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| Technical Specification | |
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# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

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 Nlmf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the LMF.

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

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] IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".

[7] IETF RFC 5139: "Revised Civic Location Format for Presence Information Data Format Location Object (PIDF-LO)".

[8] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[9] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[10] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[11] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

[12] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

[13] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[14] OpenAPI Initiative, "OpenAPI 3.0.0 Specification", <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/3.0.0.md>.

[15] IETF RFC 7807: "Problem Details for HTTP APIs".

[16] 3GPP TR 21.900: "Technical Specification Group working methods".

[17] 3GPP TS 22.071: "Location Services (LCS); Service description; Stage 1".

[18] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[19] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[20] 3GPP TS 24.080: "Mobile radio interface layer 3 Supplementary services specification; Formats and coding".

[21] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[22] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[23] 3GPP TS 29.518: "Access and Mobility Management Services".

[24] 3GPP TS 29.171: "Location Services (LCS); LCS Application Protocol (LCS-AP) between the Mobile Management Entity (MME) and Evolved Serving Mobile Location Centre (E-SMLC); SLs interface".

[25] IETF RFC 4119: "A Presence-based GEOPRIV Location Object Format".

# 3 Definitions and abbreviations

## 3.1 Definitions

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

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

LDR Location Deferred Request

LMF Location Management Function

# 4 Overview

The Location Management Function (LMF) is the network entity in the 5G Core Network (5GC) supporting the following functionality:

- Supports location determination for a UE.

- Obtains downlink location measurements or a location estimate from the UE.

- Obtains uplink location measurements from the NG RAN.

- Obtains non-UE associated assistance data from the NG RAN.

- Provides broadcast assistance data to UEs and forwards associated ciphering keys to an AMF.

Other functions of an LMF are listed in clause 4.3.8 of 3GPP TS 23.273 [19].

Figure 4-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the LMF:



Figure 4-1: Reference model – LMF

# 5 Services Offered by the LMF

## 5.1 Introduction

The LMF offers to other NFs the following services:

- Nlmf\_Location

- Nlmf\_Broadcast

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** |
| Nlmf\_Location | 6.1 | LMF Location Service | TS29572\_Nlmf\_Location.yaml | nlmf-loc | A.2 |
| Nlmf\_Broadcast | 6.2 | LMF Broadcast Service | TS29572\_Nlmf\_Broadcast.yaml | nlmf-broadcast | A.3 |

## 5.2 Nlmf\_Location Service

### 5.2.1 Service Description

The Nlmf\_Location service enables an NF to request location determination (current geodetic and optionally civic location) for a target UE or to request periodic or triggered location for a target UE.

### 5.2.2 Service Operations

#### 5.2.2.1 Introduction

The service operations defined for the Nlmf\_Location service are as follows:

- DetermineLocation: It provides UE location information to the consumer NF.

- EventNotify: It notifies the consumer NF of an event for periodic or triggered location for a target UE.

- CancelLocation: It enables a consumer NF to cancel an ongoing periodic or triggered location for a target UE.

- LocationContextTransfer: It enables a consumer NF to transfer location context information for periodic or triggered location of a target UE to a new LMF.

#### 5.2.2.2 DetermineLocation

##### 5.2.2.2.1 General

The following procedures are defined, using the "DetermineLocation" service operation:

- Retrieve UE Location

- Retrieve UE Location for 5G-MO-LR

##### 5.2.2.2.2 Retrieve UE Location

This procedure allows a consumer NF to request the location information (geodetic location and, optionally, civic location) for a target UE or to activate periodic or triggered deferred location for a target UE.



Figure 5.2.2.2.2-1: DetermineLocation Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI associated with the "determine-location" custom operation. The input parameters for the request (external client type, LCS correlation identifier, serving cell identifier, location QoS, supported GAD shapes, LDR Type, H-GMLC address, LDR Reference, UE connectivity state per access type ….) may be included in the HTTP POST request body.

If UE LCS Capability is received in the request indicating LPP is not supported by the UE, the LMF shall not send LPP messages to the UE in subsequent positioning procedures.

2a. On success, "200 OK" shall be returned. The response body shall contain the parameters related to the determined position of the UE if any (geodetic position, civic location, positioning methods…).

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.2.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.2.2-2.

##### 5.2.2.2.3 Retrieve UE Location for 5G-MO-LR

This procedure allows a consumer NF (i.e. an AMF) to request the location information or location assistance data for a target UE which initiates MO-LR procedure (see 3GPP TS 23.273 [19]).



Figure 5.2.2.2.3-1: DetermineLocation Request for 5G-MO-LR

The same requirements in clause 5.2.2.2.2 shall be applied with following modifications:

1. Same as step 1 of figure 5.2.2.2.2-1, the request body shall include the following additional information:

- The indication received from UE indicating whether a location estimate or location assistance data is required.

- An LPP message if it is received in MO-LR Request from UE

2a. Same as step 2a of figure 5.2.2.2.2-1 if a consumer NF requests the location information for a target UE. If a NF consumer requests location assistance data for a target UE and LMF has successfully delivered location assistance data to the UE, 204 No Content shall be returned.

2b. Same as step 2b of figure 5.2.2.2.2-1.

#### 5.2.2.3 EventNotify

##### 5.2.2.3.1 General

The following procedures are defined, using the "EventNotify" service operation:

- Periodic or Triggered Event Notification

##### 5.2.2.3.2 Periodic or Triggered Event Notification

This procedure notifies the NF Service Consumer (i.e. GMLC) about event information related to periodic or triggered location of a target UE. The notification is delivered to:

- the callback URI of an H-GMLC received (from an AMF) during an earlier DetermineLocation service operation if still available and if the LMF is configured for direct access to the H-GMLC;

- the callback URI of an H-GMLC received (from another LMF) during an earlier LocationContextTransfer service operation if still available and if the LMF is configured for direct access to the H-GMLC;

- the callback URI of an H-GMLC received (from the target UE) in a supplementary services event report if the LMF is configured for direct access to the H-GMLC;

otherwise (if not available),

- the callback URI of a V-GMLC registered in the NRF, if the V-GMLC registered to the NRF with notification endpoints for periodic or triggered event notifications; or

otherwise (if not available),

- the URI of a V-GMLC locally provisioned in the LMF.



Figure 5.2.2.3.2-1: EventNotify Request

1. The LMF shall send a POST request to the GMLC callback URI determined as described above. The request body shall include a notification correlation ID (LDR reference), the UE identification (SUPI and if available GPSI), the type of event and may include a geodetic location, civic location, position methods used, and other available parameters related to the position if any (e.g. Velocity, Altitude etc.), H-GMLC callback URI (if the NF consumer is a V-GMLC) and serving LMF identification.

2a. On success, "204 No content" shall be returned by the NF Service Consumer.

2b. On failure or redirection, the appropriate HTTP status code (e.g. "403 Forbidden") indicating the error shall be returned and the message body should contain a ProblemDetails structure indicating appropriate additional error information.

#### 5.2.2.4 CancelLocation

##### 5.2.2.4.1 General

The following procedures are defined, using the "CancelLocation" service operation:

- Cancel Periodic or Triggered Location

##### 5.2.2.4.2 Cancel Periodic or Triggered Location

This procedure allows a consumer NF to cancel periodic or triggered location for a target UE. The cancellation is delivered to a resource URI on the serving LMF identified by the serving LMF identification provided to the consumer NF (i.e. AMF) by a V-GMLC or H-GMLC (see 3GPP TS 23.273 [19]).



Figure 5.2.2.4.2-1: CancelLocation Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI of "cancel-location" custom operation on the serving LMF. The request body shall include a notification correlation ID (LDR reference) and an H-GMLC callback URI.

