**3GPP TSG-S4 Meeting #123-e *S4-230472***

**Online, , 17th–21st April 2023** revision of S4aI230072

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **26.501** | **CR** | **0059** | **rev** | **3** | **Current version:** | **18.1.0** |  |
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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 |  | Radio Access Network |  | Core Network | **X** |

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| ***Source to WG:*** | BBC | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
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| ***Work item code:*** | 5GMS\_Ph2 | | | | |  | ***Date:*** | | | 2023-04-05 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Definition of reference point M3 for configuration of 5GMS AS by 5GMS AF. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Figures revised to make M3 reference point a solid line. * Various textual adjustments to bring M3 into scope. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Lack of interoperability between 5GMS AF and 5GMS AS from different vendors.. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.2, 4.3, 4.5.2, 4.6.1, 4.8, 5.1, 5.3.2, 5.4, 6.1, 6.2.2.2, 6.2.3.2, 7, A.2, A.5, A.6, A.7, A.10, A.11, A.12 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | S4aI230047 -> S4aI230063 -> S4aI230072 -> S4-230472 | | | | | | | | |

FIRST CHANGE



NOTE: The 5GMS Client in the UE is depicted in the form of Media Session Handler and Media Stream Handler constituent functions which expose APIs to one another in the same way that those APIs are exposed to 5GMS-Aware Applications. This UE architecture is not applicable generally; it is just as valid to implement a 5GMS Client that does not expose interfaces M6 and M7 within the 5GMS Client. It is also valid for a 5GMS Client inside a UE to be completely self-contained, such that all functionality typically implemented in the 5GMS-Aware Application is embedded in the UE and thus interfaces M6 and M7 are not exposed at all.

Figure 4.1-2: 5G Media Streaming General Architecture

NEXT CHANGE

## 4.2 5G unicast downlink Media Streaming architecture

### 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.

- **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.

- **Media Player:** A function on the UE that communicates with the 5GMSd AS in order to stream the media content and 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 in this release 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.

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.

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.

- 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.

- 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.

### 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.

- **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.

- **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 AFs.

- **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.

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.

NO FURTHER CHANGES IN CLAUSE 4.2.

NEXT CHANGE

## 4.3 Uplink 5G Media Streaming architecture

### 4.3.1 Media architecture

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



Figure 4.3.1-1: Media architecture for unicast uplink media streaming

NOTE 1: 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 4.3.1-1 above represents the specified 5GMSu functions within the 5G System (5GS) as defined in TS 23.501 [2]. Three main functions are defined:

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

- **5GMSu AS:** An Application Server dedicated to 5G Uplink Media Streaming.

- **5GMSu Client:** A UE-internal function dedicated to 5G Uplink Media Streaming.

5GMSu AF and 5GMSu AS are Data Network (DN) functions and communicate with the UE via N6 as defined in TS 23.501 [2].

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

Functions in external DNs, e.g., a 5GMSu AF in the External DN, may only communicate with 5G Core functions via the NEF using N33.

The architecture in Figure 4.3.1-2 below represents the media architecture connecting UE internal functions and related network functions for 5G Uplink Media Streaming.



Figure 4.3.1-2: Media architecture for unicast uplink media streaming

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

NOTE 3: Red ovals indicate API provider functions.

NOTE 4: The 5GMSu AF may also interact with the NEF for NEF-enabled API access. However, within Release 16, the NEF is only used by the 5GMSu AF to interact with the Policy and Charging Function (PCF) in 5GMS specifications.

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

The following functions are defined:

- 5G Media Streaming Client for uplink (**5GMSu Client**) on UE: Originator of 5GMSu service that may be accessed through well-defined interfaces/APIs. The UE may also be implemented in a self-contained manner such that interfaces M6u and M7u are not exposed at all.

- The 5GMSu Client contains two subfunctions:

- **Media Session Handler:** A function on the UE that communicates with the 5GMSu AF in order to establish, control and support the delivery of a media session, and that may perform QoE metrics reporting. The Media Session Handler exposes APIs that can be used by the 5GMSu-Aware Application.

- **Media Streamer:** A function on the UE that communicates with the 5GMSu AS in order to perform uplink streaming of media content and provides a service to both the 5GMSu-Aware Application for media capturing and uplink streaming and the Media Session Handler for media session control.

- **5GMSu-Aware Application:** The 5GMSu 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 5GMSu-Aware Application is not defined within the 5G Media Streaming specifications, but the function makes use of 5GMSu Client and network functions using 5GMSu interfaces and APIs.

- **5GMSu AS:** An Application Server which hosts 5G media functions. Note that there may be different realizations of a 5GMSu AS, for example a Content Delivery Network (CDN) server.

- **5GMSu Application Provider:** External application or content-specific media functionality, e.g., media storage, consumption, transcoding and redistribution that uses 5GMSu interfaces to receive streaming media from 5GMSu Aware Applications.

- **5GMSu AF:** An Application Function that provides various control functions to the Media Session Handler on the UE and/or to the 5GMSu 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.

NOTE 6: There may be multiple 5GMSu AFs present in a deployment and residing within the Data, each exposing one or more APIs.

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

- M1u (5GMSu Provisioning API): External API, exposed by the 5GMSu AF and which enables the 5GMSu Application Provider to provision the usage of the 5G Media Streaming system for uplink media streaming and to obtain feedback.

- M2u (5GMSu Publish API): Optional External API exposed by the 5GMSu AS used when the 5GMSu AS in the trusted DN is selected to receive the content for the streaming service.

- M3u: Internal API used by a 5GMSu AF to configure and manage a 5GMSu AS instance.

- M4u (Uplink Media Streaming APIs): APIs exposed by a 5GMSu AS to the Media Streamer to stream media content.

- M5u (Media Session Handling API): APIs exposed by a 5GMSu AF to the Media Session Handler for media session handling, control and assistance that also include appropriate security mechanisms e.g. authorization and authentication, and QoE metrics reporting.

- M6u (UE Media Session Handling APIs): APIs that may be exposed by a Media Session Handler to the Media Streamer for client-internal communication, and to the 5GMSu-Aware Application to make use of 5GMSu functions.

