

ETSI TS 129 176 V19.4.0 (2026-02)



TECHNICAL SPECIFICATION

**5G;
IP Multimedia Subsystems (IMS);
Media Function (MF) Services;
Stage 3
(3GPP TS 29.176 version 19.4.0 Release 19)**



Reference

RTS/TSGC-0429176vj40

Keywords

5G

ETSI

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Sous-Préfecture de Grasse (06) N° w061004871

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In the present document, modal verbs have the following meanings:

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

- can** indicates that something is possible
- cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Nmf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the Media Function (MF).

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

The IP Multimedia Subsystem (IMS) Data Channel (DC) architecture and procedures are specified in annex AC of 3GPP TS 23.228 [14].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
- [4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".
- [5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".
- [6] OpenAPI: "OpenAPI Specification Version 3.0.0", <https://spec.openapis.org/oas/v3.0.0>.
- [7] 3GPP TR 21.900: "Technical Specification Group working methods".
- [8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".
- [9] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".
- [10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".
- [11] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".
- [12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".
- [13] IETF RFC 7807: "Problem Details for HTTP APIs".
- [14] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".
- [15] IETF RFC 6902: "JavaScript Object Notation (JSON) Patch".
- [16] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".
- [17] 3GPP TS 29.175: "IP Multimedia Subsystem (IMS) Application Server (AS) Services Stage 3".
- [18] 3GPP TS 29.562: "5G System; Home Subscriber Server (HSS) Services; Stage 3".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1], 3GPP TS 23.228 [14] and the following apply. A term defined in the present document or in 3GPP TS 23.228 [14] takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Symbols

For the purposes of the present document, the following symbols given in 3GPP TS 23.228 [14] apply:

| | |
|------|--|
| DC2 | Reference point between MF and IMS AS |
| MDC1 | Reference point between MF and DCSF |
| MDC2 | Reference point either MF and DC Application Server or AR Application Server |

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], 3GPP TS 23.228 [14] and the following apply. An abbreviation defined in the present document or 3GPP TS 23.228 [14] takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

| | |
|--------|--|
| AR | Augmented Reality |
| DTLS | Datagram Transport Layer Security |
| MF | Media Function |
| IMS AS | IP Multimedia Subsystem Application Server |

4 Overview

Within the IMS DC architecture, the MF offers services to the IMS AS via the Nmf service based interface (see 3GPP TS 23.228 [14]).

Figure 4.1-1 provides the reference model (in service-based interface representation and in reference point representation), with focus on the MF services.

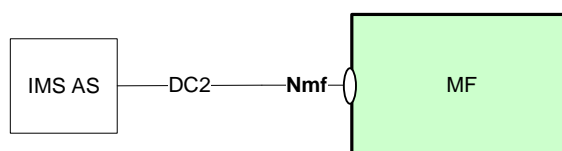


Figure 4.1-1: Reference model – MF

DC2 is the reference point between MF and IMS AS.

5 Services offered by the MF

5.1 Introduction

The MF offers the following services via the Nmf interface:

- Nmf_MediaResourceManagement (MRM) Service

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

| Service Name | Clause | Description | OpenAPI Specification File | apiName | Annex |
|--------------|--------|---------------------------------------|----------------------------|---------|-------|
| Nmf_MRM | 6.1 | Nmf Media Resource Management Service | TS29176_Nmf_MRM.yaml | nmf-mrm | A.2 |

5.2 Nmf_MediaResourceManagement (MRM) Service

5.2.1 Service Description

The Nmf_MRM service as defined in 3GPP TS 23.228 [14] is provided by the Media Function (MF). This service enables the consumer to create, update and delete media resources. Data Channel (DC) and Augmented Reality (AR) are two capabilities supported by MF.

The media resource represents a media context including one or multiple media terminations. A media termination includes media resources for one or multiple medias on the Mb interface. When a media pass through the MF, there is one termination for the input stream and one termination for the output stream.

If interworking between DC capable UE and non-DC capable UE is supported, the Nmf_MRM shall support to associate the application data channel stream and the video streams, as well as transforming data channel media to video media.

5.2.2 Service Operations

5.2.2.1 Introduction

The Nmf_MRM service supports the following service operation.

Table 5.2.2.1-1: Service operations supported by the Nmf_MRM service

| Service Operations | Description | Operation Semantics | Example Consumer(s) |
|--------------------|--|---------------------|---------------------|
| Create | Create a new media context including one or multiple media terminations. | Request/Response | IMS AS |
| Update | Update the one or multiple existing media resources within a specific media context. | Request/Response | IMS AS |
| Delete | Delete a specific media context including all the existing terminations and medias. | Request/Response | IMS AS |

5.2.2.2 Nmf_MRM_Create Service Operation

5.2.2.2.1 General

The Nmf_MRM_Create service operation is used by an NF service consumer to create a media context including one or multiple terminations and reserve media resources for anchoring one or multiple medias of Mb interface in each termination on MF. The consumer NF may also include application function (e.g. DCSF, DC AS) specification information requested by the application layer to be applied on the media by the MF.

5.2.2.2.2 Creation of a new media context

The NF service consumer shall request a new context by using HTTP method POST with "{apiRoot}/nmf/<apiVersion>/contexts" as resource URI representing the "Contexts Collection", see clause 6.1.3.2.

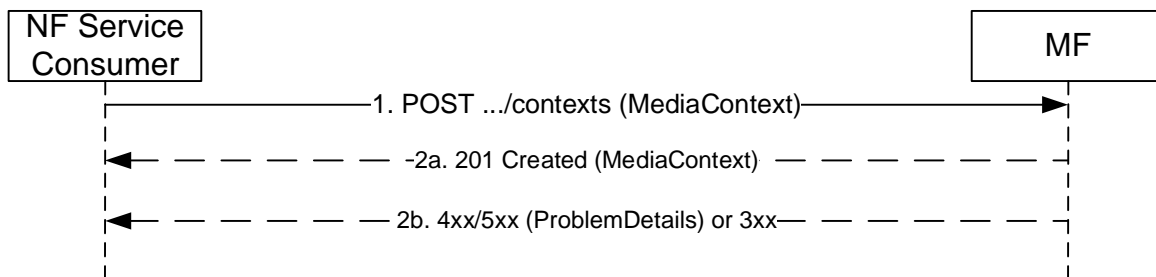


Figure 5.2.2.2.2-1 Creation of a media context

1. The NF Service Consumer shall send a POST request to create an "Individual Context" resource in the MF. The payload body of the POST request shall contain a representation of the individual context resource to be created.

