**3GPP TSG-S4 Meeting # 127-bis-e S4-240788**

Online, April 8th - 12th, 2024 *(revision of S4-240576)*

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **26.510** | **CR** |  | **rev** | **2** | **Current version:** | **1.1.4** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:***  | pCR on Introduction of RTC-related provisioning and dynamic policy |
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| ***Source to WG:*** | Qualcomm Inc. |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | 5GMS\_Pro\_Ph2 |  | ***Date:*** | 23rd January 2024 |
|  |  |  |  |  |
| ***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 canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Updates to the common procedures to support RTC are not incorporated into 26.510. |
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| ***Summary of change:*** |  |
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| ***Consequences if not approved:*** |  |
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| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **First Change** |

## 3.3 Abbreviations

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

5GC 5G Core

AF Application Function

ANBR Access Network Bit rate Recommendation

AS Application Server

EAS Edge Application Server

EEC Edge Enabler Client

EES Edge Enabler Server

QoE Quality of Experience

RTC Real-Time (media) Communication

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| **Next Change** |

### 5.2.1 Overview

A Media Application Provider may use the operations in this clause to provision the different features offered by the Media Delivery System in the Media AF. The Provisioning API exposed by the Media AF to the Media Application Provider at reference point M1 offers the following sets of operations:

1. Provisioning of *Provisioning Sessions* (see clause 5.2.2) to act as an umbrella for the following provisioning information. Each such Provisioning Session is uniquely identified by a system-dependent Provisioning Session identifier as well as by system-independent service identifier that is subsequently used by a Media-Aware Application to launch media session handling (see clause 10.2) via a 3GPP Service URL (see clause 6).

2. Discovery of the set of content ingest and/or egest protocols supported by the Media AS for a particular Provisioning Session (see clause 5.2.3):

- For downlink media streaming according to TS 26.512 [26512], discovery of the content ingest protocols available at reference point M2 and the content distribution protocols available at reference point M4.

- For uplink media streaming according to TS 26.512 [26512], discovery of the content contribution protocols available at reference point M4 and the content egest protocols available at reference point M2.

3. Provisioning of *Server Certificates* within the scope of a Provisioning Session (see clause 5.2.4) to be used by the Media AS to assert its identity to the Media Access Function in Media Clients during media delivery sessions at reference point M4.

4. Provisioning of *Content Preparation Templates* within the scope of a Provisioning Session (see clause 5.2.5) that can be used by the Media AS to manipulate media content ingested at reference point M2 or contributed at reference point M4.

5. Provisioning of *Edge Resources* within the scope of a Provisioning Session (see clause 5.2.6) to be used to instantiate the Media AS as a set of Edge Application Servers (EAS) in an Edge Data Network (EDN) using the APIs specified in TS 29.558 [29558].

5. Provisioning of *Policy Templates* within the scope of a Provisioning Session (see clause 5.2.7) that can be applied to M4 downlink/uplink media delivery sessions in order to realise different Service Operation Points as part of the Dynamic Policies feature (see clause 5.4.3).

7. Provisioning of media delivery by the Media AS within the scope of a Provisioning Session using the abovementioned building blocks:

- For downlink media streaming according to TS 26.512 [26512], provisioning of the *Content Hosting* feature of the Media AS (see clause 5.2.8), which offers functionality equivalent to that of a public Content Delivery Network (CDN): content ingest at reference point M2 for onward distribution by the Media AS to Media Clients via reference point M4 or via other distribution systems such as eMBMS or MBS.

 After discovering the set of ingest and distribution content protocols supported by the Media AS (see clause 5.2.2), the Media Application Provider may provision a Server Certificate (see clause 5.2.4), Content Preparation Template (see clause 5.2.5) and/or Edge Resources Configuration (see clause 5.2.6) for each Content Hosting distribution configuration to reference. The Media Application Provider may also provision one or more Policy Templates (see clause 5.2.7) to realise Service Operation Points pertaining to downlink media delivery.

- For uplink media streaming according to TS 26.512 [26512], provisioning of the *Content Publishing* feature of the Media AS (see clause 5.2.9), including content contribution by Media Clients at reference point M4 and subsequent content egest of content at reference point M2 after optional manipulation by a Content Preparation Template.

 After discovering the set of contribution and egest content protocols supported by the Media AS (see clause 5.2.2), the Media Application Provider may provision a Server Certificate (see clause 5.2.4), Content Preparation Template (see clause 5.2.5) and/or Edge Resources Configuration (see clause 5.2.6) for each Content Publishing contribution configuration to reference. The Media Application Provider may also provision one or more Policy Templates (see clause 5.2.7) to realise Service Operation Points relevant to the parent Provisioning Session.

- For real-time media communication according to TS 26.113 [26113], provisioning of the RTC functionality of the Media AS (see clause 5.2.12).

 The Media Application Provider may provision WebRTC Signalling, TURN and STUN subfunctions of the Media AS in the Media Delivery System to facilitate communication between Media Clients. Additionally, the Media Application Provider may provision Server Certificates (see clause 5.2.4) for presentation by these subfunctions to Media Clients. Alternatively, the Media Application Provider may provide these subfunctions itself and inform the Media AF of their endpoint addresses at the time of provisioning. The Media Application Provider may additionally provision an Edge Resources Configuration (see clause 5.2.6) for the RTC Configuration to reference. The Media Application Provider may also provision one or more Policy Templates (see clause 5.2.7) for the RTC Configuration to reference that the Media Session Handler is then able to instantiate for RTC-based media delivery sessions.

8. Provisioning of *QoE metrics reporting* within the scope of a Provisioning Session (see clause 5.2.10) to configure how and how often the Media Client should report Quality of Experience metrics to the Media AF during the course of media delivery sessions at reference point M4.

9. Provisioning of *consumption reporting* within the scope of a Provisioning Session (see clause 5.2.11) to configure how often the Media Client should report downlink media consumption to the Media AF during the course of media delivery sessions at reference point M4.