- M7u (UE Media Streamer APIs): APIs that may be exposed by a Media Streamer to the 5GMSu-Aware Application and Media Session Handler to make use of the Media Streamer, including configuration of QoE metrics to be measured and logged, and the collection of metrics measurement logs.

- M8u: (Application API): application interface used for information exchange between the 5GMSu-Aware Application and the 5GMSu Application Provider, for example to provide Service Access Information to the 5GMSu-Aware Application. This API is external and not specified in the 5GMS architecture.

NOTE 7: Non-Standalone, Roaming, Non-3GPP Access and EPC-5GC interworking aspects are FFS.

### 4.3.2 UE Media Functions

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

The 5GMSu-Aware Application itself may include many functions that are not provided by the 5GMSu Client or to the 5G UE. Examples include peripheral discovery, notifications and social network integration. The 5GMSu-Aware Application may also include functions that are equivalent to ones provided by the 5GMSu Client and may only use a subset of the 5GMSu Client functions.

With respect to the Media Streamer and Media Handler functions, Figure 4.3.2-1 shows more detailed functional components of a 5GMSu Client.



Figure 4.3.2-1: Uplink 5G Media Streaming UE functions

NOTE 1: 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 the UE 5G Uplink Media Streaming functions:

- **5GMSu-Aware Application:** application which is out of scope of the present specification and which uses the UE 5G Uplink Media Streaming functions and APIs.

- **Media Capturing:** Devices such as video cameras or microphones that transform an analogue media signal into digital media data.

- **Media Encoder(s):** Compresses the media data.

- **Media Upstream Client:** encapsulates encoded media data and pushes it upstream.

- **Network Assistance:** uplink streaming delivery assisting functions provided by the network to the 5GMSu Client and Media Streamer in the form of bit rate recommendation (or throughput estimation) and/or delivery boost. Network Assistance functionality may be supported by 5GMSu AF or ANBR-based RAN signalling mechanisms.

- **Core Functions:** configures the 5GMSu AS for uplink streaming reception.

Here are the roles of the different APIs of the UE 5G Uplink Media Streaming functions:

- M6u: API used to control the Core Functions and the Media Remote Control function.

- M7u: API used to configure, activate and stop the Media Capturing, Media Encoding(s) and Media Upstream Client functions, and also to support metrics configuration and collection functionality.

NO FURTHER CHANGES IN CLAUSE 4.3.

NEXT CHANGE

### 4.5.2 5G Media Streaming combined with Edge Computing

The 5GMS architecture is extended to add support for media processing in the edge. The extended architecture is an integration of the 5GMS architecture defined in the present document with the architecture for enabling Edge Applications defined in TS 23.558 [16], and the Edge Computing management architecture defined in TS 28.538  [17]. The extended architecture is depicted in figure 8.2-1.



Figure 4.5.2-1: Reference edge-enabled 5GMS media architecture

(No further changes in this clause)

NEXT CHANGE

### 4.6.1 Downlink media streaming over eMBMS

Figure 4.6.1-1 below depicts an architecture for downlink 5G Media Streaming via eMBMS that combines the functions and reference points of the 5GMS System with those of the MBMS System.



Figure 4.6.1-1: Architecture for downlink 5G Media Streaming over eMBMS

(No further changes in this clause)

NEXT CHANGE

## 4.8 Downlink media streaming to Media Players with multiple formats

(Only figure modified)



Figure 4.8-1: Deployment architecture for downlink media streaming to Media Players with different formats

(No further changes in this clause)

NEXT CHANGE

## 5.1 General

The downlink streaming procedures follow the general high-level workflow depicted in Figure 5.1‑1 below, starting from provisioningandingestsession preparation to the actual content streaming sessions. The **Ingest Session** refers to the time interval during which media content is uploaded to the 5GMSd AS. The **Provisioning Session** refers to the time interval during which the 5GMSd Client can access the media content and the 5GMSd Application Provider can control and monitor the media content and its delivery. Interactions between the 5GMSd AF and the 5GMSd Application Provider may occur at any time while the Provisioning Session is active.



Figure 5.1-1: Highl-evel procedure for downlink media streaming

The 5GMSd provisioning API at M1d allows selection of media session handling (M5d) and media streaming (M4d) options, including whether the media content is hosted on trusted 5GMSd AS instances. of provisioned 5GMSd features is captured in a Provisioning Session (see clause 5.3) that is uniquely identified in the 5GMS System by a Provisioning Session identifier. The Provisioning Session information may include Content Hosting Configurations, Content Preparation Templates, Server Certificates, Policy Templates, a Consumption Reporting Configuration, Metrics Reporting Configurations, Edge Resources Configurations and Event Data Processing Configurations.

The Consumption Reporting and/or Metrics Reporting Configuration information provisioned over M1d and passed to the 5GMSd Client by the 5GMSd AF over M5d determines the UE data to be collected by the 5GMSd Client and subsequently reported to the 5GMSd AF. The 5GMSd Application Provider is additionally able to provision Event Data Processing Configurations that specify data processing instructions for subsequent manipulation by the 5GMSd AF of UE data, whether reported by the 5GMSd Client or otherwise obtained, and rules for restricting the subsequent exposure by the 5GMSd AF of UE data to event consumers including the NWDAF defined in TS 23.288 [23] and/or the 5GMSd Application Provider.

The 5GMSd AF selects the M5d interface features according to the provisioning option. The Media Session Handling interface exposed by the 5GMSd AF can be used for core session handling; configuring content consumption measurement, logging, collection and reporting; configuring QoE metrics measurement, logging collection and reporting; requesting different policy and charging treatments; or 5GMSd AF-based Network Assistance.

When the media content is hosted by trusted 5GMSd AS instances, then the 5GMSd AF selects and configures the 5GMSd AS. Interactions between a 5GMSd AF and a 5GMSd AS (M3d interactions) take place for content hosting configuration, including 5GMS Ingest (M2d) and Media Streaming (M4d) resource reservations. The 5GMSd AS allocates M2d and M4d resources and communicates resource identifiers back to the 5GMSd AF. The 5GMSd AF provides information about the provisioned resources (in form of resource identifiers) for Media Session Handling (M5d), the 5GMSd Ingest (M2d) and the Media Streaming (M4d), to the 5GMSd Application Provider. The resource identifiers for Media Session Handling and Media Streaming are needed by the 5GMSd Client to access the 5GMSd functions.