2a. On success, "204 No content" shall be returned by the LMF.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.3.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.3.2-2.

#### 5.2.2.5 LocationContextTransfer

##### 5.2.2.5.1 General

The following procedures are defined, using the "LocationContextTransfer" service operation:

- Transfer Location Context

##### 5.2.2.5.2 Transfer Location Context

This procedure allows a NF service consumer (e.g. the old LMF) to transfer location context information for periodic or triggered location for a target UE (see clause 6.4 and clause 6.7.2 of 3GPP TS 23.273 [19]). The NF service consumer discovers the service URI of the new LMF by performing a discovery via NRF using:

- the identification of the LMF received (from an AMF) during an earlier Namf\_Communication\_N1MessageNotify service operation to the consumer NF;

otherwise (if not available),

- the identification of an LMF locally provisioned in the consumer NF.



Figure 5.2.2.5.2-1: LocationContextTransfer Request

1. The NF Service Consumer shall send an HTTP POST request to the Custom operation URI ("/location-context-transfer") on the Service URI discovered as described above. The request body shall include an AMF identity, Deferred location type, Deferred location parameters, Notification Target Address (H-GMLC callback URI), Notification Correlation ID (LDR reference), an embedded event report message and may include an event reporting status and UE location information, and shall include an indication of Control Plane CIoT 5GS Optimisation if N1 message is received from the UE with Control Plane CIoT 5GS Optimisation.

2a. On success, "204 No content" shall be returned by the LMF.

2b. On failure or redirection, one of the HTTP status codes listed in Table 6.1.4.4.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.4.2-2.

## 5.3 Nlmf\_Broadcast Service

### 5.3.1 Service Description

The Nlmf\_Broadcast service enables an NF to obtain ciphering keys and associated parameters applicable to location assistance data that is broadcast to subscribed UEs in ciphered form.

### 5.3.2 Service Operations

#### 5.3.2.1 Introduction

The service operations defined for the Nlmf\_Broadcast service are as follows:

- CipheringKeyData: It provides the ciphering key information to the consumer NF.

#### 5.3.2.2 CipheringKeyData

##### 5.3.2.2.1 General

The following procedures are defined, using the "CipheringKeyData" service operation:

- Request Ciphering Key Information

- Provide Ciphering Key Information

NOTE: The Request Ciphering Key procedure is included in order to provide a valid context in OpenAPI version 3 for the Provide Ciphering Key Information procedure. The Request Ciphering Key procedure is not used for support of ciphering key transfer in 3GPP TS 23.273 [19] and hence need not be supported by an NF Service Consumer or by an LMF.

##### 5.3.2.2.2 Request Ciphering Key Information

This procedure allows a consumer NF to request ciphering key information.



Figure 5.3.2.2.2-1: CipheringKeyData Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI associated with the "cipher-key-data" custom operation. The request body shall include a notification callback URI.

2a. On success, "200 OK" shall be returned. The response body shall indicate whether the LMF has ciphering key data. If the LMF has ciphering key data, the Provide Ciphering Key Information procedure is used to provide the ciphering key data to the NF Service Consumer.

2b. On failure or redirection, one of the HTTP status codes listed in Table 6.2.4.4.2-2 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 6.2.7.3-1.

##### 5.3.2.2.3 Provide Ciphering Key Information

This procedure notifies the NF Service Consumer (i.e. AMF) about updated ciphering key information applicable to broadcast of location assistance data in ciphered form to subscribed UEs. The notification is delivered to:

- the callback URI of an AMF received during an earlier CipheringKeyData request service operation if still available; or

- a callback URI registered in the NRF, if the AMF registered to the NRF with notification endpoints for ciphering key data notifications;

Otherwise (if not available),

- an AMF callback URI locally provisioned in the LMF.

The procedure is invoked by issuing a POST request to the callback URI of the NF Service Consumer. See figure 5.3.2.2.3-1.



Figure 5.3.2.2.3-1: CipheringKeyData Notify

1. The LMF shall send an HTTP POST request to the callback URI for the NF service consumer determined as described above. The request body shall include one or more ciphering keys and for each ciphering key may include a ciphering key value, ciphering key identifier, validity period and set of applicable types of broadcast assistance data.

2a. On success or partial success, "200 OK" shall be returned. The response body shall indicate which ciphering key information was successfully stored by the NF service consumer.

2b. On failure or redirection to store any ciphering key information, one of the HTTP status codes listed in table 6.2.5.1.3.1-2 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 6.2.5.1.3.1-2.

# 6 API Definitions

## 6.1 Nlmf\_Location Service API

### 6.1.1 API URI

The Nlmf\_Location service shall use the Nlmf\_Location API.

The API URI of the Nlmf\_Location API shall be:

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

The request URI 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 "nlmf-loc".

- 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, as defined in IETF RFC 7540 [12], 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].

HTTP messages and bodies for the Nlmf\_Location service shall comply with the OpenAPI [14] specification contained in Annex A.

#### 6.1.2.2 HTTP Standard Headers

##### 6.1.2.2.1 General

##### 6.1.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [13], shall be used as content type of the HTTP bodies specified in the present specification as indicated in clause 5.4 of 3GPP TS 29.500 [4].

- The Problem Details JSON Object (IETF RFC 7807 [15]). The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

Multipart messages shall also be supported (see clause 6.1.2.4) using the content type "multipart/related", comprising:

- one JSON body part with the "application/json" content type; and

- one or more binary body parts with 3gpp vendor specific content subtypes.

The 3gpp vendor specific content subtypes defined in Table 6.1.2.2.2-1 shall be supported.

Table 6.1.2.2.2-1: 3GPP vendor specific content subtypes

|  |  |
| --- | --- |
| content subtype | Description |
| vnd.3gpp.lpp | Binary encoded payload, encoding LTE Positioning Protocol (LPP) IEs, as specified in 3GPP TS 36.355 [21]. |
| NOTE: Using 3GPP vendor content subtypes allows to describe the nature of the opaque payload (e.g. LPP information) without having to rely on metadata in the JSON payload. | |

See clause 6.1.2.4 for the binary payloads supported in the binary body part of multipart messages.

#### 6.1.2.3 HTTP custom headers

##### 6.1.2.3.1 General

The following HTTP custom headers shall be supported:

- 3gpp-Sbi-Message-Priority: See 3GPP TS 29.500 [4], clause 5.2.3.2.2.

This API does not define any new HTTP custom headers.

#### 6.1.2.4 HTTP multipart messages

HTTP multipart messages shall be supported, to transfer opaque LPP Information, in the following service operations (and HTTP messages):

- DetermineLocation Request (POST);

HTTP multipart messages shall include one JSON body part and one or more binary body parts comprising:

- one LPP payload (see clause 6.1.6.4).

The JSON body part shall be the "root" body part of the multipart message. It shall be encoded as the first body part of the multipart message. The "Start" parameter does not need to be included.

The multipart message shall include a "type" parameter (see IETF RFC 2387 [9]) specifying the media type of the root body part, i.e. "application/json".

NOTE: The "root" body part (or "root" object) is the first body part the application processes when receiving a multipart/related message, see IETF RFC 2387 [9]. The default root is the first body within the multipart/related message. The "Start" parameter indicates the root body part, e.g. when this is not the first body part in the message.

For each binary body part in a HTTP multipart message, the binary body part shall include a Content-ID header (see IETF RFC 2045 [10]), and the JSON body part shall include an attribute, defined with the RefToBinaryData type, that contains the value of the Content-ID header field of the referenced binary body part.

### 6.1.3 Resources

#### 6.1.3.1 Overview

The structure of the Resource URIs of the Nlmf\_Location service is shown in figure 6.1.3.1-1.