The NF service consumer shall include in the HTTP message body within the MediaContext data type list of termination descriptors in the attribute "terminations". Each termination descriptor shall include list of media stream descriptors in the attribute "medias". Each media stream descriptor shall include:

- media ID in the attribute "mediaId", i.e. a unique identity of the media stream within the media context instance, which is generated by the NF service consumer (e.g. IMS AS) based on implementation;
- remote Mb specifications in the attribute "remoteMbEndpoint", i.e. the media stream IP address and port allocated at the remote endpoint, i.e. remote UE, remote network; and
- media resource description, which includes:
 - 1) media resource type, e.g. DC, VIDEO, AUDIO;
 - 2) if media resource type is set to "DC", the DC media specification in the attribute "dcMedia" within the data type MediaInfo shall be included. The DC media specification shall include:
 - a) media proxy configuration applicable to the media flow in the attribute "mediaProxyConfig";
 - b) data channel mapping and configuration information in the attribute "streams" when originating or terminating data channel media flows on the Mb interface which shall include the SCTP stream Id for the DC, and may include subprotocol, order, maxRetry, maxTime and priority; and
 - c) the remote SCTP endpoint and DTLS endpoint information in the attribute "remoteDcEndpoint" which includes the SCTP port for the Data Channel, the security setup of the DTLS connection, the security certificate fingerprint and the transport layer identity;

and may include:

 - a) maximum message size in the attribute "maxMessageSize", which represents the maximum size to be expected;

for establishing bootstrap data channel, the DC media specification shall include the remote MDC1 media specification information in the attribute "remoteMdc1Endpoint" within the data type "Mdc1Info" to be applied on the media by the MF and also the replacement HTTP URL for each streamId allocated by the application layer representing the application list (e.g. graphical user interface) offered to the IMS subscriber via the MDC1 interface;

for establishing P2A/A2P application data channel, the DC media specification shall include the remote MDC2 media specification information in the attribute "remoteMdc2Endpoint" within the data type "Mdc2Info" to be applied on the media by the MF;

- 3) if media resource type is set to "VIDEO" or "AUDIO", the video or audio media resource description in the attribute "remoteNonDcMedia" within the data type MediaInfo shall be included; and

may include:

- 1) the AR media resource description in the attribute "ArMedia" within the data type MediaInfo if the media resource type is set to "DC" or "VIDEO" and the media is used for AR communication;
- 2) the avatar media specification in the attribute "avatarMedia" within the data type MediaInfo.

When NF service consumer indicates the need to transcode the data channel media to video media, the data channel media and the video media shall belong to different terminations. Data channel media shall be under the termination as the input stream, and the video media shall be under the termination as the output stream.

- 2a. Upon the reception of the HTTP POST request, if the request is accepted and no error occur, the MF shall:

- create a new media context;
- assign a media contextId;
- assign a terminationId for each termination descriptor; and
- reserve media resources for each mediaId.

The MF shall include a HTTP Location header to provide the location of a newly created resource (MediaContext) together with the status code 201 indicating the requested resource is created in the response message.

- 2b. On failure, one of the HTTP status code listed in Table 6.1.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.2.3.1-3.

On redirection, the MF shall include 3xx status code, which shall contain a Location header with an URI pointing to the endpoint to another MF (service) instance.

5.2.2.3 Nmf_MRM_Update Service Operation

5.2.2.3.1 General

The Nmf_MRM_Update service operation is used by an NF service consumer to update one or multiple existing media resources within a specific media context on MF. Terminations and/or Medias can be added, modified, or deleted within an Update request.

5.2.2.3.2 Updating an existing media context

The NF Service Consumer shall modify the context by using HTTP method PATCH with the URI "{apiRoot}/nmf/<apiVersion>/contexts/{contextId}" as resource URI representing the "Individual Context ", see clause 6.1.3.3.

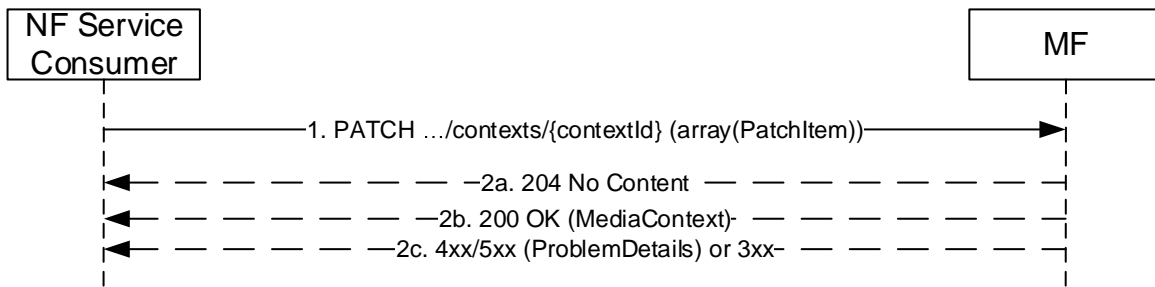


Figure 5.2.2.3.2-1 Update a media context

1. The NF Service Consumer shall send a PATCH request to modify a context resource in the MF. The modification may be for adding, updating or deleting terminations of the existing media context.

For adding, removing or updating a termination in an existing MediaContext, the payload body of the PATCH request shall contain an "add", "remove" or "replace" PATCH operation respectively, with one item of the attribute "terminations" of the MediaContext. The MF shall use the mediaId to check if the operated media exists in the MF.

- 2a. On success, if the change is to delete the existing termination and MF accepts the request change, the MF shall return the status code 204 No Content.
- 2b. On success, if the change is to add a new termination or to update the existing termination and MF accepts the request change, the MF shall return the status code 200 OK. The response shall contain the new resource representation of the resource Individual Context, which includes the added and modified resource or its sub-resource.
- 2c. On failure, one of the HTTP status code listed in Table 6.1.3.3.1-3 indicating the error shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.3.1-3.

On redirection, the MF shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint to another MF (service) instance.

5.2.2.4 Nmf_MRM_Delete Service Operation

5.2.2.4.1 General

The Nmf_MRM_Delete service operation is used by an NF service consumer to delete an existing media context including all existing terminations and medias on MF previously created by itself.

5.2.2.4.2 Deleting an existing media context

The NF Service Consumer shall delete an existing context by using HTTP method DELETE with the URI "{apiRoot}/nmf/<apiVersion>/contexts/{contextId}" as resource URI representing the "Individual Context ", see clause 6.1.3.3.

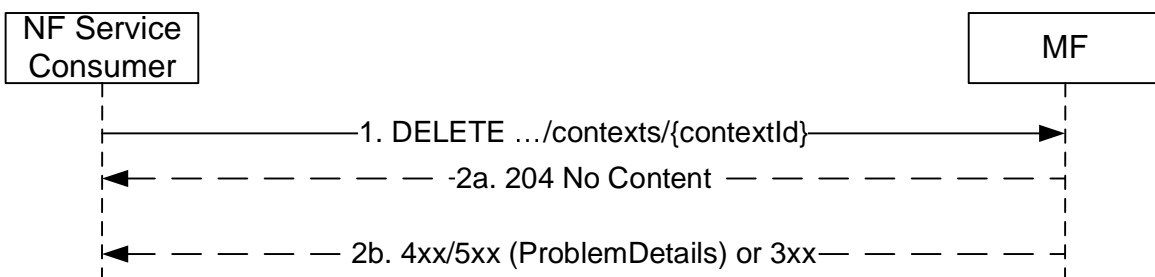


Figure 5.2.2.4.2-1 Delete a media context

1. The NF Service Consumer shall send a DELETE request to delete an existing context resource in the MF.
- 2a. On success, the request is accepted, the MF shall reply with the status code 204 No Content indicating the resource identified by context ID is successfully deleted in the response message.
- 2b. On failure, one of the HTTP status code listed in Table 6.1.3.3.2-3 indicating the error shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.3.3.2-3.