When Content Hosting is provided by a 5GMSd AS in the external DN, then the M3d interface is not used and the 5GMSd AF does not provide 5GMS Ingest (M2d) and Media Streaming (M4d) resource reservations. M3d procedures are not standardized.

5GMSd Clients can (in principle) start streaming media as soon as the corresponding content is ingested by activating a unicast downlink streaming session. However, it may take some time until the media content is available for Media Streaming (via the Media Streaming API) or the distribution availability might be based on a provisioned schedule. The unicast downlink streaming session for a given UE (or "for each UE") is active from the time at which the 5GMSd-Aware Application activates the reception of a streaming service until its termination.

The 5GMSd-Aware Application receives application data from the 5GMSd Application Providerbefore receiving the downlink streaming media. The application data contains Service Access Information, which acts as an entry point for the 5GMSd Client to start the downlink streaming session. The 5GMSd Client may either receive a reference to that Service Access Information or the full Service Access Information from the 5GMSd Application Provider.

Steps:

1. The 5GMSd Application Provider creates a Provisioning Session with the 5GMSd AF and starts provisioning the usage of the 5G Media Streaming System. During the establishment phase, the used features are negotiated and detailed configurations are exchanged. The 5GMSd AF receives Service Access Information for M5d (Media Session Handling) and, where media content hosting is negotiated, Service Access Information for M2d (Ingestion) and M4d (Media Streaming) as well. This information is needed by the 5GMSd Client to access the service. Depending on the provisioning, only a reference to the Service Access Information might be supplied.

2. When Content Hosting is offered and selected there may be interactions between the 5GMSd AF and the 5GMSd AS at reference point M3d, e.g. to configure Server Certificates and/or Content Preparation Templates and to allocate 5GMSd content ingest and distribution resources by providing a Content Hosting Configuration. The 5GMSd AS provides resource identifiers for the allocated resources to the 5GMSd AF, which then provides the information to the 5GMSd Application Provider.

3. The 5GMSd Application Provider starts the Ingest Session by ingesting content. In case of live services, the content is continuously ingested. In case of on-demand streaming services, the content may be uploaded once and then updated later on.

NOTE 1: A 5GMSd AS in the external Data Network may provide the Content Hosting.

4. The 5GMSd Application Provider provides the Service Announcement Information to the 5GMSd-Aware Application. The service announcement includes either the whole Service Access Information (i.e. details for Media Session Handling (M5d) and for Media Streaming access (M4d)) or a reference to the Service Access Information or pre-configured information. When only a reference is included, the 5GMSd Client fetches (in step 6) the Services Access Information when needed.

5. When the 5GMSd-Aware Application decides to begin streaming, the Service Access Information (all or a reference) is provided to the 5GMSd Client. The 5GMSd Client activates the unicast downlink streaming session.

6. (Optional) In case the 5GMSd Client received only a reference to the Service Access Information, then it acquires the Service Access Information from the 5GMSd AF.

NOTE 2: Pre-caching of Service Access Information may also be supported by the 5GMS Client to speed up the activation of the service.

7. The 5GMSd Client uses the Media Session Handling API exposed by the 5GMSd AF at M5d. The Media Session Handling API is used for configuring content consumption measurement, logging, collection and reporting; configuring QoE metrics measurement, logging, collection and reporting; requesting different policy and charging treatments; or 5GMSd AF-based Network Assistance. The actual time of API usage depends on the feature and interactions that may be used during the media content reception.

8. The 5GMSd Client activates reception of the media content.

NEXT CHANGE

### 5.3.2 Baseline provisioning procedure

The present clause describes the baseline procedure to provision the features using the 5GMS System.

NOTE 1: SLA negotiations between the 5GMSd Application Provider and the 5GMS System provider are outside the scope of the present specification and are included in the figure below for illustrative purposes only.



Figure 5.3.2-1: High-level procedure for provisioning the 5GMS System  
for downlink media streaming sessions

Steps:

1. The 5GMSd Application Provider discovers the address (URL) of the 5GMSd AF (M1d) for Session Provisioning.

2. The 5GMSd Application Provider authenticates itself with the system. This procedure reuses existing authentication/authorization procedures, e.g. as defined for CAPIF [13].

3. The 5GMSd Application Provider creates a Provisioning Session, providing its 5GMSd Application Provider identifier as input. 5GMSd Application Provider queries the capabilities and authorized features.

4. The 5GMSd Application Provider specifies one or more 5GMSd features in the Provisioning Session. A set of authorized features is activated, such as content consumption measurement, logging, collection and reporting; QoE metrics measurement, logging, collection and reporting; dynamic policy; network assistance; and content hosting (including ingest).

When the content hosting feature is offered and selected, the 5GMS Application Provider configures the content hosting behaviour of the 5GMSd AS. This Content Hosting Configuration is specified in clause 5.4 and includes selecting the ingest protocol and format, caching and proxying of media objects, content preparation, access protection (e.g. URL signing) and indicating a target distribution area (e.g. through geofencing).

When the dynamic policy feature is offered and selected, the 5GMSd Application Provider specifies a set of policies which can be invoked for the unicast downlink streaming session. The UE becomes aware of the selected policies in the form of a list of valid Policy Template Ids.

When the content consumption measurement, logging, collection and reporting feature is offered and selected, the 5GMSd Application Provider indicates the desired reporting interval. When the 5GMSd Application Provider has delegated Service Access Information handling to the 5GMS System, then location reporting is also selected or de-selected.

When the QoE metrics measurement, logging, collection and reporting feature is offered and selected, the 5GMSd Application Provider provides configuration input on the QoE post processing. When the 5GMSd Application Provider has delegated Service Access Information handling to the 5GMS System, then more detailed metrics reporting is configured.

When the edge computing feature is offered and selected, the 5GMSd Application Provider provides one or more Edge Resources Configurations that can be used to support either client-driven management or Application Provider-driven management of edge resources associated with the Provisioning Session.

When the event data processing feature is offered and selected, the 5GMSd Application Provider provides one or more Event Data Processing Configurations that determine how, in the scope of the Provisioning Session, content consumption and QoE metrics collected from the UE and application logs collected from the 5GMSd AS are processed into events and exposed to subscribers.

