporting client**: Functionalities in the Media Player to report client data to the 5GMSd AS as part of media requests the Media Player makes at reference point M4d.

- **Metrics Measurement and Logging Client:** Performs the measurement and logging of QoE metrics in accordance with the Metrics Reporting Configuration part of provisioning data, supplied by the 5GMSd Application Provider to the 5GMSd AF, and forwarded by the 5GMSd AF to the Media Player via the Media Session Handler.

- **DRM Client** (optional): When present, the DRM client might or might not be a part of the Media Player. It provides a content protection mechanism with its unique key management and key delivery system, authentication/‌authorization, policy enforcement and entitlement check. The DRM Client is not defined within 5G Media Streaming specifications.

- **Media Decryption** (optional): When present, media decryption is responsible to decrypt the media samples using the keys provided in the DRM license, and further passing to the Media Decoder to enable playback of encrypted media. The media decryption and media decoding could be implemented on a general-purpose processor in software or hardware or, for a more secure and robust architecture, the decryption, decoding and rendering could be implemented on the hardware of secure processors.

- **Media Decoder**: Decodes the media, such as audio or video.

- **Media Presentation and Rendering:** Presents the media using an appropriate output device and enables possible interaction with the media.

With respect to the Media Session Handler, Figure 4.2.2-2 below shows more detailed functional components of a UE to access the 5GMSd AF.



Figure 4.2.2-2: Downlink 5G Media Streaming UE functions (control-centric)

NOTE 1: The yellow colour indicates here that the 3GPP has created specifications for the function.

NOTE 2: A UE is a logical device which may correspond to the tethering of multiple physical devices or other types of realizations.

The following subfunctions are identified as part of a more detailed breakdown of Media Session Handler:

- **Core Functions:** Realization of a "session" concept for media communications, optionally spanning multiple stateless sessions. May optionally interact with network-based 5GMSd AF.

- **Metrics Collection and Reporting:** executes the collection of QoE metrics measurement logs from the Media Player and sending of metrics reports to the 5GMSd AF for the purpose of metrics analysis or to enable potential transport optimizations by the network.

- **Consumption Collection and Reporting:** executes the collection of content consumption measurement logs from the Media Player and sending of consumption reports to a 5GMSd AF about the currently consumed media within the available presentation, about the UE capabilities and about the environment of the media session for potential transport optimizations by the network or consumption report analysis.

- **Dynamic Policy:** involves interacting with the 5GMSd AF to instantiate Policy Templates that change the network Quality of Service for a media streaming session. Policy Templates may be selected based on interactions with the Media Player.

- **Network Assistance:** downlink streaming delivery assisting functions provided by the network to the 5GMSd Client and Media Player in the form of bit rate recommendation (or throughput estimation) and/or delivery boost. Network Assistance functionality may be supported by 5GMSd AF or ANBR-based RAN signalling mechanisms. This function also includes the logging of ANBR-based Network Assistance invocations and their reporting via reference point R2, as defined in clause 4.7.1.

- **Service URL Handling:** a UE function that handles 3GPP Service URLs (see clause 4.10) to support the launch of 5GMSd services and associated functions in the UE and in the network.

- I**n-band client data reporting configuration**: Configuration of Media Player via reference point M11d, based on information received via M5d, instructing it to initiate client data collection and in-band reporting at reference point M4d.

NOTE 2a: While this function may not be exclusive to 5GMS, this specification only defines Service URL handling for 5GMS.

NOTE 3: Based on such a decomposition, additional interfaces and APIs may exist in inside the UE:

- Media control interface(s) to configure and interact with the different UE media functions.

- Media control interface for media session management.

- Control interface for collection of logged QoE metrics measurements.

- Control interface for collection of logged content consumption measurements.

- Decoded media samples are handed over to the media renderer.

- Decrypted, compressed media samples are handed over to a trusted media decoder.

- In the case of encryption, the encrypted, compressed media samples are handed over to the DRM Client.