On redirection, the MF shall return 3xx status code, which shall contain a Location header with an URI pointing to the endpoint to another MF (service) instance.

6 API Definitions

6.1 Nmf_MRM Service API

6.1.1 Introduction

The Nmf_MRM service shall use the Ndcmf_MRM API.

The API URI of the Nmf_MRM API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nmf_mrm".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 7540 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Nmf_MRM API is contained in Annex A.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

6.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 7807 [13].

The use of JSON Patch (IETF RFC 6902 [15]) format in a HTTP request body shall be signaled by the content type "application/json-patch+json".

6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

6.1.3 Resources

6.1.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.1.3.1-1 depicts the resource URIs structure for the Nmf_MRM API.

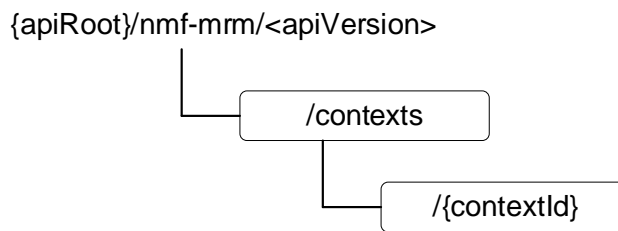


Figure 6.1.3.1-1: Resource URI structure of the Nmf_MRM API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

| Resource purpose/name | Resource URI (relative path after API URI) | HTTP method or custom operation | Description (service operation) |
|-----------------------|--|---------------------------------|--|
| Contexts Collection | /contexts | POST | Creates a new Individual Context resource. |
| Individual Context | /contexts/{contextId} | PATCH | Updates an existing Individual Context resource identified by {contextId} |
| | | DELETE | Deletes an existing Individual Context resource identified by {contextId}. |

6.1.3.2 Resource: Contexts Collection

6.1.3.2.1 Description

The Contexts Collection resource represents a collection of contexts created by NF service consumers of Nmf_MRM service at a given MF. The resource is modelled as Collection resource archetype (see clause C.2 of 3GPP TS 29.501 [2]).

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nmf_mrm/<apiVersion>/contexts**

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

| Name | Data type | Definition |
|---------|-----------|------------------|
| apiRoot | string | See clause 6.1.1 |

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.2.3.1-1: URI query parameters supported by the POST method on this resource

| Name | Data type | P | Cardinality | Description | Applicability |
|------|-----------|---|-------------|-------------|---------------|
| n/a | | | | | |

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

| Data type | P | Cardinality | Description |
|--------------|---|-------------|---|
| MediaContext | M | 1 | Creates a new Individual Context resource |

Table 6.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

| Data type | P | Cardinality | Response codes | Description |
|------------------|---|-------------|---------------------------|---|
| MediaContext | M | 1 | 201 Created | The creation of an Individual Media Context resource is confirmed and a representation of that resource is returned. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. (NOTE 2) |
| ProblemDetails | O | 0..1 | 409 Conflict | Indicates the creation of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - MEDIA_ID_CONFLICT, if the media to be created has the identical mediaId with one already created media. |
| ProblemDetails | O | 0..1 | 500 Server Internal Error | Indicates the creation of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - INSUFFICIENT_RESOURCES |

NOTE 1: The mandatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.

NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].

Table 6.1.3.2.3.1-4: Headers supported by the 201 response code on this resource

| Name | Data type | P | Cardinality | Description |
|----------|-----------|---|-------------|---|
| Location | string | M | 1 | Contains the URI of the newly created resource, according to the structure: {apiRoot}/nmf-mrm/<apiVersion>/contexts/{contextId}. |

Table 6.1.3.2.3.1-5: Headers supported by the 307 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

Table 6.1.3.2.3.1-6: Headers supported by the 308 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

6.1.3.2.4 Resource Custom Operations

None in the release of this specification.

6.1.3.3 Resource: Individual Context

6.1.3.3.1 Description

The Individual Context resource represents an individual context created by the NF service consumers of Nmf_MRM service at a given MF. This resource is modelled as the Document resource archetype (see clause C.1 of 3GPP TS 29.501 [2]).

6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/nmf_mrm/<apiVersion>/contexts/{contextId}**

The <apiVersion> shall be set as described in clause 6.1.1.

This resource shall support the resource URI variables defined in table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: Resource URI variables for this resource

| Name | Data type | Definition |
|-----------|-----------|--|
| apiRoot | string | See clause 6.1.1 |
| contextId | string | Identifies an individual context to the Nmf_MRM service. |

6.1.3.3.3 Resource Standard Methods

6.1.3.3.3.1 PATCH

This method shall support the URI query parameters specified in table 6.1.3.3.3.1-1.

Table 6.1.3.3.3.1-1: URI query parameters supported by the PATCH method on this resource

| Name | Data type | P | Cardinality | Description | Applicability |
|------|-----------|---|-------------|-------------|---------------|
| n/a | | | | | |

This method shall support the request data structures specified in table 6.1.3.3.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.3.3.1-2: Data structures supported by the PATCH Request Body on this resource

| Data type | P | Cardinality | Description |
|------------------|---|-------------|---|
| array(PatchItem) | M | 1..N | Document describes the modification(s) to an Individual Context resource. |

Table 6.1.3.3.1-3: Data structures supported by the PATCH Response Body on this resource

| Data type | P | Cardinality | Response codes | Description |
|---|---|-------------|---------------------------|--|
| MediaContext | M | 1..N | 200 OK | Represents a successful update on the media context. |
| n/a | | | 204 No Content | |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. (NOTE 2) |
| ProblemDetails | O | 0..1 | 403 Forbidden | Indicates the modification of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - MEDIA_CONNECTION_CHANGED |
| ProblemDetails | O | 0..1 | 404 Not Found | Indicates the modification of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - CONTEXT_NOT_FOUND |
| ProblemDetails | O | 0..1 | 409 Conflict | Indicates the modification of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - MEDIA_ID_CONFLICT, if a new media to be newly created has the identical mediaId already assigned to one created media. |
| Problem Details | O | 0..1 | 500 Server Internal Error | Indicates the modification of media context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - INSUFFICIENT_RESOURCES |
| NOTE 1: The mandatory HTTP error status code for the PATCH method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. | | | | |
| NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4]. | | | | |

Table 6.1.3.3.1-4: Headers supported by the 307 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

Table 6.1.3.3.1-5: Headers supported by the 308 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

6.1.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.1.3.3.3.2-1.

Table 6.1.3.3.3.2-1: URI query parameters supported by the DELETE method on this resource

| Name | Data type | P | Cardinality | Description | Applicability |
|------|-----------|---|-------------|-------------|---------------|
| n/a | | | | | |

This method shall support the request data structures specified in table 6.1.3.3.3.2-2 and the response data structures and response codes specified in table 6.1.3.3.3.2-3.