Figure 6.1.3.1-1: Resource URI structure of the Nlmf\_Location API

### 6.1.4 Custom Operations without associated resources

#### 6.1.4.1 Overview

Table 6.1.4.1-1: Custom operations without associated resources

|  |  |  |  |
| --- | --- | --- | --- |
| Operation Name | Custom operation URI | Mapped HTTP method | Description  (Service Operation) |
| determine-location | /determine-location | POST | Determine Location |
| cancel-location | /cancel-location | POST | Cancel Location |
| location-context-transfer | /location-context-transfer | POST | Transfer Location Context |

#### 6.1.4.2 Operation: determine-location

##### 6.1.4.2.1 Description

This sublause will describe the custom operation and what it is used for, and the custom operation's URI.

##### 6.1.4.2.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1 and 6.1.4.2.2-2.

Table 6.1.4.2.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| InputData | M | 1 | Input parameters to the "Determine Location" operation |

Table 6.1.4.2.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| LocationData | M | 1 | 200 OK | This case represents the successful retrieval of the location of the UE or successful activation of periodic or triggered location in the UE.  Upon success, a response body is returned containing the different parameters of the location data if obtained, such as:  - Geographic Area  - Civic Location  - Positioning methods |
| n/a |  |  | 204 No Content | This case represents the successful delivery of location assistance data to the UE, during MO-LR requesting for location assistance data for the UE. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate the following application errors:  - POSITIONING\_DENIED  - UNSPECIFIED  - UNSUPPORTED\_BY\_UE  See table 6.1.7.3-1 for the description of these errors. |
| ProblemDetails | O | 0..1 | 500 Internal Server Error | The "cause" attribute may be used to indicate the following application error:  - POSITIONING\_FAILED  See table 6.1.7.3-1 for the description of these errors. |
| ProblemDetails | O | 0..1 | 504 Gateway Timeout | The "cause" attribute may be used to indicate the following application error:  - UNREACHABLE\_USER  See table 6.1.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.4.2.2-3: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

Table 6.1.4.2.2-4: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

#### 6.1.4.3 Operation: cancel-location

##### 6.1.4.3.1 Description

This clause describes the custom operation and what it is used for.

##### 6.1.4.3.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.4.3.2-1 and table 6.1.4.3.2-2.

Table 6.1.4.3.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| CancelLocData | M | 1 | The information used to cancel location. |

Table 6.1.4.3.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| n/a |  |  | 204 No Content | This case represents successful cancellation of location. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate the following application errors:  - UNSPECIFIED  - LOCATION\_SESSION\_UNKNOWN  See table 6.1.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.4.3.2-3: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

Table 6.1.4.3.2-4: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

#### 6.1.4.4 Operation: location-context-transfer

##### 6.1.4.4.1 Description

This clause will describe the custom operation and what it is used for.

##### 6.1.4.4.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.4.4.2-1 and table 6.1.4.4.2-2.

Table 6.1.4.4.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| LocContextData | M | 1 | Input parameters to the "Location Context Transfer" operation |

Table 6.1.4.4.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| n/a |  |  | 204 No Content | This case represents successful transfer of the location context. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate the following application errors:  - UNSPECIFIED  - LOCATION\_TRANSFER\_NOT SUPPORTED  - INSUFFICIENT\_RESOURCES  - EVENT\_REPORT\_UNRECOGNIZED  See table 6.1.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.4.4.2-3: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

Table 6.1.4.4.2-4: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

### 6.1.5 Notifications

This clause specifies the notifications provided by the Nlmf\_Location service.

Table 6.1.5.1-1: Notifications overview

|  |  |  |  |
| --- | --- | --- | --- |
| Notification | Callback URI | HTTP method or custom operation | Description  (service operation) |
| EventNotify | {hgmlcCallBackURI} | POST |  |

#### 6.1.5.1 EventNotify

##### 6.1.5.1.1 Description

The EventNotify operation is used to notify the occurrence of periodic or triggered location event for a target UE to a consumer NF (e.g. GMLC).

##### 6.1.5.1.2 Notification Definition

Callback URI: {hgmlcCallBackURI}

See clause 5.2.2.1.2 for the description of how the LMF obtains the Callback URI of the NF Service Consumer (e.g. GMLC).

##### 6.1.5.1.3 Notification Standard Methods

6.1.5.1.3.1 POST

This method sends a Location event notify to the NF Service Consumer.

This method shall support the request and response data structures and response codes specified in table 6.1.5.1.3.1-1 and table 6.1.5.1.3.1-2.

Table 6.1.5.1.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| EventNotifyData | M | 1 | Input parameters to the "Location Event Notify" operation |

Table 6.1.5.1.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| n/a |  |  | 204 No Content | This case represents successful notification of the event. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF service consumer to which the notification should be sent.  If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF service consumer to which the notification should be sent.  If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be used to indicate the following application errors:  - UNSPECIFIED  - LOCATION\_SESSION\_UNKNOWN  See table 6.1.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.1.5.1.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | A URI pointing to the endpoint of NF service consumer to which the notification should be sent |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the notification is redirected |

Table 6.1.5.1.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | A URI pointing to the endpoint of NF service consumer to which the notification should be sent |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the notification is redirected |