10. Provisioning of rules for processing of UE data (as defined in TS 26.531 [26531]) related to media delivery sessions by the Data Collection AF instantiated in the Media AF (as defined in clause 4.7 of TS 26.501 [26501]), and for restricting its exposure over reference points R5 and R6 by means of Event Data Processing Configurations and Data Access Profiles for a particular Event ID.

NOTE: The *Network Assistance* feature is not provisioned by the Media Application Provider at reference point M1. Instead, it is provisioned at the discretion of the Media Delivery System operator using means beyond the scope of the present document.

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## 5.2.9A Real-time Media Communication Configuration provisioning

#### 5.2.9A.1 General

These operations are used by the Media Application Provider at reference point M1 to provision the configuration information for RTC-based media delivery sessions.

HTTP responses for successful and operation-specific failure cases are specified in the following clauses. For all other failure cases, an HTTP response indicating a response code in accordance with clause 7.1.6 shall be returned to the API client. In all failure cases, a message body in accordance with clause 7.1.7 shall be included in the response message.

#### 5.2.9A.2 Create Real-time Media Communication Configuration resource operation

This operation is used by the Media Application Provider at reference point M1 to activate the RTC feature for a particular Provisioning Session. The Media Application Provider shall use the HTTP POST method for this purpose. The request URL shall be a well-known sub-resource of the Provisioning Session resource, as specified in clause 8.9.2. The HTTP request message body shall be an RTC Configuration resource representation, as specified in clause 8.9A.3.1. There is at most one RTC Configuration resource at a time for a given Provisioning Session.

The Media Application Provider may request that the Media Delivery System provides additional support services to facilitate communication between Media Clients wishing to engage in an RTC-based media delivery session:

- If the enableStunService flag is set to true, the Media AF shall configure the Media AS to provide a STUN service to Media Clients and the Media AF shall populate information about the endpoint(s) of this service in stunServerEndpoints. Otherwise, the Media AS is not required to provide a STUN service.

- If the enableTurnService flag is set to true, the Media AF shall configure the Media AS to provide a TURN service to Media Clients and the Media AF shall populate information about the endpoint(s) of this service in turnServerEndpoints. Otherwise, the Media AS is not required to provide a TURN service.

- If the enableSwapService flag is set to true, the Media AF shall configure the Media AS to provide a SWAP service to Media Clients and the Media AF shall populate information about the endpoint(s) of this service in swapServer‌Endpoints. Otherwise, the Media AS is not required to provide a SWAP service.

If the operation is successful, the Media AF shall return a 201 (Created) HTTP response message and the request URL shall be returned as the value of the Location HTTP header field. The response message body shall be a representation of the current state of the RTC Configuration resource (see clause 8.9A.3.1), including any properties assigned by the Media AF.

If the request is acceptable but the Media AF is unable to provision the resources required by the supplied RTC Configuration, the create operation shall fail with an HTTP response status code of 500 (Internal Server Error) and an error message body per clause 7.1.7. In this case, the RTC Configuration resource shall remain in an uncreated state in the Media AF.

#### 5.2.9A.3 Retrieve Real-time Media Communication Configuration resource operation

This operation is used by the Media Application Provider to retrieve the current state of an existing RTC Configuration resource from the Media AF. The HTTP GET method shall be used for this purpose.

If the operation is successful, the Media AF shall return a 200 (OK) response message that includes a representation of the target RTC Configuration resources (see clause 8.9A.3.1) in the response message body.

#### 5.2.9A.4 Update Real-time Media Communication Configuration resource operation

This operation is invoked by the Media Application Provider to modify the properties of an existing RTC Configuration resource. All writeable properties may be updated. The HTTP PATCH or HTTP PUT methods shall be used for this purpose.

If the HTTP request is acceptable but the operation results in no change to the resource representation, a 204 (No Content) HTTP response message with an empty body should be returned.

If the operation is otherwise successful, the Media AF shall return a 200 (OK) HTTP response message and shall provide a representation of the current state of the target resource in the message body to confirm successful update.

Attempts to modify read-only properties of the target RTC Configuration resource, such as the STUN service endpoint information, shall be rejected by the Media AF with a 403 (Forbidden) HTTP response that includes an error message body per clause 7.1.7.

If the request is acceptable but the Media AF is unable to provision the resources required by the supplied RTC Configuration, the update operation shall fail with an HTTP response status code of 500 (Internal Server Error) and an error message body per clause 7.1.7. In this case the RTC Configuration resource in the Media AF shall remain in the state immediately prior to the update operation.

#### 5.2.9A.5 Destroy Real-time Media Communication Configuration resource operation

This operation is used by the Media Application Provider to destroy an RTC Configuration resource. The HTTP DELETE method shall be used for this purpose. As a result, the Media AF will release any associated network resources and invalidate the configuration.

If the procedure is successful, the Media AF shall return a 204 (No Content) HTTP response message with an empty message body.

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## 5.3 Network media session handling (M3, M5) interactions

### 5.3.2 Service Access Information acquisition

#### 5.3.2.1 General

Service Access Information is the set of parameters and addresses needed by the Media Client to activate reception of a downlink media delivery session, to activate an uplink media delivery session for content contribution or to obtain configuration parameters to initiate real-time media communication (RTC).

The Media Session Handler may obtain Service Access Information in one of two ways:

1. From the Media-aware Application via reference point M6. In this case, the Service Access Information is initially acquired by the Media-aware Application from the Media Application Provider via reference point M8 and the Media-aware Application shall pass the parameters to the Media Session Handler using one of the session launch mechanisms specified in clause 10.2.

2. From the Media AF via reference point M5. In this case, the Service Access Information is derived by the Media AF from a Provisioning Session established at reference point M1 and the Media AF exposes this to the Media Session Handler using the operations specified in this clause. At the start of a media delivery session, a minimal set of baseline Service Access Information parameters is passed to the Media Session Handling using one of the session launch mechanisms specified in clause 10.2 and this causes it to fetch the full Service Access Information from the Media AF using the procedure specified in clause 5.3.2.3.