Table 6.1.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

| Data type | P | Cardinality | Description |
|-----------|---|-------------|-------------|
| n/a | | | |

Table 6.1.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

| Data type | P | Cardinality | Response codes | Description |
|------------------|---|-------------|------------------------|---|
| n/a | | | 204 No content | |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. (NOTE 2) |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. (NOTE 2) |
| Problem Details | O | 0..1 | 404 Not Found | Indicates the deletion of the context has failed due to application error. The "cause" attribute may be used to indicate one of the following application errors: - CONTEXT_NOT_FOUND |

NOTE 1: The mandatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply.

NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].

Table 6.1.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

Table 6.1.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

| Name | Data type | P | Cardinality | Description |
|-----------------------|-----------|---|-------------|---|
| Location | string | M | 1 | An alternative URI of the resource located on an alternative MF (service) instance. Or the same URI, if a request is redirected to the same target resource via a different SCP. |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target MF instance ID towards which the request is redirected. |

6.1.3.3.4 Resource Custom Operations

None in the release of specification.

6.1.4 Custom Operations without associated resources

None in this release of specification.

6.1.5 Notifications

None in this release of specification.

6.1.6 Data Model

6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Nmf_MRM service based interface protocol.

Table 6.1.6.1-1: Nmf_MRM specific Data Types

| Data type | Clause defined | Description | Applicability |
|-----------------|----------------|--|---------------|
| MediaContext | 6.1.6.2.2 | Represents an individual context resource on MF. | |
| TerminationInfo | 6.1.6.2.3 | Represents the termination information. | |
| MediaInfo | 6.1.6.2.4 | Represents the media information. | |
| DcMedia | 6.1.6.2.5 | Represents the DC media descriptor. | |
| ArMedia | 6.1.6.2.6 | Represents the AR media descriptor. | |
| Mdc1Info | 6.1.6.2.7 | Represents the MDC1 interface information. | |
| Mdc2Info | 6.1.6.2.8 | Represents the MDC2 interface information. | |
| NonDcMedia | 6.1.6.2.9 | Represents the audio and video media. | |
| SdpString | 6.1.6.3.2 | Represents the m=line and a=lines in the SDP media description. | |
| Mdc2Protocol | 6.1.6.3.3 | Represents the type of the transport layer protocols for MDC2 interface. | |
| AvatarMedia | 6.1.6.2.10 | Represents the avatar media descriptor. | |
| Mdc2AVEndpoint | 6.1.6.2.11 | Represents the audio or video media information. | |

Table 6.1.6.1-2 specifies data types re-used by the Nmf_MRM service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nmf_MRM service based interface.

Table 6.1.6.1-2: Nmf_MRM re-used Data Types

| Data type | Reference | Comments | Applicability |
|-------------------------|---------------------|---|---------------|
| ProblemDetails | 3GPP TS 29.571 [16] | Problem Details | |
| MediaId | 3GPP TS 29.571 [16] | Uniquely identifies one media flow within an IMS session. | |
| MaxMessageSize | 3GPP TS 29.571 [16] | Max SCTP user message size. | |
| MediaResourceType | 3GPP TS 29.571 [16] | Media resource types. | |
| MediaProxy | 3GPP TS 29.571 [16] | Media proxy configuration applicable to the media flow | |
| DcEndpoint | 3GPP TS 29.571 [16] | DC endpoint | |
| DcStream | 3GPP TS 29.571 [16] | Data channel stream information. | |
| ReplaceHttpUrl | 3GPP TS 29.571 [16] | Replacement HTTP URL allocated by the application layer. | |
| Uri | 3GPP TS 29.571 [16] | Uri | |
| Endpoint | 3GPP TS 29.571 [16] | Represents the IP endpoint. | |
| MdcEndpoint | 3GPP TS 29.571 [16] | Represents the MDC1 and MDC2 endpoint information. | |
| RenderingMode | 3GPP TS 29.571 [16] | Represents the rendering mode of avatar media. | |
| InterworkingInstruction | 3GPP TS 29.175 [17] | The interworking instruction of data channel transcoding. | |
| ImsPublicId | 3GPP TS 29.562 [18] | IMS Public Identity. | |

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.1.6.2.2 Type: MediaContext

Table 6.1.6.2.2-1: Definition of type MediaContext

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|----------------|------------------------|---|-------------|--|---------------|
| contextId | string | C | 0..1 | Identifies a specific context. It is assigned by the MF when creating a new context, i.e. Nmf_MRM_Create operation. It shall be contained except in the request of creating a new media context. | |
| terminations | array(TerminationInfo) | M | 1..N | Represents the media terminations | |

6.1.6.2.3 Type: TerminationInfo

Table 6.1.6.2.3-1: Definition of type TerminationInfo

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|----------------|--|---|-------------|---|---------------|
| terminationId | string | M | 1 | Identifies a specific media termination. It shall be set to empty string (i.e., "") when service consumer requests the MF to add a new media termination in the Nmf_MRM_Create or Nmf_MRM_Update service operation. Otherwise, it shall contain the termination Id allocated by the MF. | |
| medias | array(MediaInfo) | M | 1..N | Represent the list of media resources for one or multiple medias on the Mb interface. | |
| NOTE: | When indicating transcoding via MF, the "DC" media type and the "VIDEO" media type shall belong to different terminations. | | | | |

6.1.6.2.4 Type: MediaInfo

Table 6.1.6.2.4-1: Definition of type MediaInfo

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|--------------------|-------------------|---|-------------|--|---------------|
| mediaId | MediaId | M | 1 | Identifies a media stream, e.g. data channel. | |
| associatedMediaId | MediaId | C | 0..1 | The identifier of the original multiplexed media stream which is de-multiplexed. It shall be included when the media stream identified by the value of this attribute is de-multiplexed and the mediaResourceType is set to "DC". | |
| mediaResourceType | MediaResourceType | M | 1 | Represents the media resource type, e.g. DC, AR. | |
| localMbEndpoint | Endpoint | C | 0..1 | Represents the local IP address and port number of the local endpoint of MF on the Mb interface. It will be allocated by MF. It shall be contained in the response when creating a new media stream, i.e. Nmf_MRM_Create operation or Nmf_MRM_Update operation with adding a new termination or adding a media in an existing termination. (NOTE 1, NOTE 2) | |
| remoteMbEndpoint | Endpoint | C | 0..1 | Represents the IP address and port number of the remote endpoint on the Mb interface, e.g. remote UE. It shall be contained in the request of creating a new media stream, i.e. Nmf_MRM_Create operation or Nmf_MRM_Update operation with adding a new termination or adding a media in an existing termination. It can be Null when originating a new media. (NOTE 2) | |
| dcMedia | DcMedia | C | 0..1 | Represents the data channel media descriptors. It shall be contained if the mediaResourceType is set to "DC". | |
| arMedia | ArMedia | C | 0..1 | Represents the AR media descriptors. It shall be contained if the media is used for AR communication. | |
| remoteNonDcMedia | NonDcMedia | C | 0..1 | Represents the audio or video media. It shall be contained in the request of creating a new media if the mediaResourceType is set to "AUDIO" or "VIDEO". It can be "Null" when originating a new media. | |
| localNonDcMedia | NonDcMedia | C | 0..1 | Represents the audio or video media. It shall be contained in the response of creating a new media if the mediaResourceType is set to "AUDIO" or "VIDEO". | |
| mediaProcessingURL | Uri | C | 0..1 | The mediaProcessingURL indicates the address where MF receive service-related media instructions. It shall be contained in the response when creating a new media stream, i.e. Nmf_MRM_Create operation or Nmf_MRM_Update operation with adding a new termination or adding a media in an existing termination. (NOTE 1) | |
| avatarMedia | AvatarMedia | O | 0..1 | Represents the additional media specifications needed for avatar communication services. | |

| | | | | | |
|---|----------------|---|------|--|--|
| mdc2AVEndpoint | Mdc2AVEndpoint | C | 0..1 | Represents the audio and video endpoint information on MDC2 interface. It shall be present when the attribute renderingMode within the avatarMedia is set to "NET_CENTRIC_DCAS". | |
| NOTE 1: The IE cannot be changed once the media has been established. | | | | | |
| NOTE 2: The attribute "transport" inside Endpoint data type shall be set to value only "UDP". | | | | | |