### 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 Nlmf\_Location service based interface protocol.

Table 6.1.6.1-1: Nlmf\_Location specific Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Clause defined | Description |
| InputData | 6.1.6.2.2 | Information within Determine Location Request |
| LocationData | 6.1.6.2.3 | Information within Determine Location Response |
| GeographicalCoordinates | 6.1.6.2.4 | Geographical coordinates |
| GeographicArea | 6.1.6.2.5 | Geographic area specified by different shape |
| Point | 6.1.6.2.6 | Ellipsoid Point |
| PointUncertaintyCircle | 6.1.6.2.7 | Ellipsoid point with uncertainty circle |
| PointUncertaintyEllipse | 6.1.6.2.8 | Ellipsoid point with uncertainty ellipse |
| Polygon | 6.1.6.2.9 | Polygon |
| PointAltitude | 6.1.6.2.10 | Ellipsoid point with altitude |
| PointAltitudeUncertainty | 6.1.6.2.11 | Ellipsoid point with altitude and uncertainty ellipsoid |
| EllipsoidArc | 6.1.6.2.12 | Ellipsoid Arc |
| LocationQoS | 6.1.6.2.13 | QoS of Location request |
| CivicAddress | 6.1.6.2.14 | Indicates a Civic address |
| PositioningMethodAndUsage | 6.1.6.2.15 | Indicates the usage of a positioning method |
| GnssPositioningMethodAndUsage | 6.1.6.2.16 | Indicates the usage of a Global Navigation Satellite System (GNSS) positioning method |
| VelocityEstimate | 6.1.6.2.17 | Velocity estimate |
| HorizontalVelocity | 6.1.6.2.18 | Horizontal velocity |
| HorizontalWithVerticalVelocity | 6.1.6.2.19 | Horizontal and vertical velocity |
| HorizontalVelocityWithUncertainty | 6.1.6.2.20 | Horizontal velocity with speed uncertainty |
| HorizontalWithVerticalVelocityAndUncertainty | 6.1.6.2.21 | Horizontal and vertical velocity with speed uncertainty |
| UncertaintyEllipse | 6.1.6.2.22 | Ellipse with uncertainty |
| UeLcsCapability | 6.1.6.2.23 | Indicates the LCS capability supported by the UE. |
| PeriodicEventInfo | 6.1.6.2.24 | Indicates the information of periodic event reporting |
| AreaEventInfo | 6.1.6.2.25 | Indicates the information of area based event reporting |
| ReportingArea | 6.1.6.2.26 | Indicates an area for event reporting |
| MotionEventInfo | 6.1.6.2.27 | Indicates the information of motion based event reporting |
| CancelLocData | 6.1.6.2.29 | Information within Cancel Location Request |
| LocContextData | 6.1.6.2.30 | Information within Transfer Location Context Request |
| EventReportMessage | 6.1.6.2.31 | Indicates an event report message |
| EventReportingStatus | 6.1.6.2.32 | Indicates the status of event reporting |
| UELocationInfo | 6.1.6.2.33 | Indicates location information of a UE |
| EventNotifyData | 6.1.6.2.34 | Information within Event Notify Request |
| UeConnectivityState | 6.1.6.2.35 | Indicates the connectivity state of a UE |
| Altitude | 6.1.6.3.2 | Indicates value of altitude |
| Angle | 6.1.6.3.2 | Indicates value of angle |
| Uncertainty | 6.1.6.3.2 | Indicates value of uncertainty |
| Orientation | 6.1.6.3.2 | Indicates value of orientation angle |
| Confidence | 6.1.6.3.2 | Indicates value of confidence |
| Accuracy | 6.1.6.3.2 | Indicates value of accuracy |
| InnerRadius | 6.1.6.3.2 | Indicates value of the inner radius |
| CorrelationID | 6.1.6.3.2 | LCS Correlation ID |
| AgeOfLocationEstimate | 6.1.6.3.2 | Indicates value of the age of the location estimate |
| HorizontalSpeed | 6.1.6.3.2 | Indicates value of horizontal speed |
| VerticalSpeed | 6.1.6.3.2 | Indicates value of vertical speed |
| SpeedUncertainty | 6.1.6.3.2 | Indicates value of speed uncertainty |
| BarometricPressure | 6.1.6.3.2 | Specifies the measured uncompensated atmospheric pressure |
| LcsServiceType | 6.1.6.3.2 | LCS service type |
| LdrReference | 6.1.6.3.2 | LDR Reference |
| ReportingAmount | 6.1.6.3.2 | Number of required periodic event reports |
| ReportingInterval | 6.1.6.3.2 | Event reporting periodic interval |
| MinimumInterval | 6.1.6.3.2 | Minimum interval between event reports |
| MaximumInterval | 6.1.6.3.2 | Maximum interval between event reports |
| SamplingInterval | 6.1.6.3.2 | Maximum time interval between consecutive evaluations by a UE of a trigger event |
| ReportingDuration | 6.1.6.3.2 | Maximum duration of event reporting |
| LinearDistance | 6.1.6.3.2 | Minimum straight line distance moved by a UE to trigger a motion event report |
| LMFIdentification | 6.1.6.3.2 | LMF identification |
| EventReportCounter | 6.1.6.3.2 | Number of event reports received from the target UE |
| EventReportDuration | 6.1.6.3.2 | Duration of event reporting |
| ExternalClientType | 6.1.6.3.3 | Indicates types of External Clients |
| SupportedGADShapes | 6.1.6.3.4 | Indicates supported GAD shapes |
| ResponseTime | 6.1.6.3.5 | Indicates acceptable delay of location request |
| PositioningMethod | 6.1.6.3.6 | Indicates supported positioning methods |
| PositioningMode | 6.1.6.3.7 | Indicates supported modes used for positioning method |
| GnssId | 6.1.6.3.8 | Global Navigation Satellite System (GNSS) ID |
| Usage | 6.1.6.3.9 | Indicates usage made of the location measurement |
| LcsPriority | 6.1.6.3.10 | Indicates priority of the LCS client |
| VelocityRequested | 6.1.6.3.11 | Indicates velocity requirement |
| AccuracyFulfilmentIndicator | 6.1.6.3.12 | Indicates fulfilment of requested accuracy |
| VerticalDirection | 6.1.6.3.13 | Indicates direction of vertical speed |
| LdrType | 6.1.6.3.14 | Indicates LDR types |
| ReportingAreaType | 6.1.6.3.15 | Indicates type of event reporting area |
| OccurrenceInfo | 6.1.6.3.16 | Specifies occurrence of event reporting |
| ReportingAccessType | 6.1.6.3.17 | Specifies access types of event reporting |
| EventClass | 6.1.6.3.18 | Specifies event classes |
| ReportedEventType | 6.1.6.3.19 | Specifies type of event reporting |
| TerminationCause | 6.1.6.3.20 | Specifies causes of event reporting termination |
| LcsQosClass | 6.1.6.3.21 | Specifies LCS QoS class |
| UeLocationServiceInd | 6.1.6.3.22 | Specifies location service types requested by UE |

Table 6.1.6.1-2 specifies data types re-used by the Nlmf\_Location 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 Nlmf service based interface.

Table 6.1.6.1-2: Nlmf\_Location re-used Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Comments |
| Supi | 3GPP TS 29.571 [8] | Subscription Permanent Identifier |
| Pei | 3GPP TS 29.571 [8] | Permanent Equipment Identifier |
| Gpsi | 3GPP TS 29.571 [8] | Generic Public Subscription Identifier |
| Ecgi | 3GPP TS 29.571 [8] | E-UTRA Cell Identity |
| Ncgi | 3GPP TS 29.571 [8] | NR Cell Identity |
| NfInstanceId | 3GPP TS 29.571 [8] | Network Function Instance ID |
| Uri | 3GPP TS 29.571 [8] | Uniform Resource Identifier |
| RefToBinaryData | 3GPP TS 29.571 [8] | Reference to binary data |
| AccessType | 3GPP TS 29.571 [8] | Access type |
| CmState | 3GPP TS 29.518 [23] | Connection Management State |
| Guami | 3GPP TS 29.571 [8] | GUAMI |
| SupportedFeatures | 3GPP TS 29.571 [8] | Supported Features |
| RedirectResponse | 3GPP TS 29.571 [8] | Redirect Response |