5. When content hosting is desired, the 5GMSd AF interacts with the 5GMSd AS at reference point M3d to allocate M2d resources and to configure the ingest format by means of a Content Hosting Configuration (defined in clause 5.4) which may reference Server Certificates and Content Preparation Templates, as required. The 5GMSd AS responds with the M2d content ingest address.

6. The 5GMSd AF compiles the Service Access Information. The Service Access Information contains access details and options such as the Provisioning Session identifier, M5d (Media Session Handling) addresses for content consumption reporting, QoE metrics reporting, dynamic policy, network assistance, etc. When content hosting is offered and has been selected in step 4, then also M4d (Media Streaming) information such as the DASH MPD is included.

7. The 5GMSd AF provides the results to the 5GMSd Application Provider.

a. When the 5GMSd Application Provider has selected full Service Access Information, then the results are provided in the form of addresses and configurations for M2d (Ingest), M5d (Media Session Handling) and M4d (Media Streaming).

b. When the 5GMSd Application Provider delegated the Service Access Information handling to the 5GMS System, then a reference to the Service Access Information (e.g. a URL) is provided. The Media Session Handler fetches the full Service Access Information later from the 5GMSd AF.

8. When content hosting is offered and has been selected in step 4, the 5GMSd Application Provider can start supplying content at the M2d ingest interface. In the case of progressive download or on-demand DASH sessions, the 5GMSd Application Provider makes the content assets available. In the case of Live DASH streaming sessions, the 5GMSd Application Provider starts supplying the live content.

9. The 5GMSd Application Provider executes Service Announcement and updates the UEs (during the lifetime of the Provisioning Session).

Optional:

10. The 5GMSd Application Provider may update the Provisioning Session.

Depending on the parameters of the Provisioning Session:

11. The 5GMSd AF may send event-related or periodic notifications to the 5GMSd Application Provider.

According to schedule, or upon request:

12. The 5GMSd Application Provider may manually terminate the Provisioning Session (at any time). All associated resources are released. Content may be removed from the 5GMSd AS. The 5GMSd Application Provider may configure a schedule for Provisioning Session termination.

13. The 5GMSd AF sends a notification upon Provisioning Session termination.

The 5GMSd AF may request the creation or reuse of one or more network slices for distributing the content of the provisioned session. If more than one network slice is provisioned for the distribution of the content of a session, the list of allowed S‑NSSAIs shall be conveyed to the target UEs (e.g. through URSP or through M5d or M8d).

NOTE 2: The 5GMSd AS(s) serving the content are only accessible through the DNN(s) used by the network slice(s) provisioned for the distribution of that content.

NEXT CHANGE

## 5.4 Content Hosting Configuration for downlink Media Streaming

### 5.4.1 General

The 5G Media Streaming architecture defines an interface (M1d) for provisioning which offers the procedures to configure content ingest for downlink media streaming over 5G. Once a Provisioning Session is established using the API at interface M1d, content hosting can be configured. The control part of the ingest interface may be performed through the NEF. Ingested content is accessible from the 5GMSd AS at interface M4d through a new location identifier.

The M2d interface supports the ingest of the following types of content:

- Live streaming content.

- On-demand streaming content.

- Static files such as images, scene descriptions, etc.

The 5GMSd AF provides an API at interface M1d that allows a 5GMSd Application Provider to create/update/delete a Content Hosting Configuration. A Content Hosting configuration contains all the parameters for a particular content ingest and distribution setup.

NOTE: In the current version of the present document, the M2d ingest interface only supports unicast downlink streaming.

### 5.4.2 Media ingest procedure

The media ingest procedure is as follows:



Figure 5.4-1: Media Ingest procedure

The steps are as follows:

1: *Initialization:* the 5GMSd Application Provider discovers the entry point and authenticates itself with the 5GMSd AF.

2: *Create Content Hosting Configuration:* the 5GMSd Application Provider creates a new Content Hosting Configuration for its content through the 5GMSd AF. The configuration specifies a domain name, supplies a certificate for HTTPS access to the content, sets the caching rules per media type, indicates the distribution area (e.g. through geofencing), distribution protocol, the desired content preparation, URL signing, etc. Upon successful configuration, the 5GMSd AF responds with a Content Hosting Configuration identifier, and the location of the 5GMSd AS to which to send the content (if using the push mode).

3: *Provision 5GMSd AS instance(s):* The 5GMSd AF configures the related 5GMSd AS instance(s) to prepare for media ingest for that particular Content Hosting Configuration. As well as configuring any necessary Server Certificates and/or Content Preparation Templates, this step may involve instructing the 5GMSd AS instance(s) to set appropriate caching rules, to perform URL signature validation and to limit access through geofencing. The 5GMSd AS(s) responds indicating whether the configuration was successful or not.

4: *Confirm configuration information:* The 5GMSd AF communicates the Content Hosting Configuration of the 5GMSd AS(s) back to the 5GMSd Application Provider for further media push or pull.

5: *Publish Media Player Entry:* The 5GMSd Application Provider shall then publish the Media Player Entry to the 5GMSd-Aware Application to enable access to the content.

6: *Media ingest:* The 5GMSd AS(s) may start pulling or receiving content (if using push mode) from the 5GMSd Application Provider. The 5GMSd AS performs the requested content preparation prior to providing access to the content.

NOTE: Pull of media content from the external 5GMSd AS(s) may be triggered by a request from the 5MGSd Client.

The 5GMSd Application Provider may update a Content Hosting Configuration subsequently to modify some of its parameters. The subset of parameters that can be updated may be limited by the 5GMSd AF.

NEXT CHANGE

## 6.1 General

The procedures for uplink media streaming allow a 5GMSu Application Provider to create, modify, establish and delete sessions. Uplink media streaming sessions exist between a 5GMSu Client and a 5GMSu AS.

The uplink streaming procedures follow a general high-level workflow, starting from provisioningto the actual uplink streaming sessions. The Egest Session refers to the time period during which media content is uplink streamed to the 5GMSu AS and optionally egested from there to the 5GMS Application Provider. The Provisioning Session refers to the time period during which the 5GMSu Client is permitted to upload stream media content. Interactions between the 5GMSu AF and the 5GMSu Application Provider may occur at any time while the Provisioning Session is active.