6.1.6.2.5 Type: DcMedia

Table 6.1.6.2.5-1: Definition of type DcMedia

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|-------------------------|---|-------------|--|---------------|
| mediaProxyConfig | MediaProxy | M | 1 | Represents the media proxy configuration on the MF. The value shall be set to "HTTP_PROXY" if the mediaId represents the bootstrap data channel. The value shall be set to "DC_APPLICATION_PROXY" if the mediaId represents the network initiated P2P application data channel. | |
| replaceHttpUrl | map(ReplaceHttpUrl) | C | 0..1 | A map (list of key-value pairs where streamId is used as key of the map) of ReplacementHttpUrl. Represents URL for the specific IMS subscriber when requesting the application list (e.g. graphical user interface) via the MDC1 interface. It shall be included if the mediaId represents bootstrap data channel and streamId is 0 and 100. | |
| mdc1Info | Mdc1Info | C | 0..1 | Represents the information of MDC1 interface. It shall be contained when the mediaId represents a bootstrap data channel. | |
| mdc2Info | Mdc2Info | C | 0..1 | Represents the information of MDC2 interface. It shall be contained when the mediaId represents a P2A/A2P application data channel. | |
| streams | map(DcStream) | M | 1..N | A map (list of key-value pairs where streamId is used as key of the map) of DcStream. Represents the data channel mapping and configuration information when originating/terminating data channel media flows on the Mb interface. | |
| maxMessageSize | MaxMessageSize | O | 0..1 | Represents the maximum size of to be expected. | |
| localDcEndpoint | DcEndpoint | C | 0..1 | Represents the DC endpoint for the Data Channel. It will be allocated by MF. It shall be contained in the response when creating a new media stream, i.e. Nmf_MRM_Create operation or Nmf_MRM_Update operation with adding a new termination or adding a media in an existing termination. (NOTE) | |
| remoteDcEndpoint | DcEndpoint | C | 0..1 | Represents the DC Endpoint for the Data Channel on the Mb interface. It shall be contained in the request of creating a new media stream, i.e. Nmf_MRM_Create operation or Nmf_MRM_Update operation with adding a new termination or adding a media in an existing termination. It can be NULL when originating a data channel media. (NOTE) | |
| interworkingInfo | InterworkingInstruction | O | 0..1 | Represents instructions on how to interwork to other media types. | |
| NOTE: The IE cannot be changed once the media has been established. | | | | | |

6.1.6.2.6 Type: ArMedia

Table 6.1.6.2.6-1: Definition of type ArMedia

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---------------------|-----------|---|-------------|---|---------------|
| mediaProcessingSpec | string | M | 1 | It specifies how the AR media stream should be processed. It indicates how the MF assists in the AR media rendering function. | |

6.1.6.2.7 Type: Mdc1Info

Table 6.1.6.2.7-1: Definition of type Mdc1Info

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|-------------|---|-------------|--|---------------|
| remoteMdc1Endpoint | MdcEndpoint | C | 0..1 | Represents the remote MDC1 media endpoint information of DCSF. It shall be contained in the request when creating a new media. | |
| localMdc1Endpoint | MdcEndpoint | C | 0..1 | Represents the local MF MDC1 media endpoint information. It will be allocated by MF and contained in the response when creating a new media. | |
| NOTE: The MDC1 interface shall use "TCP/TLS" transport layer protocol and the attributes "tlsId", "fingerprint" within the data type MdcEndpoint shall be included. | | | | | |

6.1.6.2.8 Type: Mdc2Info

Table 6.1.6.2.8-1: Definition of type Mdc2Info

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---|--------------|---|-------------|---|---------------|
| mdc2Protocol | Mdc2Protocol | C | 0..1 | Represents the transport layer protocol or protocol stack for MDC2 interface. It shall be included when the mediaProxyConfig is set to "HTTP". | |
| remoteMdc2Endpoint | MdcEndpoint | C | 0..1 | Represents the remote MDC2 media endpoint information on DC AS. It shall be included in the request for creating a new media. (NOTE 1) (NOTE 2) | |
| localMdc2Endpoint | MdcEndpoint | C | 0..1 | Represents the local MDC2 media endpoint information on MF. It will be allocated by MF and contained in the response when creating a new media. (NOTE 1) (NOTE 2) | |
| NOTE 1: When the mdc2Protocol is set to "UDP/DTLS/SCTP", "TCP/TLS" or "SCTP/DTLS", the attributes "tlsId" and "fingerprint" within the data type MdcEndpoint shall be included, and the "securitySetup" may be included. When the mdc2Protocol is set to "UDP/DTLS/SCTP", the attributes "sctpPort" within the data type MdcEndpoint shall be included. | | | | | |
| NOTE 2: When the mediaProxyConfig is set to "UDP_PROXY", only UDP/IP connections should be established between the MF and the DC AS, the attributes "tlsId", "sctpPort" and "fingerprint" within the MdcEndpoint shall not present. | | | | | |

6.1.6.2.9 Type: NonDcMedia

Table 6.1.6.2.9-1: Definition of type NonDcMedia

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|---------------------|------------------|---|-------------|--|---------------|
| sdpmLine | SdpString | M | 1 | Represents the m=line in the SDP media description. | |
| sdpaLines | array(SdpString) | M | 0..N | Represents the a=lines in the SDP media description. | |
| associatedDcMediaId | MediaId | O | 0..1 | Indicates the data channel media identifier this media associates. | |

6.1.6.2.10 Type: AvatarMedia

Table 6.1.6.2.10-1: Definition of type AvatarMedia

| Attribute name | Data type | P | Cardinality | Description | Applicability |
|------------------|---------------|---|-------------|--|---------------|
| resourceUrl | Uri | C | 0..1 | Represents the URL that MF to retrieve the avatar representation to perform network rendering. This IE shall be included when the value of the renderingMode set to "NET_CENTRIC_MF". | |
| mediaProcessSpec | string | C | 0..1 | Represents how the media stream associated with the resource URL should be processed. This IE shall be included when the value of the renderingMode set to "NET_CENTRIC_MF". | |
| renderingMode | RenderingMode | M | 1 | Represents the rendering mode of avatar media. | |
| resourceUeId | ImsPublicId | C | 0..1 | Represents the UE that owns the avatar representation to be retrieved by the MF. This IE shall be included when the value of the renderingMode set to "UE_CENTRIC". | |
| requesterUeId | ImsPublicId | C | 0..1 | Represents the UE that is requesting the avatar representation to be retrieved by the MF. This IE shall be included when the value of the renderingMode set to "UE_CENTRIC". | |
| avatarId | AvatarId | O | 0..1 | It indicates the identifier of an avatar representation. | |