NOTE 4: Non-Standalone, Roaming, Non-3GPP Access and EPC-5GC interworking aspects are FFS.

## ===== 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. The Service Access Information may be provided as, or may be accessed via, a 3GPP-defined Service URL that provides a unique resolvable identifier to the 5GMSd Provisioning Session and that may also include a reference to the Media Player Entry. 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 5GMS Client, including content type, profile indicators and precedence.  A Media Player Entry document may additionally include Service Descriptions, each one identified by an *External reference* that enables it to be matched with a Policy Template, and each describing the set of media streaming parameters (e.g., bit rate, target latency) that realise a Service Operation Point.  A Media Player Entry URL may be embedded in a 3GPP Service URL. |
| 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 in -band client data reporting is activated for a downlink streaming session the parameters defined in annex K.3.7 of ISO/IEC 23009-1 [29] may be present as part of the relevant metrics configuration set. (These parameters are used to activate in-band client data reporting in case the Media Player Entry does not include in-band client data reporting configuration information.)

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 =====

## 5.13 In-band client data reporting

### 5.13.1 Scenario

In the considered scenario, client data is reported in band with media requests at reference point M4d. Client data is initially sent to the 5GMSd AS via reference point M4d, and from there provided to the 5GMSd AF using the QoE metrics reporting mechanism at reference point M3d. The call flow is aligned with QoE metrics collection and reporting as defined in clause 5.5.

### 5.13.2 Procedure

Figure 5.13.2-1 illustrates a scenario where client data collection and in-band reporting by the 5GMSd AS is configured by the 5GMSd AF via reference point M3d. In this example, it is assumed that the client data collection information provided by the 5GMSd AF comprises instructions/rules regarding client data reporting. It is further assumed that the 5GMSd AF is required to expose client data events to separate destination entities, upon optionally having performed post-processing on the collected report information. The 5GMSd AF and 5GMSd AS may be either trusted or untrusted.