The 5GMSu Provisioning API allows the selection of Media Session Handling (M5u) and Uplink Streaming (M4u) options, including whether the media content is published to trusted 5GMSu ASs. The 5GMSu AF selects the M5u interface according to the provisioning option. The Media Session Handling interface exposed by the 5GMSu AF can be used for remote control, metrics reporting, requesting different policy and charging treatments, or 5GMSu AF-based Network Assistance.

When the 5GMSu AF and 5GMSu AS reside in the same DN, then the 5GMSu AF selects the 5GMSu AS. Interactions between a 5GMSu AF and a 5GMSu AS (M3u interactions) take place for Content Egest (M2u) and Uplink Streaming (M4u) resource reservations. The 5GMSu AS allocates M2u and M4u resources and communicates resource identifiers back to the 5GMSu AF. The 5GMSu AF provides information about the provisioned resources (in the form of resource identifiers) for Media Session Handling, Content Egest, and Uplink Streaming to the 5GMSu Application Provider. The resource identifiers for Media Session Handling and Uplink Streaming are needed by the 5GMSu Client to access the selected features.

5GMSu Client can (in principle) start the uplink streaming by activating its uplink streaming session. The uplink streaming session for a given UE (or for each UE) is active from the time at which the 5GMSu-Aware Application activates the transmission of an uplink streaming service until its termination.

The 5GMSu-Aware Application receives application metadata from the 5GMSu Application Provider before transmitting the uplink streaming media. The application metadata contains Service Access Information, which acts as an entry point for the 5GMSu Client to start the uplink streaming session. The 5GMSu Client may either receive the Service Access Information from the 5GMSu Application Provider (using a not standardized interface) or instructions for a remote control session. When remote control is activated, then the 5GMSu Client is remotely configured and controlled by a 5GMSu AF.



Figure 6.1-1: High-level call flow for uplink media streaming

Steps:

1. The 5GMSu Application Provider provisions the 5GMSu AF at reference point M1u, including a Content Publishing Configuration for content egest and, optionally, Content Preparation Templates.

2. When Content Publishing is offered and selected, there may be interactions between the 5GMSu AF and the 5GMSu AS at reference point M3u, e.g. to configure Server Certificates and/or Content Preparation Templates and to confirm the availability of resources for Content Preparation and Content Egest by providing a Content Publishing Configuration (defined in clause 6.2.3). The 5GMSu AS provides resource identifiers for the allocated resources to the 5GMSu AF, which then provides the information to the 5GMSu Application Provider.

At some later point in time:

3. The 5GMSu Application Provider provides Service Access Information to the 5GMS-Aware Application at reference point M8u.

4. When the 5GMSu-Aware Application decides to activate an uplink media streaming session, the Service Access Information is provided to the 5GMSu Client.

5. The 5GMSu Client requests the 5GMSu AF to initialise uplink media streaming (M5u).

Alternatively:

6. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

7. The 5GMSu Client requests Service Access Information from the 5GSMu AF at reference point M5u.

Then:

8. If remote control is activated, the 5GMSu AF configures and controls, via M5u, the Media Remote Control sub-function of the 5GMSu Client.

9. The 5GMSu Client starts the Egest Session by activating the uplink streaming session.

10. Uplink media streaming starts from the 5GMSu Client to the 5GMSu AS via reference point M4u.

11. If content preparation was provisioned in step 1, the uplinked media may be manipulated by the 5GMSu AS prior to egest.

12. Media streaming egest starts from the 5GMSu AS to the 5GMSu Application Provider at reference point M2u.

Clauses A.11 to A.15 define additional collaboration scenarios for uplink streaming. The call flow for each collaboration scenario is also included in each clause.

NEXT CHANGE

#### 6.2.2.2 Baseline provisioning procedure

This clause describes the baseline procedure to provision the features using the 5GMS System.

NOTE 1: SLA negotiations between the 5GMSu Application Provider and the 5GMS System provider are outside the scope of the present specification and are included in the figure below for illustrative purposes only.



Figure 6.2.2.2-1: High-level procedure for provisioning the 5GMS System  
for uplink media streaming sessions

Steps:

1. The 5GMSu Application Provider authenticates itself with the system. This procedure reuses existing authentication/authorization procedures, e.g. as defined for CAPIF [13].

2. The 5GMSu Application Provider creates a Provisioning Session, providing its 5GMSu Application Provider identifier as input. 5GMSu Application Provider queries the capabilities and authorized features.

3. The 5GMSuApplication Provider specifies one or more 5GMSu features in the Provisioning Session. A set of authorized features is activated, such as content dynamic policy; network assistance; and content publishing (including egest).

When the content publishing feature is offered and selected, the 5GMS Application Provider provides a Content Publishing Configuration to configure the content publishing behaviour of the 5GMSu AS (see next step), including selecting the uplink ingest protocol and format, content preparation and egest protocol and format.

When the dynamic policy feature is offered and selected, the 5GMSu Application Provider specifies a set of policies which can be invoked for the uplink streaming session. The UE becomes aware of the selected policies in the form of a list of valid Policy Template Ids.

When the edge computing feature is offered and selected, the 5GMSu Application Provider provides one or more Edge Resources Configurations that can be used to support either client-driven management or Application Provider-driven management of edge resources associated with the Provisioning Session.

4. When content publication is desired, the 5GMSu AF interacts with the 5GMSu AS at reference point M3u to configure any necessary Server Certificates and/or Content Publishing Templates and to allocate resources for M2u egest protocol and format by means of a Content Publishing Configuration. The 5GMSu AS responds to the 5GMSu AF with the M2u content egest address.

5. The 5GMSu AF compiles the Service Access Information. The Service Access Information contains access details and options such as the Provisioning Session identifier, M5u (Media Session Handling) addresses for uplink entry point, dynamic policy, network assistance, etc.

6. The 5GMSu AF provides the results to the 5GMSu Application Provider.

The following steps:

7. When the 5GMSu Application Provider has selected full Service Access Information, the results are provided in the form of addresses and configurations for M2u (content egest), M5u (Media Session Handling) and M4u (Media Uplink Streaming). The 5GMSu Application Provider provides a subset of this information to the 5GMSu-Aware Application through M8u.