6.1.6.2.11 Type: Mdc2AVEndpoint

Table 6.1.6.2.11-1: Definition of type Mdc2AVEndpoint

| Attribute name | Data type | P | Cardinality | Description |
|------------------------|-----------|---|-------------|--|
| audioMediaEndpointDcAs | Endpoint | C | 0..1 | The endpoint information of the DC AS for the audio media. It shall be present in the request message when creating an audio media on the MDC2 interface. |
| audioMediaEndpointMf | Endpoint | C | 0..1 | The endpoint information of the MF for the audio media. It shall be present in the response message of creating an audio media in MDC2 interface. |
| videoMediaEndpointDcAs | Endpoint | C | 0..1 | The endpoint information of the DC AS for the video media. It shall be present in the request message when creating a video media on MDC2 interface. |
| videoMediaEndpointMf | Endpoint | C | 0..1 | The endpoint information of the MF for the video media. It shall be present in the response of creating a video media on MDC2 interface. |

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

| Type Name | Type Definition | Description | Applicability |
|-----------|-----------------|---|---------------|
| AvatarId | string | Represents a string identifier of an avatar representation. | |
| SdpString | string | Represents the content after "m=" of the "m=" line and the content after "a=" of the associated "a=" lines. | |

6.1.6.3.3 Enumeration: Mdc2Protocol

The enumeration Mdc2Protocol represents the type of the transport layer protocols for MDC2 interface. It shall comply with the provisions defined in table 6.1.6.3.3-1.

Table 6.1.6.3.3-1: Mdc2Protocol

| Enumeration value | Description |
|-------------------|-----------------------------------|
| "UDP/DTLS/SCTP" | UDP/DTLS/SCTP for MDC2 interface. |
| "TCP" | TCP for MDC2 interface. |
| "UDP" | UDP for MDC2 interface. |
| "SCTP" | SCTP for MDC2 interface. |
| "TCP/TLS" | TCP/TLS for MDC2 interface. |
| "SCTP/DTLS" | SCTP/DTLS for MDC2 interface. |

6.1.7 Error Handling

6.1.7.1 General

For the Nmf_MRM API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Nmf_MRM API.

6.1.7.2 Protocol Errors

No specific procedures for the Nmf_MRM service are specified.

6.1.7.3 Application Errors

The application errors defined for the Nmf_MRM service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

| Application Error | HTTP status code | Description |
|--------------------------|---------------------------|---|
| CONTEXT_NOT_FOUND | 404 Not Found | Indicates that the requested context is not found in the MF. |
| MEDIA_CONNECTION_CHANGED | 403 Forbidden | Indicates that the connection information which has been marked that cannot be changed once the media has established is changed in the request. including the remoteMbEndpoint, localMbEndpoint etc. |
| MEDIA_ID_CONFLICT | 409 Conflict | Indicates that a new media to be created has the identical mediaId already assigned to one created media. |
| INSUFFICIENT_RESOURCES | 500 Server Internal Error | Indicates that the modification of media context has failed due to insufficient resources. |

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Nmf_MRM API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

| Feature number | Feature Name | Description |
|----------------|--------------|-------------|
| | | |

6.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Nmf_MRM API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Nmf_MRM API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nmf_MRM service.

The Nmf_MRM API defines a single scope "nmf-mrm" for the entire service, and it does not define any additional scopes at resource or operation level.

6.1.10 HTTP redirection

An HTTP request may be redirected to a different MF service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different MF producer instance will return the NF Instance ID of the new MF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an MF redirects a service request to a different MF using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new MF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

Annex A (normative): OpenAPI specification

A.1 General

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5.3.1 of 3GPP TS 29.501 [5] and clause 5B of 3GPP TR 21.900 [7]).

A.2 Nmf_MRM API

```
openapi: 3.0.0

info:
  title: 'MF Media Resource Management (MRM) Service'
  version: 1.1.0
  description: |
    MF Media Resource Management (MRM) Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.176 V19.4.0; IP Multimedia Subsystem (IMS); Media Function (MF) Services; Stage 3.
  url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.176/

servers:
  - url: '{apiRoot}/nmf-mrm/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
      - nmf-mrm

paths:
  /contexts:
    post:
      summary: Create a new media context.
      operationId: CreateMediaContext
      tags:
        - MediaContext(Collection)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/MediaContext'
      responses:
        '201':
          description: Success
          content:
            application/json:
```

```

    schema:
      $ref: '#/components/schemas/MediaContext'
  headers:
    Location:
      description: >
        Contains the URI of the newly created resource, according to the structure:
        {apiRoot}/nmf-mrm/<version>/contexts/{contextId}
      required: true
      schema:
        type: string
'307':
  description: Temporary Redirect
  content:
    application/json:
      schema:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
  headers:
    Location:
      description: The URI pointing to the resource located on the redirect target MF.
      required: true
      schema:
        type: string
'308':
  description: Permanent Redirect
  content:
    application/json:
      schema:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
  headers:
    Location:
      description: The URI pointing to the resource located on the redirect target MF.
      required: true
      schema:
        type: string
'400':
  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
'401':
  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
'403':
  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
'404':
  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
'409':
  $ref: 'TS29571_CommonData.yaml#/components/responses/409'
'411':
  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
'413':
  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
'415':
  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
'429':
  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
'500':
  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
'503':
  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
default:
  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

/contexts/{contextId}:
  patch:
    summary: Update Media Context
    operationId: UpdateMediaContext
    tags:
      - Media Context ID (Document)
    parameters:
      - name: contextId
        in: path
        required: true
        description: Unique ID of the Media Context to update.
        schema:
          type: string
    requestBody:
      content:
        application/json-patch+json:
          schema:
            type: array

```

```

    items:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/PatchItem'
    minItems: 1
  required: true
  responses:
    '200':
      description: Expected response to a valid request.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/MediaContext'
    '204':
      description: Expected response with empty body
    '307':
      description: Temporary Redirect
      content:
        application/json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
      headers:
        Location:
          description: The URI pointing to the resource located on the redirect target MF.
          required: true
          schema:
            type: string
    '308':
      description: Permanent Redirect
      content:
        application/json:
          schema:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
      headers:
        Location:
          description: The URI pointing to the resource located on the redirect target MF.
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '409':
      $ref: 'TS29571_CommonData.yaml#/components/responses/409'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '412':
      $ref: 'TS29571_CommonData.yaml#/components/responses/412'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '501':
      $ref: 'TS29571_CommonData.yaml#/components/responses/501'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
  default:
    $ref: 'TS29571_CommonData.yaml#/components/responses/default'

delete:
  summary: Deletes a given Media Context
  operationId: DeleteMediaContext
  tags:
    - Media Context ID (Document)
  parameters:
    - name: contextId
      in: path
      required: true
      description: Unique ID of the Media Context to delete.
      schema:
        type: string
  responses:
    '204':