#### 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: InputData

Table 6.1.6.2.2-1: Definition of type InputData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| externalClientType | ExternalClientType | O | 0..1 | When present, this IE shall carry the external client type of the requester. |
| correlationID | CorrelationID | O | 0..1 | When present, this IE shall carry the correlation ID of the request. |
| amfId | NfInstanceId | O | 0..1 | Indicates the AMF Instance serving the UE. LMF shall use the AMF Instance to forward LCS related N1/N2 messages to the UE/RAN. |
| locationQoS | LocationQoS | O | 0..1 | When present, this IE shall carry the QoS of the location request. |
| supportedGADShapes | array(SupportedGADShapes) | O | 1..N | When present, this IE shall carry the GAD shapes supported by the requester. |
| supi | Supi | O | 0..1 | Indicates the SUPI of the target UE. |
| pei | Pei | O | 0..1 | Indicates the PEI of the target UE. |
| gpsi | Gpsi | O | 0..1 | Indicates the GPSI of the target UE. |
| ecgi | Ecgi | O | 0..1 | When present, this IE shall indicate the identifier of the E-UTRAN cell serving the UE or the serving cell identifier of the Primary Cell in the Master RAN Node that is an E-UTRAN node on Dual Connectivity scenarios.  (NOTE 2) |
| ecgiOnSecondNode | Ecgi | O | 0..1 | When present, the serving cell identifier of the Primary Cell in the Secondary RAN Node that is an E-UTRAN node when available on Dual Connectivity scenarios.  (NOTE 3) (NOTE 4) |
| ncgi | Ncgi | O | 0..1 | When present, this IE shall indicate the identifier of the NR cell serving the UE or the serving cell identifier of the Primary Cell in the Master RAN Node that is a NR node on Dual Connectivity scenarios.  (NOTE 2) |
| ncgiOnSecondNode | Ncgi | O | 0..1 | When present, the serving cell identifier of the Primary Cell in the Secondary RAN Node that is a NR node when available on Dual Connectivity scenarios.  (NOTE 3) (NOTE 4) |
| priority | LcsPriority | O | 0..1 | When present, this IE shall indicate the priority of the location request. |
| velocityRequested | VelocityRequested | O | 0..1 | When present, this IE shall indicate whether velocity is requested or not. |
| ueLcsCap | UeLcsCapability | O | 0..1 | When present, this IE shall indicate the LCS capability supported by the UE. |
| lcsServiceType | LcsServiceType | O | 0..1 | The LCS service type |
| ldrType | LdrType | O | 0..1 | The type of LDR |
| hgmlcCallBackURI | Uri | C | 0..1 | Callback URI of the H-GMLC  It shall be present, if attribute LdrType is present. |
| vgmlcAddress | Uri | C | 0..1 | V-GMLC address that corresponds to the V-GMLC that receives Location Request  It shall be present, if attribute LdrType is present and the target UE is in roaming case. |
| ldrReference | LdrReference | C | 0..1 | LDR Reference Number  It shall be present, if attribute LdrType is present. |
| periodicEventInfo | PeriodicEventInfo | C | 0..1 | Information for periodic event reporting |
| areaEventInfo | AreaEventInfo | C | 0..1 | Information for area event reporting |
| motionEventInfo | MotionEventInfo | C | 0..1 | Information for motion event reporting |
| reportingAccessTypes | array(ReportingAccessType) | O | 1..N | Allowed access types for event reporting |
| ueConnectivityStates | array(UeConnectivityState) | O | 1..N | When present, this IE shall indicate the UE connectivity state per access type |
| ueLocationServiceInd | UeLocationServiceInd | C | 0..1 | If UE sends an MO-LR Request message, this IE shall be present and indicate the request type for a 5GC-MO-LR. |
| lppMessage | RefToBinaryData | C | 0..1 | If UE includes the LPP message in MO-LR Request, this IE shall be present and Indicate the binary data of LPP message. |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported. |
| NOTE 1: At least one of the attributes defined in this table shall be present in the InputData structure.  NOTE 2: Attribute "ecgi" and "ncgi" shall not be present at the same time.  NOTE 3: Attribute "ecgiOnSecondNode" and "ncgiOnSecondNode" shall not be present at the same time.  NOTE 4: Attribute "ecgiOnSecondNode" or "ncgiOnSecondNode" shall not be present if neither attribute "ecgi" nor "ncgi" is present. | | | | |

##### 6.1.6.2.3 Type: LocationData

Table 6.1.6.2.3-1: Definition of type LocationData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| locationEstimate | GeographicArea | M | 1 | For a request for triggered location where location estimates are not required, the location estimate can be based on current serving cell. |
| accuracyFulfilmentIndicator | AccuracyFulfilmentIndicator | O | 0..1 | When present, this IE shall indicate fulfilment of required accuracy. |
| ageOfLocationEstimate | AgeOfLocationEstimate | O | 0..1 | When present, this IE shall indicate age of the location estimate. |
| velocityEstimate | VelocityEstimate | O | 0..1 | When present, this IE shall indicate velocity estimate. |
| civicAddress | CivicAddress | O | 0..1 | When present, this IE shall indicate a civic address. |
| positioningDataList | array(PositioningMethodAndUsage) | O | 1..N | When present, this IE shall include a list of data related to positioning methods. |
| gnssPositioningDataList | array(GnssPositioningMethodAndUsage) | O | 1..N | When present, this IE shall include a list of data related to GNSS positioning methods. |
| ecgi | Ecgi | O | 0..1 | When present, this IE shall indicate the ID of the E-UTRAN cell serving the UE. |
| ncgi | Ncgi | O | 0..1 | When present, this IE shall indicate the ID of the NR cell serving the UE. |
| altitude | Altitude | O | 0..1 | Altitude of the positioning estimate. When the shape used in "locationEstimate" supports conveying the altitude parameter, this IE shall be absent. |
| barometricPressure | BarometricPressure | O | 0..1 | If present, this IE contains the barometric pressure measurement as reported by the target UE. |
| servingLMFidentification | LMFIdentification | O | 0..1 | When present, this IE shall indicate the identity of the serving LMF |

##### 6.1.6.2.4 Type: GeographicalCoordinates

Table 6.1.6.2.4-1: Definition of type GeographicalCoordinates

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| lon | number | M | 1 | Longitude (Double-precision float value):  Format: double  Minimum: -180  Maximum: 180 |
| lat | number | M | 1 | Latitude (Double-precision float value):  Format: double  Minimum: -90  Maximum: 90 |

##### 6.1.6.2.5 Type: GeographicArea

Table 6.1.6.2.5-1: Definition of type GeographicArea as a list of mutually exclusive alternatives

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | Cardinality | Discriminator property name | Discriminator mapping | Description |
| Point | 1 | shape | POINT | Geographical area consisting of a single point, represented by its longitude and latitude. |
| PointUncertaintyCircle | 1 | shape | POINT\_UNCERTAINTY\_CIRCLE | Geographical area consisting of a point and an uncertainty value. |
| PointUncertaintyEllipse | 1 | shape | POINT\_UNCERTAINTY\_ELLIPSE | Geographical area consisting of a point, plus an uncertainty ellipse and a confidence value. |
| Polygon | 1 | shape | POLYGON | Geographical area consisting of a list of points (between 3 to 15 points). |
| PointAltitude | 1 | shape | POINT\_ALTITUDE | Geographical area consisting of a point and an altitude value. |
| PointAltitudeUncertainty | 1 | shape | POINT\_ALTITUDE\_UNCERTAINTY | Geographical area consisting of a point, an altitude value and an uncertainty value. |
| EllipsoidArc | 1 | shape | ELLIPSOID\_ARC | Geographical are consisting of an ellipsoid arc. |
| NOTE: The "anyOf" keyword (instead of "oneOf" keyword which is normally used for mutually exclusive alternatives) is used for GeographicArea type in yaml file to avoid validation failure of OpenAPI. According to current definition, a PointUncertaintyCircle object will always pass the validation with both PointUncertaintyCircle and Point, which fails the qualification of "oneOf" keyword. | | | | |

##### 6.1.6.2.6 Type: Point

Table 6.1.6.2.6-1: Definition of type Point

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POINT". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |

##### 6.1.6.2.7 Type: PointUncertaintyCircle

Table 6.1.6.2.7-1: Definition of type PointUncertaintyCircle

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POINT\_UNCERTAINTY\_CIRCLE". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |
| uncertainty | Uncertainty | M | 1 | Indicates the uncertainty value. |

##### 6.1.6.2.8 Type: PointUncertaintyEllipse

Table 6.1.6.2.8-1: Definition of type PointUncertaintyEllipse

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POINT\_UNCERTAINTY\_ELLIPSE". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |
| uncertaintyEllipse | UncertaintyEllipse | M | 1 | Indicates an uncertainty ellipse. |
| confidence | Confidence | M | 1 | Indicates the value of confidence. |

##### 6.1.6.2.9 Type: Polygon

Table 6.1.6.2.9-1: Definition of type Polygon

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POLYGON". |
| pointList | array(GeographicalCoordinates) | M | 3..15 | Array with up to15 items, where each item is a "point". |

##### 6.1.6.2.10 Type: PointAltitude

Table 6.1.6.2.10-1: Definition of type PointAltitude

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POINT\_ALTITUDE". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |
| altitude | Altitude | M | 1 | Indicates the value of altitude. |