8. When the 5GMSu-Aware Application decides to activate the streaming service transmission, the Service Access Information is provided to the 5GMSu Client.

9. The 5GMSu Client requests the 5GMSu AF to initialise uplink media streaming (M5u), including reservation of any resources required for content preparation.

Or, alternatively:

10. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

11. When the 5GMSu Application Provider has delegated Service Access Information handling to the 5GMS System, a reference to the Service Access Information (e.g. an URL) is provided. The Media Session Handler fetches the full Service Access Information later from the 5GMSu AF.

Then:

12. The 5GMSu Client streams the content to the 5GMSu AS.

13. When content publishing is offered and has been selected in step 4, the 5GMSu Application Provider can start retrieving the content from the M2u egest interface.

Optionally:

14. The 5GMSu Application Provider may update the Provisioning Session.

According to schedule, or upon request by the 5GMSu-Aware Application:

15. The 5GMSu Application Provider may manually terminate the Provisioning Session (at any time). All associated resources are released. Content may be removed from the 5GMSu AS. The 5GMSd Application Provider may configure a schedule for Provisioning Session termination.

16. The 5GMSu AF sends a notification to the 5GMSu Client upon Provisioning Session termination.

The 5GMSu AF may request the creation or reuse of one or more network slices for ingesting the content of the provisioned session. If more than one network slice is provisioned for the ingest of the content of a session, the list of allowed S‑NSSAIs shall be conveyed to the target UE (e.g. through URSP or through M8u, step 7, or M5u, step 10).

NOTE 2: The 5GMSu AS receiving the content is only accessible through the DNN(s) used by the network slice(s) provisioned for the distribution of that content.

NEXT CHANGE

#### 6.2.3.2 Media egest procedure

The media egest procedure is as follows:



Figure 6.2.3-1: Media egest procedure

The steps are as follows:

1: *Initialization:* the 5GMSu Application Provider discovers the M1u endpoint address and authenticates itself with the 5GMSu AF.

2: *Create Content Publishing Configuration:* the 5GMSu Application Provider creates a new Content Publishing Configuration through the 5GMSu AF. The configuration specifies path, protocol, entry point, the egest push/pull mode, and possibly one or more content preparation templates. Upon successful configuration, the 5GMSu AF responds with a Content Publishing Configuration identifier, and the location of the 5GMSu AS from which to pull the content (if using the pull mode).

3: *Provision 5GMSu AS instance(s):* The 5GMSu AF configures the related 5GMSu AS instance(s) for a particular Content Publishing Configuration via reference point M3u. This step may involve instructing the 5GMSu AS to establish one or more content preparation processes declared in Content Preparation Templates. The 5GMSu AS(s) responds whether the configuration was successful or not.

4: *Confirm provisioning:* Upon successful provisioning, the 5GMSu AF responds with a Content Publishing Configuration identifier, and the location of the 5GMSu AS from which to pull the content (if using the pull mode).

One of the following steps:

5: *Provide the uplink entry point:* The 5GMSu Application Provider publishes the uplink entry point to the 5GMSu-Aware Application through reference point M8u to enable it to begin uplink streaming to the 5GMSu AS.

or:

6: The 5GMSu Client acquires the uplink entry point as part of Service Access Information through reference point M5u.

7: The 5GMSu-Aware Application requests the 5GMSu Client to start the uplink streaming.

8: The 5GMSu Client starts uplink streaming of the content to the 5GMSu AS via reference point M4u.

9: *Media egest:* The 5GMSu Application Provider may start pulling or receiving content (if using push mode) from the 5GMSu AS. The 5GMSu AS performs the requested content preparation prior to making the uplink content ready for being pulled by or pushed to the 5GMSu Application Provider.

NOTE: Pulling media content from the 5GMSu AS may be triggered by a request from the 5MGSu Client through M8u.

The 5GMSu Application Provider may update a Content Publishing Configuration subsequently to modify some of its parameters. The subset of parameters that can be updated may be limited by the 5GMSu AF.

NEXT CHANGE

# 7 5GMS network media processing

## 7.1 General

A 5GMS Application Provider may request media processing to be performed on its media data. This can be instantiated as part of the Uplink or Downlink streaming.

The media processing is performed according to one or more Content Preparation Templates by a set of 5GMS AS instances, which may need to build complex media processing workflows. The 5GMS AF coordinates the media processing and ensures that the appropriate QoS and traffic handling for the session are provided.

## 7.2 Media processing procedures for downlink media streaming

As part of setting up a Content Hosting Configuration for downlink media streaming, a 5GMSd Application Provider may request custom processing to be performed.

The following processing operations may be available:

- Adaptive Bit Rate (ABR) Encoding, Encryption and Encapsulation.

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

- Content Replacement (e.g. Ad insertion, blackouts, regional content):

- MPD (e.g. MPD) modification.

- App Server: other content enrichment functions such as Closed Caption insertion, object detection, content filtering, etc.

The procedures are as follows:



Figure 7.2-1: Media processing procedures for downlink media streaming

The steps are as follows:

1. Upon setting up a Content Hosting Configuration, the 5GMSd Application Provider requests media processing to be set up. The 5GMSd Application Provider provides a description of the type and placement of the processing. The 5GMS System may only allow a shortlisted set of media processing functions to be used by the 5GMSd Application Provider.

2. The 5GMSd AF provisions via reference point M3d a selected set of 5GMSd AS instance(s) to fulfil the requested media processing in the appropriate placement by means of one or more Content Preparation Templates references by a Content Hosting Configuration. Depending on the configuration, one or multiple AS instance(s) may be involved. The Content Hosting Configuration may also reference Server Certificates configured at reference point M3d.

3. The 5GMSd AS instance(s) confirm successful provisioning to the 5GMSd AF.

4. The 5GMSd AF confirms the successful creation of the Content Hosting Configuration with the requested media processing to the external Media application server.

5. A 5GMSd Client sends a request for media content to one of the 5GMSd AS instance(s) listed in the provisioned Content Hosting Configuration (see clause 5.4).

6. If it does not already have a copy of the requested media cached, the 5GMSd AS fetches the media from the 5GMSd Application Provider.