```

```

description: Expected response to a successful deletion.
'307':
  description: Temporary Redirect
  content:
    application/json:
      schema:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
  headers:
    Location:
      description: The URI pointing to the resource located on the redirect target MF.
      required: true
      schema:
        type: string
'308':
  description: Permanent Redirect
  content:
    application/json:
      schema:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RedirectResponse'
  headers:
    Location:
      description: The URI pointing to the resource located on the redirect target MF.
      required: true
      schema:
        type: string
'400':
  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
'401':
  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
'403':
  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
'404':
  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
'411':
  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
'429':
  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
'500':
  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
'501':
  $ref: 'TS29571_CommonData.yaml#/components/responses/501'
'503':
  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
default:
  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

```

components:

```

securitySchemes:
  oAuth2ClientCredentials:
    type: oauth2
    flows:
      clientCredentials:
        tokenUrl: '{nrfApiRoot}/oauth2/token'
        scopes:
          nmf-mrm: Access to the Nmf_MRM API.

```

schemas:

```

MediaContext:
  description: Information of a Media Context in a MF.
  type: object
  required:
    - terminations
  properties:
    contextId:
      type: string
    terminations:
      type: array
      items:
        $ref: '#/components/schemas/TerminationInfo'
    minItems: 1

```

```

TerminationInfo:
  description: Represents the termination information.
  type: object
  required:
    - terminationId

```

```

- medias
properties:
  terminationId:
    type: string
  medias:
    type: array
    items:
      $ref: '#/components/schemas/MediaInfo'
    minItems: 1

MediaInfo:
description: Represents the media information.
type: object
required:
- mediaId
- mediaResourceType
properties:
  mediaId:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/MediaId'
  associatedMediaId:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/MediaId'
  mediaResourceType:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/MediaResourceType'
  localMbEndpoint:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'
  remoteMbEndpoint:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'
  dcMedia:
    $ref: '#/components/schemas/DcMedia'
  arMedia:
    $ref: '#/components/schemas/ArMedia'
  localNonDcMedia:
    $ref: '#/components/schemas/NonDcMedia'
  remoteNonDcMedia:
    $ref: '#/components/schemas/NonDcMedia'
  mediaProcessingUri:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
  avatarMedia:
    $ref: '#/components/schemas/AvatarMedia'
  mdc2AVEndpoint:
    $ref: '#/components/schemas/Mdc2AVEndpoint'

DcMedia:
description: Represents the DC media descriptor.
type: object
required:
- streams
- mediaProxyConfig
properties:
  mediaProxyConfig:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/MediaProxy'
  replaceHttpUrl:
    type: object
    description: >
      Contains a list of replacement HTTP URLs. The streamId attribute
      within the ReplaceHttpUrl data type is the key of the map.
    additionalProperties:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/ReplaceHttpUrl'
    minProperties: 1
  mdc1Info:
    $ref: '#/components/schemas/Mdc1Info'
  mdc2Info:
    $ref: '#/components/schemas/Mdc2Info'
  streams:
    type: object
    description: >
      Contains a data channel mapping and configuration information. The streamId
      attribute within the DcStream data type is the key of the map.
    additionalProperties:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DcStream'
    minProperties: 1
  maxMessageSize:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/MaxMessageSize'
  localDcEndpoint:
    $ref: 'TS29571_CommonData.yaml#/components/schemas/DcEndpoint'
  remoteDcEndpoint:

```

```

    $ref: 'TS29571_CommonData.yaml#/components/schemas/DcEndpoint'
  interworkingInfo:
    $ref: 'TS29175_Nimsas_MediaControl.yaml#/components/schemas/InterworkingInstruction'

Mdc1Info:
  description: Represents the information of MDC1 interface.
  type: object
  properties:
    remoteMdc1Endpoint:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MdcEndpoint'
    localMdc1Endpoint:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MdcEndpoint'

Mdc2Info:
  description: Represents the information of MDC2 interface.
  type: object
  properties:
    remoteMdc2Endpoint:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MdcEndpoint'
    localMdc2Endpoint:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MdcEndpoint'
    mdc2Protocol:
      $ref: '#/components/schemas/Mdc2Protocol'

ArMedia:
  description: Represents the AR media descriptor.
  type: object
  required:
    - mediaProcessingSpec
  properties:
    mediaProcessingSpec:
      type: string

AvatarMedia:
  description: Represents the Avatar media descriptor.
  type: object
  required:
    - renderingMode
  properties:
    resourceUrl:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    mediaProcessSpec:
      type: string
    renderingMode:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/RenderingMode'
    resourceUeId:
      $ref: 'TS29562_Nhss_imsSDM.yaml#/components/schemas/ImsPublicId'
    requesterUeId:
      $ref: 'TS29562_Nhss_imsSDM.yaml#/components/schemas/ImsPublicId'
    avatarId:
      $ref: '#/components/schemas/AvatarId'

NonDcMedia:
  description: Represents the audio and video media
  type: object
  required:
    - sdpmLine
    - sdpaLines
  properties:
    sdpmLine:
      $ref: '#/components/schemas/SdpString'
    sdpaLines:
      type: array
      items:
        $ref: '#/components/schemas/SdpString'
    associatedDcMediaId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/MediaId'

Mdc2AVEndpoint:
  description: Represents the audio or video endpoint information on MDC2 interface
  type: object
  properties:
    audioMediaEndpointDcAs:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'
    audioMediaEndpointMf:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'

```

```
videoMediaEndpointDcAs:  
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'  
videoMediaEndpointMf:  
  $ref: 'TS29571_CommonData.yaml#/components/schemas/Endpoint'
```

```
SdpString:  
  description: The content after "m=" of the "m=" line and the content after "a=" of the  
  associated "a=" lines.  
  type: string
```

```
AvatarId:  
  description: A string identifier used to identify an avatar representation.  
  type: string
```

```
Mdc2Protocol:  
  description: The type of the transport layer protocols for MDC2 interface.  
  anyOf:  
  - type: string  
    enum:  
    - UDP/DTLS/SCTP  
    - TCP  
    - UDP  
    - SCTP  
    - TCP/TLS  
    - SCTP/DTLS  
  - type: string  
    description: >  
    This string provides forward-compatibility with future extensions to the enumeration  
    and is not used to encode content defined in the present version of this API.
```