The data model of the Service Access Information resource acquired by the Media Session Handler of the Media Client is specified in clause 9.2.3.

- Typically, the Service Access Information for downlink media delivery includes a media entry point (e.g. a URL to a DASH MPD or a URL to a progressive download file) that can be consumed by the Media Access Function and is handed to the Media Access Function via reference point M7.

- The Service Access Information for real-time media communication (RTC) includes information used by the Media Client to configure RTC-based media delivery sessions via the Media AS at reference point M4.

Service Access Information additionally includes configuration information to allow the Media Session Handler to invoke procedures for dynamic policy (see clause 5.3.3), network assistance (clause 5.3.4), QoE metrics reporting (clause 5.3.5) and consumption reporting (clause 5.3.6).

If an Edge Resources Configuration with client-driven management (EM\_CLIENT\_DRIVEN) is provisioned in the applicable Provisioning Session (see clause 5.2.6), the Media AF shall convey a Client Edge Resources Configuration to the Media Session Handler as part of the Service Access Information it provides at reference point M5.

NOTE: The requirements for an edge-enabled Media Session Handler are defined in clause 4.5.2 of TS 26.501 [26501].

HTTP responses for successful and operation-specific failure cases are specified in the following clauses. For all other failure cases, an HTTP response indicating a response code in accordance with clause 7.1.6 shall be returned to the API client. In all failure cases a message body in accordance with clause 7.1.7 shall be included in the response message.

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#### 5.3.3.2 Create Dynamic Policy Instance resource operation

In order to instantiate a new dynamic policy, the Media Session Handler shall first create a resource for the Dynamic Policy Instance in the Media AF. The Media Session Handler shall use the HTTP POST message for this purpose. The body of the HTTP POST message shall be a Dynamic Policy Instance resource representation that includes a Provisioning Session identifier, the resource identifier of the target Policy Template and a set of Service Data Flow descriptions identifying the application flow(s) to be policed.

1. The provisioningSessionId property associates the Dynamic Policy Instance resource with a Provisioning Session.

2. The policyTemplateId property uniquely identifies the Policy Template on which the Dynamic Policy Instance is based.

3. The serviceDataFlowDescriptions property of the Dynamic Policy Instance resource representation is populated by the Media Session Handler and shall declare a set of Service Data Flow templates according to TS 23.503 [23503] that describe one or more application data flows comprising the media delivery session. Each Service Data Flow template contains exactly one of the following filtering specifications to identify traffic belonging to a media delivery application flow:

- a flowDescription object (including 5-tuples, Type of Service, Security Parameter Index, etc.).

- a domainName.

4. When the Media Session Handler attempts to activate a QoS-related Policy Template, the qosSpecification property shall be present in the Dynamic Policy Instance resource representation and it shall contain the following properties specified in clause 7.3.3.6 to describe the QoS requirements of the media application flows described by the serviceDataFlowDescriptions property:

- downlinkBitRates, indicating the maximum requested bit rate, minimum desired bit rate and minimum requested bit rate in the downlink direction.

- uplinkBitRates, indicating the maximum requested bit rate, minimum desired bit rate and minimum requested bit rate in the uplink direction.

- desiredPacketLatency, indicating the desired packet latency in both the downlink and uplink directions.

- desiredPacketLossRate, indicating the desired packet loss rate in both the downlink and uplink directions.

- *rtcQosInformation*, indicating for an RTC session the QoS information for each sub-component of the RTC session.

5. When the 5G System employs a traffic enforcement function to ensure that traffic complies with the policy described by the qosSpecification property, the Media AF shall explicitly indicate this in the Dynamic Policy resource representation by setting the qosEnforcement property to true.

If the operation is successful, the Media AF shall create a new Dynamic Policy Instance resource. In this case, the Media AF shall return a 201 (Created) HTTP response message to the Media Session Handler, and the URL of the newly created Dynamic Policy Instance resource, including its resource identifier, shall be provided as the value of the Location HTTP header field. The response message body shall be a representation of the current state of the Dynamic Policy Instance resource (see clause 9.3.3.1), including any properties assigned by the Media AF.

When the Dynamic Policy Instance is successfully instantiated, the Media AF triggers the creation of a corresponding PCC rule in the 5G System according to clause 5.5.2 to enforce the required QoS and/or charging policy on the specified application flow(s). Depending on the ServiceDataFlowDescription objects in the received Dynamic Policy Instance resource representation and the sdfMethod indicated by each one, the Media AF shall populate for each one a flowDescription object and/or provide an Application Identifier referring to a PFD (Packet Flow Description) object containing the domain name of a Media AS instance.

NOTE: When the Media AF is deployed in an external Data Network, it is the responsibility of the NEF to map any external Application Identifier supplied by the Media AF into an internal Application Identifier that is known to the PCF.

If the supplied Dynamic Policy Instance is not acceptable to the Media AF, the create operation shall fail with an HTTP response status code of 400 (Bad Request) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF forbids the instantiation of the referenced Policy Template, for example because the UE is not permitted in the charging specification, the create operation shall fail with an HTTP response status code of 403 (Forbidden) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF is unable to provision the resources required by the supplied Dynamic Policy Instance, the create operation shall fail with an HTTP response status code of 500 (Internal Server Error) and an error message body per clause 7.1.7. In this case, the Dynamic Policy Instance resource shall remain in an uncreated state in the Media AF.

If the Media Session Handler needs to instantiate several dynamic policies, it may invoke this operation as often as needed.

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#### 5.3.4.2 Create Network Assistance Session resource operation

This operation is used by the Media Session Handler to create a Network Assistance Session in the Media AF. The POST HTTP method shall be used for this purpose and the request message body shall be a Network Assistance Session resource representation as specified in clause 9.4.3.1.

1. The provisioningSessionId property associates the Network Assistance Session with a Provisioning Session.

2. The Media Session Handler shall populate the Network Assistance Session resource representation in the request with service data flow information and optionally the Policy Template identifier of the network QoS policy currently in force on the media streaming session for which Network Assistance operations are to be performed. (The Media AF subsequently uses this information to execute Network Assistance operations in the 5GC.)