7. The 5GMSd AS processes the ingested media based on the media processing workflow configured by the Content Preparation Template(s) provisioned in step 2.

8. The 5GMSd AS serves the requested media to the 5GMSd Client after successful media processing.

Different variants of these procedures may be possible, depending on the type of processing, the placement of the processing, and the characteristics of the Content Hosting Configuration.

## 7.3 Media processing procedures for uplink media streaming

The 5GMSu AF instructs the 5GMSu AS to perform processing of the media according to the provided media processing document.

The procedure is defined as follows:



Figure 7.3-1: Media pocessing pProcedures for uplink media streaming

The steps are as follows:

1. *Setup of uplink streaming configuration*: The 5GMSu Application Provider sends a request to start an uplink session to the 5GMSu AF. The request contains a description of the media processing that is to be performed by the 5GMSu AS in the form of one or more Content Preparation Templates referenced by a Content Publishing Configuration. Depending on the configuration one 5GMSu AS may be involved.

2. *Provision 5GMSu AS*: The 5GMSu AF parses the media processing description and provisions the 5GMSu AS that will perform the requested processing via reference point M3u. If the requested processing is not accepted, the session creation fails.

3. *5GMSu AS ready*: The 5GMSu AS confirms the correct configuration and informs the 5GMSu AF that it is ready to receive and process media as requested.

4. *Confirm uplink streaming configuration*: The 5GMSu AF confirms the successful creation of the uplink streaming configuration to the 5GMSu Application Provider.

5. *Uplink streaming session starts*: the session is triggered in the 5GMSu Client.

6. *Uplink media streaming*: Media content is streamed from the 5GMSu Client to the 5GMSu AS.

7. The 5GMSu AS process(es) the received media based on the provisioned media processing workflow configured in step 2.

NEXT CHANGE

# A.2 Downlink media streaming with both AF and AS deployed in the trusted Data Network

This collaboration scenario shown in figure A.2-1 represents a MNO CDN scenario, where the CDN is used for ingest and delivery of the content. In this collaboration scenario, similar to that in clause A.1, the Media Session Handler is not present/necessary for downlink media streaming operation since all Service Access Information is delivered at reference point M8d from the 5GMSd Application Provider to the 5GMSd-Aware Application, and in turn the Service Access Information is passed to the Media Player. Similarly, M8d is used for UE application-level data reporting from the 5GMSd-Aware Application to the 5GMSd Application Provider. The 5GMSd AF is present in this scenario to obtain Service Access Information from the 5GMSd Application Provider (at M1d), and in turn, passes that information to the 5GMSd AS.



Figure A.2-1: Downlink media streaming with AF and AS in the trusted Data Network

NEXT CHANGE

# A.5 Downlink media streaming with AS deployed in an external Data Network, provisioned by AF deployed in the trusted Data Network

The collaboration scenario shown in figure A.5-1 is similar to that depicted in clause A.4 with the difference that the external content hosting function (5GMSd AS) is provisioned from a 5GMSd AF which is located in a trusted Data Network. It is expected that a 5GMSd AF and 5GMSd AS from different providers are interconnected using an M3d interface. The Ingest API (M2d′) may follow 5GMS specifications.



Figure A.5-1: Downlink media streaming with AS in external Data Network, provisioned by AF in the trusted Data Network

Interface M2d′ may be similar to interface M2d. All other interfaces depicted follow 3GPP specifications.

NEXT CHANGE

# A.6 Downlink media streaming with AS deployed in the trusted Data Network, provisioned by AF deployed in an external Data Network

The collaboration scenario shown in figure A.6-1 is similar to those depicted in clauses A.4 and A.5 with the difference that the trusted content hosting function (5GMSd AS) is provisioned from an external 5GMSd AF. It is expected that a 5GMSd AF and 5GMSd AS from different providers are interconnected using an M3d interface. The Provisioning API (M1d′) may follow 5GMS specifications. Interactions between the externally-deployed 5GMSd AF and the PCF are proxied via the NEF at reference point N33.



Figure A.6-1: Downlink media streaming with AS in the trusted Data Network, provisioned by AF in external Data Network

The interface at reference point M1d′ may be similar to that defined at reference point M1d. All other interfaces depicted follow 3GPP specifications.

NEXT CHANGE

# A.7 Downlink media streaming with both AF and AS deployed in the trusted Data Network and AF interaction with PCF

The collaboration scenario shown in figure A.7-1 represents a MNO CDN scenario (similar to that in clause A.2) where the CDN is used for ingest and delivery of the content. Additional 5GMS features are used which require interaction with the PCF.



Figure A.7-1: Downlink media streaming with AF and AS in the trusted Data Network

NEXT CHANGE

# A.10 Uplink media streaming using content preparation with both AF and AS deployed in the trusted Data Network

In this collaboration scenario shown in figure A.10-1, both the 5GMSu AS and 5GMSu reside in the trusted Data Network. Additionally, reference point M2u is used for content egest to the external 5GMSu Application Provider.



Figure A.10-1: Uplink media streaming with AF and AS in trusted Data Network

Figure A.10‑2 provides a high-level call flow for this collaboration scenario.



Figure A.10-2: Call flow for uplink media streaming using content preparation with AF and AS in trusted Data Network

Steps:

1. The 5GMSu Application Provider creates a Provisioning Session with the 5GMSu AF.

**2. The 5GMSu Application Provider requests the 5GMSu AF to create one Content Publishing Configuration that defines the instructions for content egest (M1u).**

**3. The 5GMSu AF, based on the received Content Publishing Configuration, requests the 5GMSu AS to confirm the availability of content resources for content preparation (M3u).**

**4. The 5GMSu AF acknowledges the successful creation of the Content Publishing Configuration to the 5GMSu Application Provider (M1u).**

At some later point in time:

5. The 5GMSu Application Provider provides Service Access Information to the 5GMS-Aware Application at reference point M8u.

6. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

**7. The 5GMSu Client requests that the 5GMSu AF initialises uplink media streaming, including any content preparation required by the Content Publishing Configuration (M5u).**

Alternatively:

8. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

9. The 5GMSu Client requests Service Access Information from the 5GSMu AF at reference point M5u.

As a consequence:

**10. The 5GMSd AF requests initialisation of the content preparation process by the 5GMSd AS (M3u).**

**11. The 5GMSd AS initialises the content preparation process, if it is not already running.**

**12. The 5GMSd AF acknowledges the initialisation of the content preparation process (M3u).**

Then:

13. The 5GMSu Client performs media session handling for the uplink streaming session (M5u).

14. Uplink media streaming starts from the 5GMSu Client to the 5GMSu AS (M4u).

**15. If content preparation was successfully initialized at step 11 or before, the uplinked media may be manipulated by the 5GMSu AS prior to egest.**

16. Media streaming egest starts from the 5GMSu AS to the 5GMSu Application Provider (M2u).

Finally:

**17. The 5GMSu AS releases its resources after observing a period of interactivity.**

NOTE: This step is implementation dependent.

# A.11 Uplink media streaming using content preparation (media plane only) with both AF and AS deployed in the trusted Data Network

This scenario pertains to a collaboration in the uplink media plane only for which the 5GMSu AS is deployed in the trusted Data Network. Here, the 5GMS System is assumed to offer uplink streaming capabilities as a service to an external 5GMSu Application Provider. This collaboration scenario is analogous to the scenario in clause A.2 in terms of the use of M8u (as opposed to M8d in clause A.2) for the delivery of Service Access Information from the 5GMSu Application Provider to the 5GMSu Client via the 5GMSu Aware Application, and the reporting of UE application data from the 5GMSu-Aware Application to the 5GMSu Application Provider.



ucollaborationinteractionClient during an uplink streaming session

Figure A.11-1: Uplink media streaming (media plane only) with AF and AS in the trusted Data Network

Figure A.11‑2 provides a high-level call flow for this collaboration scenario.



Figure A.11-2: Uplink media streaming using content preparation (media plane only) with AF and AS in the trusted Data Network

Steps:

1. The 5GMSu Application Provider creates a Provisioning Session for uplink streaming with the 5GMSu AF.

**2. The 5GMSu Application Provider creates a Content Publishing Configuration as part of the Provisioning Session that defines the instructions for content egest (M1u).**

**3. The 5GMSu AF, based on the received Content Publishing Configuration, requests the 5GMSu AS to instantiate the content preparation process (M3u).**

**4. The 5GMSu AS initialises the content preparation process.**

**5. The 5GMSu AS acknowledges the initialisation of the required process (M3u).**

**6. The 5GMSu AF acknowledges the successful creation of the Content Publishing Configuration to the 5GMSu Application Provider (M1u).**

At some later point in time:

7. The 5GMSu Application Provider optionally provides Service Access Information to the 5GMS-Aware Application (M8).

8. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

9. Uplink media streaming starts from the 5GMSu Client to the 5GMSu AS (M4u).

**10. If content preparation was initialized in step 4, the uplinked media may be manipulated by the 5GMSu AS prior to egest.**

11. Media streaming egest starts from the 5GMSu AS to the 5GMSu Application Provider (M2u).

Finally:

**12. The 5GMSu AS releases its resources after observing a period of inactivity.**

NOTE: This step is implementation-dependent.

NEXT CHANGE

# A.15 Hybrid uplink and downlink media streaming using content preparation

This scenario represents a hybrid end-to-end form of collaboration across uplink media streaming and downlink media streaming services. An external 5GMS Application Provider relies on the 5GMS System to support both the uplink streaming media transmission by 5GMSu Clients and subsequent distribution of that content via downlink media streaming for reception by 5GMSd Clients within the same 5GMS System.



Figure A.15-1: Hybrid uplink and downlink media streaming

Figure A.15-2 shows the call flow for this scenario. To simplify the call flow, the content preparation process is omitted.



Figure A.15-2: Call flow for hybrid uplink and downlink media streaming using content preparation

Steps:

1. The 5GMSd Application Provider creates a Provisioning Session with the 5GMSd AF (M1d).

2. The 5GMSd Application Provider provisions the 5GMSD AF with a Content Hosting Configuration.

3. The 5GMSdAF, based on the received Content Hosting Configuration, requests the 5GMSd AS to confirm the availability of distribution resources (M3d).

4. The 5GMSd AF acknowledges to the 5GMSd Application Provider the successful creation of the Content Hosting Configuration (M1d).

5. The 5GMS Application Provider creates a Provisioning Session with the 5GMSu AF (M1u).

**6. The 5GMSu AF requests the 5GMSu AS to confirm the uplink resources availability. (M3u).**

7. The 5GMSu AF acknowledges to the 5GMSu Application Provider of the successful provisioning (M1u).

At some later point in time:

8. The 5GMSu Application Provider provides Service Access Information to the 5GMS-Aware Application at reference point M8u.

9. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

**10. The 5GMSu Client requests that the 5GMSu AF initialises uplink media streaming (M5u).**

Alternatively:

11. The 5GMS-Aware Application requests the 5GMSu Client to start an uplink streaming session (M6u/M7u).

12. The 5GMSu Client requests Service Access Information from the 5GSMu AF at reference point M5u.

At some later point in time:

13. Uplink media streaming starts from the 5GMSu Client to the 5GMSu-like AS (M4u′).

14. Media streaming egest starts from the 5GMSu-like AS to the 5GMSu Application Provider (M2u′).

**15. If content preparation was provisioned in step 6, the uplinked media may be manipulated by the 5GMSu AS prior to being streamed to the 5GMSd AS.**

16. The 5GMSu AS streams the content to the 5GMSd AS (I2, not specified).

Steps 17–21 concern the 5GMS downlink streaming process:

17. The 5GMS Application Provider optionally provides the service access information to the 5GMSd-Aware Application (M8d).

18. The 5GMS-Aware Application requests the 5GMSd Client to start an uplink streaming session (M6d/M7d).

19. If Service Access Information was not provided in step 14, the 5GMSd Client requests this information from the 5GSMd AF (M5d).

20. The 5GMSd Client requests the start of the downlink streaming session from the 5GSMd AF (M5d).

21. The downlink media streaming starts (M4d).

Finally:

**22. The 5GMSu AS releases its uplink content preparation resources after observing a period of interactivity.**

**23. The 5GMSd AS releases its downlink content preparation resources after observing a period of interactivity.**

NOTE: Steps 22 and 23 are implementation-dependent.

END OF CHANGES