Annex B (informative): Change history

| Change history | | | | | | | |
|----------------|----------|-----------|------|-----|-----|---|-------------|
| Date | Meeting | Tdoc | CR | Rev | Cat | Subject/Comment | New version |
| 2023-04 | CT4#115e | C4-231552 | | | | Version 0.1.0 | 0.1.0 |
| 2023-05 | CT4#116 | C4-232178 | | | | Clause 4 Overview | 0.2.0 |
| 2023-05 | CT4#116 | C4-232224 | | | | Clause 5.1 Introduction of DCMF services | 0.2.0 |
| 2023-05 | CT4#116 | C4-232506 | | | | Service description and service operation introduction of MRM service | 0.2.0 |
| 2023-05 | CT4#116 | C4-232607 | | | | MRM API definition | 0.2.0 |
| 2023-05 | CT4#116 | C4-232637 | | | | MRM service operations | 0.2.0 |
| 2023-08 | CT4#117 | C4-233707 | | | | Change DCMF to MF | 0.3.0 |
| 2023-08 | CT4#117 | C4-233307 | | | | Update the data channel related data types | 0.3.0 |
| 2023-08 | CT4#117 | C4-233306 | | | | Update MF service to support AR | 0.3.0 |
| 2023-10 | CT4#118 | C4-234539 | | | | Update the scope | 0.4.0 |
| 2023-10 | CT4#118 | C4-234540 | | | | Support of Redirection | 0.4.0 |
| 2023-10 | CT4#118 | C4-234575 | | | | Clarification on the DC media | 0.4.0 |
| 2023-10 | CT4#118 | C4-234543 | | | | Editorial Corrections | 0.4.0 |
| 2023-10 | CT4#118 | C4-234544 | | | | Update the data model for AR remote cooperation | 0.4.0 |
| 2023-10 | CT4#118 | C4-234341 | | | | Usage of the apiVersion placeholder | 0.4.0 |
| 2023-11 | CT4#119 | C4-235576 | | | | Move the Endpoint to Common Data | 0.5.0 |
| 2023-11 | CT4#119 | C4-235473 | | | | OpenAPI of Nmf_MRM Service | 0.5.0 |
| 2023-12 | CT#102 | CP-233022 | | | | Presented for information and approval | 1.0.0 |
| 2023-12 | CT#102 | CP-233022 | | | | Approved in TSC CT#102 | 18.0.0 |
| 2024-03 | CT#103 | CP-240043 | 0002 | | F | Support of media renegotiation | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0001 | 1 | B | EN resolution on AR media | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0004 | 1 | F | Change the map data type and correct the editorial errors | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0007 | 1 | F | Clarification of definitions, symbols and abbreviations | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0008 | 1 | F | Correction IE of mdc2Protocol | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0003 | 2 | F | Add the error insufficient resource | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0006 | 1 | F | Update the Nmf_MRM_Update service operation | 18.1.0 |
| 2024-03 | CT#103 | CP-240043 | 0005 | 3 | F | Update the Nmf_MRM_Create service operation | 18.1.0 |
| 2024-03 | CT#103 | CP-240056 | 0009 | | F | 29.176 Rel-18 API version and External doc update | 18.1.0 |
| 2024-06 | CT#104 | CP-241044 | 0010 | | F | Clarification on the Media Context ID and termination ID | 18.2.0 |
| 2024-06 | CT#104 | CP-241044 | 0011 | 1 | F | Update the MDC1 and MDC2 interface information | 18.2.0 |
| 2024-06 | CT#104 | CP-241305 | 0012 | 3 | F | Inclusion of the video and audio media | 18.2.0 |
| 2024-06 | CT#104 | CP-241044 | 0013 | 2 | F | Update the presence condition and cardinality for mediaProxyConfig | 18.2.0 |
| 2024-06 | CT#104 | CP-241052 | 0014 | | F | 29.176 Rel-18 API version and External doc update | 18.2.0 |
| 2024-09 | CT#105 | CP-242048 | 0017 | | F | Remove the redundant securitySetup in DcMedia | 18.3.0 |
| 2024-09 | CT#105 | CP-242048 | 0015 | 1 | F | Cardinality correction | 18.3.0 |
| 2024-09 | CT#105 | CP-242048 | 0018 | 1 | F | Update the procedure of creation a new media context | 18.3.0 |
| 2024-09 | CT#105 | CP-242048 | 0016 | 1 | F | Updates to MF Media Resource Management Service Operations | 18.3.0 |
| 2024-09 | CT#105 | CP-242054 | 0019 | | F | 29.176 Rel-18 API version and External doc update | 18.3.0 |
| 2024-12 | CT#106 | CP-243027 | 0020 | | F | Correction on Nmf_MRM service | 18.4.0 |
| 2024-12 | CT#106 | CP-243068 | 0022 | | F | 29.176 Rel-18 API version and External doc update | 18.4.0 |
| 2024-12 | CT#106 | CP-243045 | 0021 | 1 | B | Support of interworking with MTSI client | 19.0.0 |
| 2025-02 | CT#107 | CP-250047 | 0024 | 2 | B | Support of avatar communication | 19.1.0 |
| 2025-02 | CT#107 | CP-250137 | 0025 | | F | 29.176 Rel-19 API version and External doc update | 19.1.0 |
| 2025-06 | CT#108 | CP-251049 | 0028 | 1 | A | Correction on the MediaInfo data type | 19.2.0 |
| 2025-06 | CT#108 | CP-251049 | 0030 | 1 | A | Correction on Nmf_MRM OpenAPI | 19.2.0 |
| 2025-06 | CT#108 | CP-251068 | 0034 | 1 | B | Define the rendering mode for avatar media specification data type | 19.2.0 |
| 2025-06 | CT#108 | CP-251068 | 0031 | 1 | B | Updates the Nmf_MRM service to support DC multiplexing | 19.2.0 |
| 2025-06 | CT#108 | CP-251068 | 0032 | 1 | B | Update the MediaProxy value | 19.2.0 |
| 2025-06 | CT#108 | CP-251049 | 0036 | 1 | A | HTTP Response Code for Application Error MEDIA_ID_CONFLICT | 19.2.0 |
| 2025-06 | CT#108 | CP-251079 | 0039 | | F | 29.176 Rel-19 API version and External doc update | 19.2.0 |
| 2025-09 | CT#109 | CP-252050 | 0041 | 1 | F | Correction on the data channel multiplexing | 19.3.0 |
| 2025-09 | CT#109 | CP-252050 | 0040 | 2 | B | Instruction on transcoding for interworking | 19.3.0 |
| 2025-09 | CT#109 | CP-252176 | 0042 | | F | 29.176 Rel-19 API version and External doc update | 19.3.0 |
| 2025-12 | CT#110 | CP-253155 | 0049 | 1 | B | Audio/Video support in MDC2 interface | 19.4.0 |
| 2025-12 | CT#110 | CP-253155 | 0050 | 1 | F | Correction on the description of associatedMediaId | 19.4.0 |
| 2025-12 | CT#110 | CP-253155 | 0051 | 1 | F | Usage of Avatar ID | 19.4.0 |
| 2025-12 | CT#110 | CP-253155 | 0044 | 1 | B | Update to AvatarMedia data type | 19.4.0 |
| 2025-12 | CT#110 | CP-253142 | 0047 | 1 | F | Correction on the procedure for AR communication | 19.4.0 |
| 2025-12 | CT#110 | CP-253167 | 0052 | 1 | F | API version and External doc update | 19.4.0 |

History

| Version | Date | Status |
|----------------|---------------|---------------|
| V19.3.0 | January 2026 | Publication |
| V19.4.0 | February 2026 | Publication |
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