 The serviceDataFlowDescriptions property of the Network Assistance Session resource representation is populated by the Media Session Handler and shall declare a set of Service Data Flow templates according to TS 23.503 [33] that describe one or more application data flows comprising the media delivery session. Each Service Data Flow template contains exactly one of the following filtering specifications to identify traffic belonging to a media delivery application flow:

- a flowDescription object (including 5-tuples, Type of Service, Security Parameter Index, etc.).

- a domainName.

3. The requestedQoS property may be provided in the Network Assistance Session resource representation to specify an initial network QoS the Media Session Handler wishes to use for the media streaming session. If the policyTemplateId property is also populated in the Network Assistance Session resource representation, the Media AF shall return a 400 (Bad Request) HTTP response message if the requested network QoS lies outside the limits specified in the referenced Policy Template.

- If the requestedQoS property is omitted from the Network Assistance Session resource representation but the policyTemplateId is populated, the Media AF shall use the network QoS currently provisioned in the referenced Policy Template as the floor/ceiling for bit rate recommendations and delivery boosts within the scope of the Network Assistance Session.

- If neither a policyTemplateId nor a requestedQoS are supplied when creating a Network Assistance Session, operations invoked on the Media AF within the scope of the Network Assistance session are constrained only by the policies of the PCF. Upon successful creation, the Media AF shall return a 201 (Created) response message and the URL of the newly created resource, including its Network Assistance session resource identifier, shall be provided as the value of the Location HTTP header field. The response message body shall be a representation of the current state of the Network Assistance Session resource (see clause 9.4.3.1), including any properties assigned by the Media AF.

If the operation is successful, the Media AF shall create a new Network Assistance Session resource. In this case, the Media AF shall return a 201 (Created) HTTP response message to the Media Session Handler, and the URL of the newly created Network Assistance Session resource, including its resource identifier, shall be provided as the value of the Location HTTP header field. The response message body shall be a representation of the current state of the Network Assistance Session resource (see clause 9.4.3.1), including any properties assigned by the Media AF.

When the Network Assistance Session is successfully instantiated, the Media AF triggers the creation of a corresponding PCC rule in the 5G System according to clause 5.5.3 to enforce the required QoS on the specified application flow(s). Depending on the ServiceDataFlowDescripton objects in the received Network Assistance Session resource representation and the sdfMethod indicated by each one, the Media AF shall populate for each one a flowDescription object and/or provide an Application Identifier referring to a PFD (Packet Flow Description) object containing the domain name of a Media AS instance.

NOTE: When the Media AF is deployed in an external Data Network, it is the responsibility of the NEF to map any external Application Identifier supplied by the Media AF into an internal Application Identifier that is known to the PCF.

If the supplied Network Assistance Session is not acceptable to the Media AF, the create operation shall fail with an HTTP response status code of 400 (Bad Request) and an error message body per clause 7.1.7. In this case, the Network Assistance Session resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF forbids the use of the referenced Policy Template in a Network Assistance Session, for example because the UE is not permitted in the charging specification, the create operation shall fail with an HTTP response status code of 403 (Forbidden) and an error message body per clause 7.1.7. In this case, the Network Assistance Session resource shall remain in an uncreated state in the Media AF.

If the request is acceptable but the Media AF is unable to provision the resources required by the supplied Network Assistance Session, the create operation shall fail with an HTTP response status code of 500 (Internal Server Error) and an error message body per clause 7.1.7. In this case, the Network Assistance Session resource shall remain in an uncreated state in the Media AF.

The Media Client uses the Network Assistance Session resource identifier (naSessionId) provided by the Media AF to refer all subsequent API calls to the Media AF instance responsible for that Network Assistance Session.

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#### 7.3.4.3 ProvisioningSessionType enumeration

Table 7.3.4.3‑1: Definition of ProvisioningSessionType enumeration

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| Enumeration value | Description |
| MS\_DOWNLINK | Downlink media streaming |
| MS\_UPLINK | Uplink media streaming |
| RTC | Real-time media communication (RTC) |

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#### 7.3.3.3A M1RTCFlowInformation type

Table 7.3.3.3A-1: Definition of M1RTCFlowInformation type

|  |  |  |  |
| --- | --- | --- | --- |
| Property name | Data type | Cardinality | Description |
|  |  |  |  |
| mediaType | MediaType | 1..1 | Media type for which the flow information shall be applied. This is used to associate the QoS information with the right sub-component of the session (e.g. applicable to audio or video). |
| marBwDlBitRate | BitRate | 1..1 | Maximum requested bit rate for the Downlink. |
| marBwUlBitRate | BitRate | 1..1 | Maximum requested bit rate for the Uplink. |
| minDesBwDlBitRate | BitRate | 0..1 | Minimum desired bit rate for the Downlink. |
| minDesBwUlBitRate | BitRate | 0..1 | Minimum desired bit rate for the Uplink. |
| mirBwDlBitRate | BitRate | 1..1 | Minimum requested bit rate for the Downlink. |
| mirBwUlBitRate | BitRate | 1..1 | Minimum requested bandwidth for the Uplink. |
| desLatency | integer | 0..1 | Desired Latency. |
| desLoss | integer | 0..1 | Desired Loss Rate. |
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|  |  |  |  |
| desPduSetParameters | PduSetQosPara | 0..1 | Desired PDU Set QoS parameters as specified in clause 5.5.4.11 of TS 29.571 [29571] |
| pduSetMarking | boolean | 0..1 | Indicates if PDU Set marking is to be activated for this flow. |

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#### 7.3.3.4 M1QoSSpecification type