##### 6.1.6.2.11 Type: PointAltitudeUncertainty

Table 6.1.6.2.11-1: Definition of type PointAltitudeUncertainty

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "POINT\_ALTITUDE\_UNCERTAINTY". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |
| altitude | Altitude | M | 1 | Indicates the value of altitude. |
| uncertaintyEllipse | UncertaintyEllipse | M | 1 | Indicates the uncertainty ellipse |
| uncertaintyAltitude | Uncertainty | M | 1 | Indicates the uncertainty of the altitude. |
| confidence | Confidence | M | 1 | Indicates the value of confidence. |

##### 6.1.6.2.12 Type: EllipsoidArc

Table 6.1.6.2.12-1: Definition of type EllipsoidArc

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| shape | SupportedGADShapes | M | 1 | It shall take the value "ELLIPSOID\_ARC". |
| point | GeographicalCoordinates | M | 1 | Indicates a geographic point represented by its longitude and latitude. |
| innerRadius | InnerRadius | M | 1 | Indicates the value of inner radius of the Ellipsoid Arc. |
| uncertaintyRadius | Uncertainty | M | 1 | Indicates the uncertainty radius of the Ellipsoid Arc. |
| offsetAngle | Angle | M | 1 | Indicates the offset angle of the Ellipsoid Arc. |
| includedAngle | Angle | M | 1 | Indicates the included angle of the Ellipsoid Arc. |
| confidence | Confidence | M | 1 | Indicates the value of confidence. |

##### 6.1.6.2.13 Type: LocationQoS

Table 6.1.6.2.13-1: Definition of type LocationQoS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hAccuracy | Accuracy | O | 0..1 | Horizontal accuracy |
| vAccuracy | Accuracy | O | 0..1 | Vertical accuracy |
| vertRequested | boolean | O | 0..1 | Vertical accuracy requested (yes/no) |
| responseTime | ResponseTime | O | 0..1 | No delay, Low delay or Delay tolerant |
| lcsQosClass | LcsQosClass | C | 0..1 | LCS QoS Class, see clause 4.1b of 3GPP TS 23.273 [19].  This IE shall be absent if neither hAccuracy nor vAccuracy is included. |

##### 6.1.6.2.14 Type: CivicAddress

Table 6.1.6.2.14-1: Definition of type CivicAddress

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| country | string | M | 1 | The two-letter ISO 3166 country code in capital ASCII letters, e.g., DE or US  IETF RFC  4776 [6] |
| A1 | string | O | 0..1 | National subdivisions (state, canton, region, province, prefecture)  IETF RFC  4776 [6] |
| A2 | string | O | 0..1 | County, parish, gun (JP), district (IN)  IETF RFC  4776 [6] |
| A3 | string | O | 0..1 | City, township, shi (JP)  IETF RFC  4776 [6] |
| A4 | string | O | 0..1 | City division, borough, city district, ward, chou (JP)  IETF RFC  4776 [6] |
| A5 | string | O | 0..1 | Neighbourhood, block  IETF RFC  4776 [6] |
| A6 | string | O | 0..1 | Group of streets below the neighbourhood level  IETF RFC  4776 [6] |
| PRD | string | O | 0..1 | Leading street direction  IETF RFC  4776 [6] |
| POD | string | O | 0..1 | Trailing street suffix  IETF RFC  4776 [6] |
| STS | string | O | 0..1 | Street suffix or type  IETF RFC  4776 [6] |
| HNO | string | O | 0..1 | House number  IETF RFC  4776 [6] |
| HNS | string | O | 0..1 | House number suffix  IETF RFC  4776 [6] |
| LMK | string | O | 0..1 | Landmark or vanity address  IETF RFC  4776 [6] |
| LOC | string | O | 0..1 | Additional location information  IETF RFC  4776 [6] |
| NAM | string | O | 0..1 | Name (residence and office occupant)  IETF RFC  4776 [6] |
| PC | string | O | 0..1 | Postal/zip code  IETF RFC  4776 [6] |
| BLD | string | O | 0..1 | Building (structure)  IETF RFC 5139 [7] |
| UNIT | string | O | 0..1 | Unit (apartment, suite)  IETF RFC 5139 [7] |
| FLR | string | O | 0..1 | Floor  IETF RFC  4776 [6] |
| ROOM | string | O | 0..1 | Room  IETF RFC 5139 [7] |
| PLC | string | O | 0..1 | Place-type  IETF RFC 5139 [7] |
| PCN | string | O | 0..1 | Postal community name  IETF RFC 5139 [7] |
| POBOX | string | O | 0..1 | Post office box (P.O. box)  IETF RFC 5139 [7] |
| ADDCODE | string | O | 0..1 | Additional code  IETF RFC 5139 [7] |
| SEAT | string | O | 0..1 | Seat (desk, cubicle, workstation)  IETF RFC 5139 [7] |
| RD | string | O | 0..1 | Primary road or street  IETF RFC 5139 [7] |
| RDSEC | string | O | 0..1 | Road clause  IETF RFC 5139 [7] |
| RDBR | string | O | 0..1 | Road branch  IETF RFC 5139 [7] |
| RDSUBBR | string | O | 0..1 | Road sub-branch  IETF RFC 5139 [7] |
| PRM | string | O | 0..1 | Road pre-modifier  IETF RFC 5139 [7] |
| POM | string | O | 0..1 | Road post-modifier  IETF RFC 5139 [7] |
| usageRules | string | O | 0..1 | When present, this IE shall carry the value of "usage-rules" Element of the PIDL-LO XML document, with UTF-8 encoding.  IETF RFC 4119 [25] |
| method | string | O | 0..1 | When present, this IE shall contain the method token, carried by the "method" Element of the PIDL-LO XML document.  IETF RFC 4119 [25] |
| providedBy | string | O | 0..1 | When present, this IE shall carry the value of "provided-by" Element of the PIDL-LO XML document, with UTF-8 encoding.  IETF RFC 4119 [25] |

EXAMPLE: The above structure follows the same label naming as in the XML schema shown in IETF RFC 5139 [7]. The same example shown in XML in that RFC, in clause 5, would be equivalent to the following JSON document:

{

"country": "AU",

"A1": "NSW",

"A3": "Wollongong",

"A4": "North Wollongong",

"RD": "Flinders",

"STS": "Street",

"RDBR": "Campbell Street",

"LMK": "Gilligan's Island",

"LOC": "Corner",

"NAM": "Video Rental Store",

"PC": "2500",

"ROOM": "Westerns and Classics",

"PLC": "store",

"POBOX": "Private Box 15"

}

##### 6.1.6.2.15 Type: PositioningMethodAndUsage

Table 6.1.6.2.15-1: Definition of type PositioningMethodAndUsage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| method | PositioningMethod | M | 1 | Indicates the related positioning method |
| mode | PositioningMode | M | 1 | Indicates the mode of the location measurement from the related positioning method. |
| usage | Usage | M | 1 | Indicates the usage of the location measurement from the related positioning method. |
| methodCode | integer | C | 0..1 | This IE shall be present when the *method* IE is with value "NETWORK\_SPECIFIC".  When present, this IE shall carry the code value of the network specific positioning method in decimal which encodes the binary value "10000 to 11111" (bits 8-4 of "*Positioning Method and Usage*" IE within "*Positioning Data*" parameter, as specified in clause 7.4.13 of 3GPP TS 29.171 [24].)  Minimum: 16  Maximum: 31 |