Msc-generator~|version=8.6.1~|lang=signalling~|size=1079x1574~|text=hscale=auto;~nnumbering=yes;~n~ndefcolor CoreColour=216,216,216;~ndefcolor MnScolour=112,48,160;~ndefcolor APcolour=183,221,232;~ndefcolor MScolour=255,255,0;~ndefcolor clientColour=255,255,204;~ndefcolor ECcolour=245,157,86;~ndefcolor EVEXcolour=229,185,181;~n~nTN: Trusted or\nuntrusted {~n~4App [fill.color=APcolour, label=~qApp\n ~q];~n};~nTR: Trusted UE functions {~n~4MSH[fill.color=MScolour, label=~qMedia Session\nHandler~q];~n~4MP [fill.color=MScolour, label=~qMedia\nPlayer~q];~n};~nEI: Trusted or untrusted network functions {~n~4AFcontainer [fill.color=MScolour, label=~q5GMSd AF~q] {~n~8MAF [fill.color=MScolour]: ~q~q;~n~8DCAF [fill.color=EVEXcolour]: ~qData Collection AF~q;~n~4};~n~4MAS [fill.color=MScolour, label=~q5GMSd\nAS~q];~n~4NWDAF [fill.color=CoreColour, label=~qNWDAF~q];~n~4AP [fill.color=APcolour, label=~q5GMSd\nApplication\nProvider~q];~n};~nvspace 5;~n~nvspace 5;~nbox MAF..AP [line.corner=round, line.color=none, fill.color=MScolour,0.3]: \IProvisioning of in-band client data collection, reporting and exposure {~n~4numbering.append=~qabc~q;~n~4AP-~gMAF: Provision in-band client data collection, reporting and exposure\n\_M1d [number=a];~n~4MAF~gDCAF: Internal\nconfiguration;~n~4MAF-~gMAS: Configure client data reporting\n\_M3d;~n~4MAF~l-MAS [number=no]: Client data reporting confirmed;~n~4MAF-~gAP [number=no]: Provisioning confirmed;~n~4AP-~gDCAF: Subscribe to client data events;~n~4.. [tag=~qopt~q, fill.color=EVEXcolour,0.3, number=no] {~n~8NWDAF~gDCAF: Subscribe to\nclient data events;~n~4};~n};~nhide DCAF, NWDAF;~n~nvspace 5;~nApp~l-~gAP [arrow.type=dot]: Service Announcement and Content Discovery including client data inband reporting configuration; ~n~n...;~nbox -- [line.corner=round, line.color=none, fill.color=MScolour,0.3]: \IStreaming session and media playback establishment~n{~n~4numbering.append=~qabc~q;~n~4App-~gMP: Start of playback indication\n\_M7d;~n~4MP~l-~gMSH [arrow.type=dot]: Set up streaming session\n\_M11d;~n~4MSH~l-~gMAF [arrow.type=dot]: Acquire Service Access Inormation\n\_M5d;~n~4MP-~gMSH: Streaming session established\n\_M11d;~n~4App~l=~gMP~l=~gMAS~l=~gAP [arrow.type=dot]: Set up media playback pipeline;~n~4hide App;~n};~n~nvspace 5;~nMSH-~gMP: Enable client data\ncollection and in-band reporting\n\_M11d;~nMSH~l-MP [number=no]: Client data in-band collection\nand reporting confirmed;~n~nvspace 5;~nbox App--AP [tag=~qloop~q]: {~n~4box App--AP [tag=~qpar~q, fill.color=MScolour,0.3]: \IMedia playback {~n~8numbering.append=~qabc~q;~n~8MAS~l-MP: Request media content\n\bincluding in-band client data\b\n\_M4d;~n~8MAS--MAS: \BExtract and process\nclient data;~n~8vspace 5;~n~8.. [tag=~qopt~q, fill.color=MScolour,0.3, number=no]: \IMedia playback {~n~9~3MAS~l-~gAP: \bRequest media content\nbased on client data\b\n\_M2d;~n~8};~n~8MAS-~gMP: Deliver media content;~n~8MP-~gMSH: Notify start of media playback\n\_M11d;~n~8hide MSH, MP;~n~8MAS-~gMAF: \BReport client data\n\_M3d;~n~8hide MAS;~n~8MAF--MAF: \BProcess client data;~n~8vspace 5;~n~8MAF--MAF: \BConfigure 5G System\n based on client data;~n~4} [tag=~q~q, fill.color=EVEXcolour,0.3]: \IEvent exposure {~n~8numbering.append=~qabc~q;~n~8show DCAF;~n~8vspace 5;~n~8MAF--MAF: \BScheme-specific\nclient data\nprocessing;~n~8MAF~gDCAF: Client data;~n~8DCAF-~gAP: Client data event\n\_R6;~n~8.. [tag=~qopt~q, fill.color=EVEXcolour,0.3, number=no] {~n~9~3show NWDAF;~n~9~3DCAF~gNWDAF: Client data event\n\_R5;~n~8};~n~4};~n};~n~|

Figure 5.13.2-1: Client data collection in 5GMSd reported in-band via M4d and M3d

The message sequence steps are described below. Extensions to the basic 5G Media Streaming call flow are highlighted in **bold**:

1: The 5GMS System is provisioned **to collect, report and expose client data to interested event consumers**.

1a: The **5GMSd AF is provisioned at reference point M1d with in-band client data reporting configuration information** pertaining to client data collection by the Media Player and reporting of it to the 5GMSd AF via the 5GMSd AS. **This includes different client data collection, in-band reporting and data processing instructions regarding required post-processing functionality and subsequent exposure of processed client data to the 5GMSd Application Provider and/or to the NWDAF.**

1b: The 5GMSd AF configures the Data Collection AF instantiated inside it **to receive client data reports from the 5GMSd AS and to make the client data available for exposure to event consumers**.

1c: The 5GMSd AF also configures the 5GMSd AS to extract client data from media requests at reference point M4d and report it to the 5GMSd AF via reference point M3d.