Table 7.3.3.4-1: Definition of type M1QoSSpecification

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| --- | --- | --- | --- | --- |
| Property name | Data type | Cardinality | Usage | Description |
| qosReference | string | 0..1 |  | As specified in clause 5.6.2.7 of TS 29.514 [29514] (see NOTE). |
| downlink‌Qos‌Specification | M1Unidirectional‌QoS‌Specification | 0..1 |  | QoS specification in the downlink direction (see NOTE and clause 7.3.3.3). |
| uplink‌Qos‌Specification | M1Unidirectional‌QoS‌Specification | 0..1 |  | QoS specification in the uplink direction (see NOTE and clause 7.3.3.3). |
| rtcQosSpecification | array(M1RTCFlowInformation) | 0..1 |  | QoS specification for RTC flows (see NOTE and clause 7.3.3.3A). |
| NOTE: At least one of these properties shall be specified. |

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#### 7.3.3.5A PDUSetMarking type

Table 7.3.3.5A-1: Definition of PDUSetMarking type

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| --- | --- | --- | --- |
| Property name | Data type | Cardinality | Description |
| headerExtensionInfo | RtpHeaderExtInfo | 0..1 | Configuration information of the RTP header extension used for PDU Set marking as specified in clause 5.5.4.14 of TS 29.571 [29571]. |
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When the RTP Header Extensions for PDU Set Marking is activated for the media flow, the RTP Header Extension Information shall indicate the PDU Set marking configuration.

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#### 7.3.3.5B M5RTCFlowInformation type

Table 7.3.3.5B-1: Definition of type M5RTCQoSSpecification type

|  |  |  |  |
| --- | --- | --- | --- |
| Property name | Data type | Cardinality | Description |
| mediaIdentifier | string | 1..1 | Provides an identifier for the media stream to associate with the corresponding service component in the serviceDataFlowDescriptions of the Dynamic Policy resource. |
| marBwDlBitRate | BitRate | 1..1 | Maximum requested bit rate for the Downlink. |
| marBwUlBitRate | BitRate | 1..1 | Maximum requested bit rate for the Uplink. |
| minDesBwDlBitRate | BitRate | 0..1 | Minimum desired bit rate for the Downlink. |
| minDesBwUlBitRate | BitRate | 0..1 | Minimum desired bit rate for the Uplink. |
| mirBwDlBitRate | BitRate | 1..1 | Minimum requested bit rate for the Downlink. |
| mirBwUlBitRate | BitRate | 1..1 | Minimum requested bandwidth for the Uplink. |
| desLatency | integer | 0..1 | Desired Latency. |
| desLoss | integer | 0..1 | Desired Loss Rate. |
| desPduSetParameters | PduSetQosPara | 0..1 | Desired PDU Set QoS parameters as specified in clause 5.5.4.11 of TS 29.571 [29571] |
| pduSetMarking | PDUSetMarking | 0..1 | An object that contains the PDU Set marking configuration information for use by the Media Client. |

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| **Next Change** |

#### 7.3.3.6 M5QoSSpecification type

Table 7.3.3.6-1: Definition of type M5QoSSpecification

|  |  |  |  |
| --- | --- | --- | --- |
| Property name | Data type | Cardinality | Description |
| downlinkBitRates | M5BitRate‌Specification | 1..1 | Bit rate specification for the downlink direction (see clause 7.3.3.5). |
| uplinkBitRates | M5BitRate‌Specification | 1..1 | Bit rate specification for the uplink direction (see clause 7.3.3.5). |
| desiredPacketLatency | number | 0..1 | Desired packet latency in milliseconds, expressed as a positive floating-point value. |
| desiredPacketLossRate | Packet‌Loss‌Rate | 0..1 | Desired packet loss rate expressed in tenth of a percent. |
| rtcQoSInformation | array(M5RTCFlowInformation) | 0..1 | For RTC sessions, individual flow information is provided. The aggregate uplink and downlink QoS parameters shall conform to the values specified in the above fields. |
| NOTE: Clause 5.6.2.7 of TS 29.514 [29514] restricts packet latency and packet loss to be the same in the downlink and uplink directions for a given MediaComponent when the CHEM feature is not supported by the PCF. |

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| **Next Change** |

## 8.1 Overview

This clause defines the provisioning API used by a Media Application Provider at reference point M1 to configure downlink Media Delivery, uplink Media Delivery, or Real-time Communication services. The corresponding OpenAPI definitions for the Maf\_Provisioning service are specified in clause A.3. A summary of the resource structure is shown in table 8.1‑1 below. The default endpoint address of the Media AF at reference point M1 is specified in clause 7.1.2.1.

Table 8.1‑1: Resource structure of Maf\_Provisioning APIs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| HTTP request path element hierarchy | Description | Allowed HTTP methods | Resource | OpenAPI |
| Create | Retrieve | Update | Destroy | Non-RESTful operation | structure definition clause | definition clause |
| provisioning-sessions | Provisioning Sessions collection | POST | GET |  |  |  | 8.2.2 | A.3.1 |
|  {provisioningSessionId} | Provisioning Session resource |  | GET |  | DELETE |  |
|  content-protocols | Content Protocols resource |  | GET |  |  |  | 8.3.2 | A.3.2 |
|  certificates | Server Certificates collection | POST |  |  |  |  | 8.4.2 | A.3.3 |
|  {certificateId} | Server Certificate resource |  | GET | PUT | DELETE |  |
|  content-preparation-templates | Content Preparation Templates collection | POST |  |  |  |  | 8.5.2 | A.3.4 |
|  {contentPreparationTemplateId} | Content Preparation Template resource |  | GET | PUT, PATCH | DELETE |  |
|  edge-resources-configurations | Edge Resources Configurations collection | POST |  |  |  |  | 8.6.2 | A.3.5 |
|  {edgeResourcesConfigurationId} | Edge Resources Configuration resource |  | GET | PUT, PATCH | DELETE |  |
|  policy-templates | Policy Templates collection | POST |  |  |  |  | 8.7.2 | A.3.6 |
|  {policyTemplateId} | Policy Template resource |  | GET | PUT, PATCH | DELETE |  |
|  content-hosting-configuration | Content Hosting Configuration resource | POST | GET | PUT, PATCH | DELETE |  | 8.8.2 | A.3.7 |
|  purge | Content Hosting cache purge operation |  |  |  |  | POST |
|  content-publishing-configuration | Content Publishing Configuration resource | POST | GET | PUT, PATCH | DELETE |  | 8.9.2 | A.3.8 |
|  purge | Content Publishing cache purge operation |  |  |  |  | POST |
|  rtc-configuration | RTC Configuration resource | POST | GET | PUT, PATCH | DELETE |  | 8.9A.2 | A.3.8A |
|  metrics-reporting-configuration | Metrics Reporting Configuration collection | POST |  |  |  |  | 8.10.2 | A.3.9 |
|  {metricsReportingConfigurationId} | Metrics Reporting Configuration resource |  | GET | PUT, PATCH | DELETE |  |
|  consumption-reporting-configuration | Consumption Reporting Configuration resource | POST | GET | PUT, PATCH | DELETE |  | 8.11.2 | A.3.10 |
|  event-data-processing-configurations | Event Data Processing Configuration collection | POST |  |  |  |  | 8.12.2 | A.3.11 |
|  {event‌Data‌Processing‌ConfigurationId} | Event Data Processing Configuration resource |  | GET | PUT, PATCH | DELETE |  |