##### 6.1.6.2.16 Type: GnssPositioningMethodAndUsage

Table 6.1.6.2.16-1: Definition of type GnssPositioningMethodAndUsage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| mode | PositioningMode | M | 1 | Indicates the mode of location measurement from the related GNSS positioning method. |
| gnss | GnssId | M | 1 | Indicates the related GNSS positioning method |
| usage | Usage | M | 1 | Indicates the usage of the location measurement from related GNSS positioning method. |

##### 6.1.6.2.17 Type: VelocityEstimate

Table 6.1.6.2.17-1: Definition of type VelocityEstimate as a list of mutually exclusive alternatives

|  |  |  |
| --- | --- | --- |
| Data type | Cardinality | Description |
| HorizontalVelocity | 1 | Velocity estimate including horizontal speed and bearing. |
| HorizontalWithVerticalVelocity | 1 | Velocity estimate including horizontal speed and bearing, and also vertical speed and vertical direction. |
| HorizontalVelocityWithUncertainty | 1 | Velocity estimate including horizontal speed and bearing; it also includes an uncertainty value. |
| HorizontalWithVerticalVelocityAndUncertainty | 1 | Velocity estimate including horizontal speed and bearing, and also vertical speed and vertical direction; it also includes uncertainty value for horizontal and vertical speeds. |

##### 6.1.6.2.18 Type: HorizontalVelocity

Table 6.1.6.2.18-1: Definition of type HorizontalVelocity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hSpeed | HorizontalSpeed | M | 1 | Horizontal speed in kilometres per hour. |
| bearing | Angle | M | 1 | Bearing angle in degrees, measured clockwise from North. |

##### 6.1.6.2.19 Type: HorizontalWithVerticalVelocity

Table 6.1.6.2.19-1: Definition of type HorizontalWithVerticalVelocity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hSpeed | HorizontalSpeed | M | 1 | Horizontal speed in kilometres per hour. |
| bearing | Angle | M | 1 | Bearing angel in degrees, measured clockwise from North. |
| vSpeed | VerticalSpeed | M | 1 | Vertical Seed in kilometres per hour. |
| vDirection | VerticalDirection | M | 1 | Vertical Direction: upward or downward. |

##### 6.1.6.2.20 Type: HorizontalVelocityWithUncertainty

Table 6.1.6.2.20-1: Definition of type HorizontalVelocityWithUncertainty

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hSpeed | HorizontalSpeed | M | 1 | Speed in kilometres per hour. |
| bearing | Angle | M | 1 | Bearing angel in degrees, measured clockwise from North. |
| uncertainty | SpeedUncertainty | M | 1 | Uncertainty of horizontal speed in kilometres per hour. |

##### 6.1.6.2.21 Type: HorizontalWithVerticalVelocityAndUncertainty

Table 6.1.6.2.21-1: Definition of type HorizontalWithVerticalVelocityAndUncertainty

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hspeed | HorizontalSpeed | M | 1 | Speed in kilometres per hour. |
| bearing | Angle | M | 1 | Bearing angel in degrees, measured clockwise from North. |
| vSpeed | VerticalSpeed | M | 1 | Vertical Seed in kilometres per hour. |
| vDirection | VerticalDirection | M | 1 | Vertical Direction: upwards or downwards. |
| hUncertainty | SpeedUncertainty | M | 1 | Uncertainty of horizontal speed in kilometres per hour. |
| vUncertainty | SpeedUncertainty | M | 1 | Uncertainty of vertical speed in kilometres per hour. |

##### 6.1.6.2.22 Type: UncertaintyEllipse

Table 6.1.6.2.22-1: Definition of type UncertaintyEllipse

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| semiMajor | Uncertainty | M | 1 | Indicates the semi-major axis of the uncertainty ellipse. |
| semiMinor | Uncertainty | M | 1 | Indicates the semi-minor axis of the uncertainty ellipse. |
| orientationMajor | Orientation | M | 1 | Indicates the orientation angle of the major axis. |

##### 6.1.6.2.23 Type: UeLcsCapability

Table 6.1.6.2.23-1: Definition of type UeLcsCapability

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| lppSupport | boolean | O | 0..1 | Indicates whether the UE supports LPP or not.  - true (default): LPP supported by the UE  - false: LPP not supported by the UE |
| ciotOptimisation | boolean | O | 0..1 | Indicates whether the UE supports and is allowed to use Control Plane CIoT 5GS Optimisation to send an event report for periodic or triggered location or not. Refer to 3GPP TS 23.273 [19] clause 6.7 for more detail.  - true: Control Plane CIoT 5GS Optimisation is supported by the UE and allowed  - false (default): Control Plane CIoT 5GS Optimisation not supported by the UE or not allowed |

##### 6.1.6.2.24 Type: PeriodicEventInfo

Table 6.1.6.2.24-1: Definition of type PeriodicEventInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| reportingAmount | ReportingAmount | M | 1 | Number of event reports |
| reportingInterval | ReportingInterval | M | 1 | Interval of event reports |
| NOTE: reportingAmount x reportingInterval shall not exceed 8639999 (99 days, 23 hours, 59 minutes and 59 seconds) for compatibility with OMA MLP and RLP. | | | | |

##### 6.1.6.2.25 Type: AreaEventInfo

Table 6.1.6.2.25-1: Definition of type AreaEventInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| areaDefinition | array(ReportingArea) | M | 1..250 | One or more reporting areas |
| occurrenceInfo | OccurrenceInfo | O | 0..1 | One time only report indication |
| minimumInterval | MinimumInterval | C | 0..1 | Minimum interval between event reports.  This IE shall not be included if occurrenceInfo is present and set to one time event. |
| maximumInterval | MaximumInterval | C | 0..1 | Maximum interval between event reports.  This IE shall not be included if occurrenceInfo is present and set to one time event. |
| samplingInterval | SamplingInterval | O | 0..1 | Maximum time interval between consecutive evaluations by a UE of a trigger event. |
| reportingDuration | ReportingDuration | O | 0..1 | Maximum duration of event reporting. |
| reportingLocationReq | boolean | C | 0..1 | This IE shall be present and set to true if a location estimate is required for each event report. |

##### 6.1.6.2.26 Type: ReportingArea

Table 6.1.6.2.26-1: Definition of type ReportingArea

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| areaType | ReportingAreaType | M | 1 | Type of reporting area. |
| tai | Tai | C | 1 | TAI for EPS or 5GS.  This IE shall be present if the reporting area type is EPS TAI or 5GS TAI. |
| ecgi | Ecgi | C | 1 | ECGI.  This IE shall be present if the reporting area type is ECGI. |
| ncgi | Ncgi | C | 1 | NCGI.  This IE shall be present if the reporting area type is NCGI. |
| NOTE: One of tai, ecgi or ncgi shall be included. | | | | |

##### 6.1.6.2.27 Type: MotionEventInfo

Table 6.1.6.2.27-1: Definition of type MotionEventInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| linearDistance | LinearDistance | M | 1 | Minimum linear (straight line) distance for motion event reports. |
| occurrenceInfo | OccurrenceInfo | O | 0..1 | One time only report indication |
| minimumInterval | MinimumInterval | C | 0..1 | Minimum interval between event reports.  This IE shall not be included if occurrenceInfo is present and set to one time event. |
| maximumInterval | MaximumInterval | C | 0..1 | Maximum interval between event reports.  This IE shall not be included if occurrenceInfo is present and set to one time event. |
| samplingInterval | SamplingInterval | O | 0..1 | Maximum time interval between consecutive evaluations by a UE of a trigger event. |
| reportingDuration | ReportingDuration | O | 0..1 | Maximum duration of event reporting. |
| reportingLocationReq | boolean | C | 0..1 | This IE shall be present and set to true if a location estimate is required for each event report. |