1d: The 5GMSd Application Provider subscribes to receive events containing **client data information**.

1e: The NWDAF may also subscribe to receive events containing **client data information**.

2: The 5GMSd-Aware Application triggers the Service Announcement and Content Discovery procedure at reference point M8d. The Service Announcement may include the whole **Service Access Information that includes a client data collection and in-band reporting configuration** to be used by the Media Player.

Time passes until the 5GMSd Client initiates session establishment and media playback.

3: Streaming Session and media playback is established.

3a: The 5GMSd-Aware Application informs the Media Player of impending media playback by invoking a suitable method at reference point M7d.

3b: The Media Player requests the establishment of a streaming session by invoking a suitable method at reference point M11d on the Media Session Handler, which acknowledges the request.

3c: The Media Session Handler requests may acquire whole Service Access Information from the 5GMSd AF via reference point M5d if did not already receive this in step 2 above.

3d: The Media Session Handler informs the Media Player about the successful set-up of the streaming session by means of a suitable notification at reference point M11d.

3e: The media playback pipeline is set up between the Media Player, the 5GMSd AS at reference point M4d and with the 5GMSd Application Provider at reference point M2d.

4: **Using a suitable interaction at reference point M11d, the Media Session Handler interrogates the Media Player at reference point M11d on its capability to perform client data collection and in-band reporting at reference point M4d and instructs the player to enable client data collection and in-band reporting, including a session identifier. In response the Media Player acknowledges its support for the collection of the required client data.**

During the course of media playback, steps 6a to 6f below may be repeated, depending on the duration of the playback.

5a: The Media Player requests **media content from the 5GMSd AS via reference point M4d and includes configured client data in the request according to the configuration obtained in step 4 above**.

5b: The 5GMSd AS extracts and processes client data from this request.

5c: In the case of a live streaming service, media content may have already been published by the 5GMSd Application Provider to the 5GMSd AS at reference point M2d. However, in this case it is considered that the 5GMSd AS ingests media from the 5GMSd Application Provider in pull mode. The 5GMSd AS checks if the requested data is already cached and if not, requests the data from the upstream 5GMSd Application Provider. **The 5GMSd AS may also use information in the client data to request future segments in advance of a request at reference point M4d.**

5d: The 5GMSd AS delivers the requested media data to the Media Player at reference point M4d.

5e: The Media Player starts playback and informs the Media Session Handler by means of a suitable notification at reference point M11d.

5f: **The 5GMSd AS reports the requested client data to the 5GMSd AF via reference point M3d**.

5g: **The 5GMSd AF extracts the relevant client data from the report and processes it.**

5h: **Based on reported client data the 5GMSd AF may decide to communicate with the 5G System to initiate media handling functions such as Network Assistance.**

In parallel with the media streaming session, the client datareceived by the 5GMSd AF is prepared for exposure:

6a: **In accordance with its in-band client data reporting configuration as provisioned in step 1, the 5GMSd AF performs separate post-processing in accordance with the received types of client data reports.**

6b The client data is shared with the Data Collection AF instantiated in the 5GMSd AF.

6c: The Data Collection AF instantiated in the 5GMSd AF exposes an event containing **processed client data** to the 5GMSd Application Provider at reference point R6 in accordance with the Event Data Processing Configuration provisioned in step 1.

6d: The Data Collection AF instantiated in the 5GMSd AF may expose an event containing **processed client data** to the NWDAF at reference point R6 in accordance with the Event Data Processing Configuration provisioned in step 1.

NOTE 2: Although not explicitly shown or described in figure 5.13.2-1, should the 5GMSd AF represent an untrusted network entity and the NWDAF represent a trusted network entity, the NWDAF’s subscription to receive processed client data events from the 5GMSd AF is mediated in the southbound direction by the NEF (Network Exposure Function) through the Nnef\_EventExposure service as specified in TS 29.591 [29591] to enable event notifications as described in step 10.