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| **Next Change** |

#### 8.2.3.1 ProvisioningSession resource

Different properties are present in the ProvisioningSession resource depending on the type of Provisioning Session indicated in the provisioningSessionType property, and this is specified in the *Applicability* column.

Table 8.2.3.1‑1: Definition of ProvisioningSession resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Property name | Type | Cardinality | Usage | Description | Applicability |
| provisioningSessionId | ResourceId | 1..1 | C: ROR: ROU: – | A unique identifier for this Provisioning Session. | All types. |
| provisioningSession‌Type | Provisioning‌Session‌Type | 1..1 | C: RWR: RWU: – | The type of Provisioning Session. | All types. |
| aspId | AspId | 0..1 | C: RWR: RWU: – | The identity of the Application Service Provider responsible for this Provisioning Session, as specified in clause 5.6.2.3 of TS 29.514 [29514]. | All types. |
| appId | ApplicationId | 1..1 | C: RWR: RWU: – | The Application Identifier (see table 5.4.2‑1 of TS 29.571 [29571]) to which this Provisioning Session pertains.The same <aspId, ‌appId> duple may be present in several Provisioning Sessions in a given 5GMS System.Used as the AF Application identifier (see clause 5.6.2.3 of TS 29.514 [29514]) for PCF interactions. When a 5GMS AF in the Trusted DN is provisioned from outside the Trusted DN, the NEF is responsible for mapping an external Application Identifier to the corresponding internal AF Application Identifier known to the PCF. | All types. |
| serverCertificateIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Server Certificate identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK,RTC |
| contentPreparation‌TemplateIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Content Preparation Template identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK |
| metricsReporting‌ConfigurationIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Metrics Reporting Configuration identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK,RTC |
| policyTemplateIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Policy Template identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK,RTC |
| edgeResources‌ConfigurationIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Edge Resources Configuration identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK,RTC |
| eventDataProcessing‌ConfigurationIds | array(ResourceId) | 0..1 | C: ROR: ROU: – | A list of Event Data Processing Configuration identifiers currently associated with this Provisioning Session. | DOWNLINK,UPLINK |

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| **Next Change** |

## 8.9A Real-time Media Communication provisioning API

### 8.9A.1 Overview

The Real-time Media Communication provisioning API is used by the Media Application Provider to supply configuration information, in the form of an RTCConfiguration resource (specified in clause 8.9A.3) that is used by the Media Client to gain access to real-time media communication (RTC) functionality of the Media AS. The provisioning API allows for the enablement and/or advertisement of STUN, TURN, and SWAP services to support communication between Media Clients in an RTC-based media delivery session. These services may either be provided by the Media AS itself or provisioned by the Media AF.

### 8.9A.2 Resource structure

The RTC Configuration API is accessible through this URL base path:

{apiRoot}/3gpp-maf-provisioning/{apiVersion}/provisioning-sessions/{provisioningSessionId}/

Table 8.9A.2-1 below specifies the operations and the corresponding HTTP methods that are supported by this API. In each case, the Provisioning Session identifier shall be substituted into {provisioningSessionId} in the above URL template and the sub-resource path specified in the second column shall be appended to the URL base path.

Table 8.8.2‑1: Operations supported by the Real-Time Communication Configuration API

|  |  |  |  |
| --- | --- | --- | --- |
| Operation name | Sub‑resource path | Allowed HTTP method(s) | Description |
| Create RTC Configuration | rtc-configuration | POST | Create the RTC Configuration resource within the context of a parent Provisioning Session. |
| Retrieve RTC Configuration | GET | Retrieve an existing RTC Configuration resource. |
| Update RTC Configuration | PUT, PATCH | Modify an existing RTC Configuration resource. |
| Destroy RTC Configuration | DELETE | Destroy an existing RTC Configuration resource. |

### 8.9A.3 Data model

#### 8.9A.3.1 RTCConfiguration resource

Table 10.1-1: Definition of RTCConfiguration resource

| Property name | Data Type | Cardinality | Description |
| --- | --- | --- | --- |
| edgeResources‌ConfigurationId | ResourceId | 0..1 | A reference to an Edge Resources Configuration resource (see clause 8.6.2).When present, indicates that the Media AS supporting this RTC Configuration shall be realised as a set of one or more EAS instances configured per the referenced resource. |
| enableStunService | boolean | 0..1 | If true, the Media AS shall provide a STUN service to the Media Session Handler for use in RTC-based media delivery sessions initiated in the context of the parent Provisioning Session.If omitted, the default value shall be false. |
| stunEndpoints | array(EndpointAccess) | 0..1 | A list of trusted STUN server endpoints that may be used as ICE candidates for RTC-based media delivery sessions.If present, the array shall contain at least one member. |
| enableTurnService | boolean | 0..1 | If true, the Media AS shall provide a TURN service to the Media Session Handler for use in RTC-based media delivery sessions initiated in the context of the parent Provisioning Session.If omitted, the default value shall be false. |
| turnEndpoints | array(EndpointAccess) | 0..1 | A list of trusted TURN server endpoints that may be used as ICE candidates for RTC-based media delivery sessions.If present, the array shall contain at least one member. |
| enableSwapService | boolean | 0..1 | If true, the Media AS shall provide a SWAP service to the Media Session Handler for use in RTC-based media delivery sessions initiated in the context of the parent Provisioning Session.If omitted, the default value shall be false. |
| swapEndpoints | array(EndpointAccess) | 0..1 | A list of trusted WebRTC Signalling Server endpoints that support the SWAP protocol that may be used by the applicationfor RTC-based media delivery sessions in the context of the parent Provisioning Session.If present, the array shall contain at least one member. |

#### 8.9A.3.2 EndpointAccess

This data type is derived by extension from EndpointAddress (see clause 7.3.3.11).

Table 10.1-1: Definition of EndpointAccess resource

| Property name | Data Type | Cardinality | Description |
| --- | --- | --- | --- |
| domainName | string | 0..1 | The Fully-Qualified Domain Name of the service endpoint. |
| ipv4Address | Ip | 0..1 | The IPv4 address of the service endpoint. |
| Ipv6Address | string | 0..1 | The IPv6 address of the service endpoint. |
| ports | array(Uint16) | 0..1 | A list of listening ports over which the service is accessible (e.g. STUN servers must offer two listening ports). |
| credentials | object | 0..1 | An object that provides authentication information to be used with the server. |
|  | username | string | 1..1 | A username that is authorized to access the server. |
|  | passphrase | string | 1..1 | The credentials that are associated with the username. |
| certificateId | ResourceId | 0..1 | An identifier of the certificate resource that provides the X.509 [X509] to be presented to Media Clients by the Media AS.Omitted when exposed at reference point M5. |

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| **Next Change** |

#### 9.2.3.1 ServiceAccessInformation resource type

The data model for the ServiceAccessInformation resource is specified in table 9.2.3.1-1 below. Different properties are present in the resource depending on the type of Provisioning Session from which the Service Access Information is derived (as indicated in the provisioningSessionType property) and this is specified in the *Applicability* column.

Table 9.2.3.1‑1: Definition of ServiceAccessInformation resource

| Property name | Type | Cardinality | Usage | Description | Applicability |
| --- | --- | --- | --- | --- | --- |
| provisioningSessionId | ResourceId | 1..1 | RO | Unique identification of the M1 Provisioning Session. | All types |
| provisioningSession‌Type | Provisioning‌Session‌Type | 1..1 | RO | The type of Provisioning Session. | All types. |
| streamingAccess | object | 0..1 | RO | Present if Content Hosting or Content Publishing is provisioned in the parent Provisioning Session. | MS\_DOWNLINK |
|  | entryPoints | Array(M5‌Media‌Entry‌Point) | 0..1 | RO | A list of alternative Media Entry Points for the Media Client to choose between. |
|  |  | locator | AbsoluteUrl | 1..1 | RO | A pointer to a document at reference point M2 that defines a media presentation e.g. MPD for DASH content or URL to a video clip file. |
|  |  | contentType | string | 1..1 | RO | The MIME content type of resource at locator. |  |
|  |  | profiles | array(Uri) | 0..1 | RO | An optional list of conformance profile URIs with which this Media Entry Point is compliant.If present, the array shall contain at least one item. |  |
|  | eMBMS‌Service‌Announcement‌Locator | AbsoluteUrl | 0..1 | RO | A pointer to an eMBMS User Service Announcement document. | MS\_DOWNLINK |
| rtcClientConfiguration | object | 0..1 | RO | Present if real-time media communication (RTC) is provisioned. | RTC |
|  | stunEndpoints | array(EndpointAccess) | 0..1 | RO | An array of trusted STUN service endpoints for use as ICE candidates.If the credentials property was not provisioned at reference point M1, the Media AF shall populate this with a set of credentials unique to the requesting Media Client. |
|  | turnEndpoints | array(EndpointAcess) | 0..1 | RO | An array of trusted TURN service endpoints for use as ICE candidates.If the credentials property was not provisioned at reference point M1, the Media AF shall populate this with a set of credentials unique to the requesting Media Client. |
|  | swapEndpoints | array(EndpointAccess) | 0..1 | RO | An array of trusted WebRTC Signalling Function service endpoints that support the SWAP protocol. If provided, the application shall use one of the listed servers for RTC-based media delivery sessions within the scope of provisioning‌SessionId.If the credentials property was not provisioned at reference point M1, the Media AF shall populate this with a set of credentials unique to the requesting Media Client. |
| clientConsumptionReporting‌Configuration | object | 0..1 | RO | Present if consumption reporting is activated for this Provisioning Session. | MS\_DOWNLINK,RTC |
|  |  | reportingInterval | DurationSec | 0..1 | RO | The time interval, expressed in seconds, between consumption report messages being sent by the Media Session Handler. The value shall be greater than zero.When this property is omitted, a single final report shall be sent immediately after the media streaming session has ended. |
|  |  | serverAddresses | array(AbsoluteUrl) | 1..1 | RO | A list of Media AF addresses (URLs) where the consumption reporting messages are sent by the Media Session Handler. See NOTE.Each address shall be an opaque base URL, following the format specified in clause 7.1.3 up to and including the {apiVersion} path element. |
|  |  | locationReporting | boolean | 1..1 | RO | Indicates whether the Media Session Handler is required to provide location data in consumption reporting messages (in case of MNO or trusted third parties).Shall be set false if the locationReporting parameter is omitted from the Consumption‌Reporting‌Configuration, as specified in table 8.11.3.1‑1. |
|  |  | accessReporting | boolean | 1..1 | RO | Indicates whether the Media Session Handler is required to supply consumption reporting units whenever the access network changes during a media delivery session.Shall be set false if the accessReporting parameter is omitted from the Consumption‌Reporting‌Configuration, as specified in table 8.11.3.1‑1. |
|  |  | samplePercentage | Percentage | 1..1 | RO | The percentage of media delivery sessions that shall send consumption reports, expressed as a floating-point value between 0.0 and 100.0.Shall be set to 100.0 if the samplePercentage parameter is omitted from the Consumption‌Reporting‌Configuration, as specified in table 8.11.3.1‑1. |
| dynamicPolicyInvocation‌Configuration | object | 0..1 | RO | Present if Policy Templates have been provisioned in the parent Provisioning Session and at least one of them is in the READY state. | MS\_DOWNLINK,MS\_UPLINK,RTC |
|  | serverAddresses | array(AbsoluteUrl) | 1..1 | RO | A list of Media AF addresses (URLs) which offer the APIs for dynamic policy invocation sent by the Media Session Handler. See NOTE.Each address shall be an opaque base URL, following the format specified in clause 7.1.3 up to and including the {apiVersion} path element. |  |
|  | policyTemplateBindings | array(object) | 1..1 | RO | A list of duples, each one binding an external reference to a Policy Template resource identifier. |  |
|  |  | externalReference | string | 1..1 | RO | Additional identifier for this Policy Template, unique within the scope of its Provisioning Session, that can be cross-referenced with external metadata about the media streaming session.Example: "HD\_Premium". |  |
|  |  | policyTemplateId | ResourceId | 1..1 | RO | The resource identifier of a Policy Template tagged with externalReference that is in the READY state. |  |
|  | sdfMethods | array(SdfMethod) | 1..1 | RO | A list of Service Data Flow description methods, e.g. 5-tuple, ToS, 2-tuple, etc., which should be used by the Media Session Handler to describe the Service Data flows at reference point M2 for media delivery sessions. |  |
| clientMetricsReporting‌Configurations | array(object) | 0..1 | RO | Present if QoE metrics reporting is provisioned in the parent Provisioning Session.If present, contains one or more client metrics reporting configurations. | MS\_DOWNLINK,MS\_UPLINK,RTC |
|  | metricsReporting‌ConfigurationId | ResourceId | 1..1 | RO | The identifier of this metrics reporting configuration, unique within the scope of the parent Provisioning Session.The value shall be the same as the corresponding identifier provisioned at reference point M1 (see clause 8.10.3.1). |
|  | serverAddresses | array(AbsoluteUrl) | 1..1 | RO | A list of Media AF addresses to which metrics reports shall be sent. See NOTE.Each address shall be an opaque base URL, following the format specified in clause 7.1.3 up to and including the {apiVersion} path element. |
|  | scheme | Uri | 1..1 | RO | A URI identifying the metrics scheme that metrics reports shall use (see clause 5.2.10). |
|  | dataNetworkName | Dnn | 0..1 | RO | The name of the Data Network which shall be used to send metrics reports.If not specified, the default DN shall be used. |
|  | reportingInterval | DurationSec | 0..1 | RO | The time interval, expressed in seconds, between metrics reports being sent by the Media Session Handler. The value shall be greater than zero.When this property is omitted, a single final report shall be sent immediately after the media streaming session has ended. |
|  | samplePercentage | Percentage | 1..1 | RO | The percentage of media delivery sessions that shall report QoE metrics, expressed as a floating point value between 0.0 and 100.0. |
|  | urlFilters | array(string) | 0..1 | RO | A non-empty list of Media Entry Point URL patterns for which QoE metrics shall be reported. The format of each pattern shall be a regular expression as specified in [ECMA262].If not specified, reporting shall be done for all media delivery sessions. |
|  | samplingPeriod | DurationSec | 1..1 | RO | The time interval the Media Client should wait between sampling the QoE metrics specified by this metrics reporting configuration. |
|  | metrics | array(string) | 1..1 | RO | A list of QoE metrics which shall be reported.If empty, the complete (or default if applicable) set of metrics associated with the specified scheme shall be collected and reported. |
| networkAssistance‌Configuration | object | 0..1 | RO | Present if Network Assistance is provisioned in the parent Provisioning Session. | MS\_DOWNLINK,MS\_UPLINKRTC |
|  | serverAddresses | array(AbsoluteUrl) | 1..1 | RO | A list of Media AF addresses (URLs) that offer the APIs for AF-based Network Assistance at reference point M5. See NOTE.Each address shall be an opaque URL, following the format specified in clause 7.1.3 up to and including the {apiVersion} path element. |
| client‌EdgeResources‌Configuration | object | 0..1 | RO | Present only for Provisioning Sessions with client-driven edge computing management mode provisioned. | MS\_DOWNLINK,MS\_UPLINK,RTC |
|  | eligibilityCriteria | Edge‌Processing‌Eligibility‌Criteria | 0..1 | RO | Conditions for activating edge resources for media delivery sessions in the scope of the parent Provisioning Session. (See clause 7.3.3.8.) |
|  | easDiscoveryTemplate | EAS‌Discovery‌Template | 1..1 | RO | A template for the EAS discovery filter that shall be used by the EEC to discover and select a Media EAS instance to serve media delivery sessions at reference point M4 in the scope of the parent Provisioning Session. (See clause 9.2.3.2.) |
|  | easRelocation‌Requirements | M5EAS‌Relocation‌Requirements | 0..1 | RO | EAS relocation tolerance and requirements.If absent, the EEC shall assume that relocation is tolerated by all Media EAS instances in the scope of the parent Provisioning Session. (See clause 9.2.3.3.) |
| NOTE: In deployments where multiple instances of the Media AF expose the Media Session Handling APIs at reference point M5, the 5G System may use a suitable mechanism (e.g., HTTP load balancing or DNS-based host name resolution) to direct requests to a suitable Media AF instance. |

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| **Next Change** |

## A.3.8A Maf\_Provisioning\_RealTimeCommunication API

For the purpose of referencing entities specified in this clause, it shall be assumed that the OpenAPI definitions are contained in a physical file named "TS26510\_Maf\_Provisioning\_RealTimeCommunication.yaml".