##### 6.1.6.2.28 Void

##### 6.1.6.2.29 Type: CancelLocData

Table 6.1.6.2.29-1: Definition of type CancelLocData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| hgmlcCallBackURI | Uri | M | 1 | Callback URI of the H-GMLC |
| ldrReference | LdrReference | M | 1 | LDR Reference |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported. |

##### 6.1.6.2.30 Type: LocContextData

Table 6.1.6.2.30-1: Definition of type LocContextData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| amfId | NfInstanceId | M | 1 | Indicates the AMF Instance serving the UE. LMF shall use the AMF Instance to forward LCS related N1/N2 messages to the UE/RAN. |
| locationQoS | LocationQoS | C | 0..1 | This IE shall contain the location QoS if available. |
| supportedGADShapes | array(SupportedGADShapes) | C | 0..N | This IE shall contain the supported GAD shapes if available. |
| supi | Supi | C | 0..1 | This IE shall contain the SUPI if available. |
| gpsi | Gpsi | C | 0..1 | This IE shall contain the GPSI if available. |
| ldrType | LdrType | M | 1 | The type of LDR |
| hgmlcCallBackURI | Uri | M | 1 | Callback URI of the H-GMLC |
| ldrReference | LdrReference | M | 1 | LDR Reference |
| periodicEventInfo | PeriodicEventInfo | C | 0..1 | Information for periodic event reporting |
| areaEventInfo | AreaEventInfo | C | 0..1 | Information for area event reporting |
| motionEventInfo | MotionEventInfo | C | 0..1 | Information for motion event reporting |
| eventReportMessage | EventReportMessage | M | 1 | Contains an embedded event report |
| eventReportingStatus | EventReportingStatus | O | 0..1 | Status of event reporting |
| ueLocationInfo | UELocationInfo | O | 0..1 | Location information for the target UE |
| cIoT5GSOptimisation | boolean | C | 0..1 | This IE shall be present if it was received from AMF. When present, it shall be set as follows:  - true: Control Plane CIoT 5GS Optimisation was used and no signalling or data is currently pending for the UE at the AMF.  - false (default): Control Plane CIoT 5GS Optimisation was not used or signalling or data is currently pending for the UE at the AMF. |
| ecgi | Ecgi | C | 0..1 | When present, this IE shall indicate the identifier of the E-UTRAN cell serving the UE.  This IE shall be present if it was received from AMF. |
| ncgi | Ncgi | C | 0..1 | When present, this IE shall indicate the identifier of the NR cell serving the UE.  This IE shall be present if it was received from AMF |
| guami | Guami | C | 0..1 | This IE shall be present if it was received from AMF.  When present, it shall contain the GUAMI serving the UE. |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported. |
| NOTE: At least one of periodicEventInfo, areaEventInfo or motionEventInfo shall be present in the LocContextData structure. | | | | |

##### 6.1.6.2.31 Type: EventReportMessage

Table 6.1.6.2.31-1: Definition of type EventReportMessage

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| eventClass | EventClass | M | 1 | This IE shall contain the event class for the message content specified in eventContent. |
| eventContent | RefToBinaryData | M | 1 | This IE shall reference the event report binary data corresponding to the eventClass. |

##### 6.1.6.2.32 Type: EventReportingStatus

Table 6.1.6.2.32-1: Definition of type EventReportingStatus

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| eventReportCounter | EventReportCounter | O | 0..1 | This IE shall contain a count of event reports. |
| eventReportDuration | EventReportDuration | O | 0..1 | This IE shall contain the duration of event reporting. |

##### 6.1.6.2.33 Type: UELocationInfo

Table 6.1.6.2.33-1: Definition of type UELocationInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| locationEstimate | GeographicArea | O | 0..1 | Previous location estimate for the target UE. |
| ageOfLocationEstimate | AgeOfLocationEstimate | O | 0..1 | Age of previous location estimate. |
| velocityEstimate | VelocityEstimate | O | 0..1 | Previous velocity estimate for the target UE. |
| ageOfVelocityEstimate | AgeOfLocationEstimate | O | 0..1 | Age of previous velocity estimate. |

##### 6.1.6.2.34 Type: EventNotifyData

Table 6.1.6.2.34-1: Definition of type EventNotifyData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| reportedEventType | ReportedEventType | M | 1 | This IE shall contain the type of event being reported. |
| supi | Supi | C | 0..1 | This IE shall contain the SUPI if available. |
| gpsi | Gpsi | C | 0..1 | This IE shall contain the GPSI if available. |
| hgmlcCallBackURI | Uri | C | 0..1 | Callback URI of the H-GMLC (NOTE 1) |
| ldrReference | LdrReference | M | 1 | LDR Reference |
| locationEstimate | GeographicArea | O | 0..1 | If present, this IE shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate. |
| ageOfLocationEstimate | AgeOfLocationEstimate | O | 0..1 | If present, this IE shall contain an indication of how long ago the location estimate was obtained. |
| civicAddress | CivicAddress | O | 0..1 | If present, this IE shall contain a civic address. |
| positioningDataList | array(PositioningMethodAndUsage) | O | 1..N | If present, this IE shall indicate the usage of each non-GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. |
| gnssPositioningDataList | array(GnssPositioningMethodAndUsage) | O | 1..N | If present, this IE shall indicate the usage of each GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully. |
| servingLMFIdentification | LMFIdentification | C | 0..1 | This IE shall be included to identify an LMF which acts as a serving LMF if a serving LMF is used. |
| terminationCause | TerminationCause | C | 0..1 | This IE shall be included if event reporting has been terminated |
| velocityEstimate | VelocityEstimate | O | 0..1 | If present, this IE shall contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty. |
| altitude | Altitude | O | 0..1 | If present, this IE indicates the altitude of the positioning estimate.  When the shape used in "locationEstimate" supports conveying the altitude parameter, this IE shall be absent. |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported. |
| NOTE 1: The hgmlcCallBackURI shall be included when the consumer NF is not the H-GMLC. | | | | |

##### 6.1.6.2.35 Type: UeConnectivityState

Table 6.1.6.2.35-1: Definition of type UeConnectivityState

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| accessType | AccessType | M | 1 | Shall indicate the access type of the UE. |
| connectivitystate | CmState | O | 0..1 | When present, it shall indicate the UE connectivity state in the indicated access type. |

#### 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 |
| Altitude | number | Double-precision float value of the altitude, expressed in meters.  Minimum: -32767. Maximum: 32767.  Format: double. |
| Angle | integer | Integer value of the angle, expressed in degrees.  Minimum: 0. Maximum: 360. |
| Uncertainty | number | Float value of uncertainty, expressed in meters.  Minimum: 0  Format: float. |
| Orientation | integer | Integer value of the orientation angle, expressed in degrees.  Minimum: 0. Maximum: 180. |
| Confidence | integer | Integer value of the confidence, expressed in percentage value.  Minimum: 0. Maximum: 100. |
| Accuracy | number | Float value of accuracy, expressed in meters.  Minimum: 0  Format: float. |
| InnerRadius | integer | Integer value of the inner radius, expressed in meters.  Minimum: 0. Maximum: 327675.  Format: int32. |
| CorrelationID | string | LCS Correlation ID. The correlation ID shall be of a minimum length of 1 character and maximum length of 255 characters. |
| AgeOfLocationEstimate | integer | Integer value of the age of the location estimate, expressed in minutes.  Minimum: 0. Maximum: 32767. |
| HorizontalSpeed | number | Float value of horizontal speed, expressed in kilometres per hour.  Minimum: 0. Maximum: 2047.  Format: float. |
| VerticalSpeed | number | Float value of horizontal speed, expressed in kilometres per hour.  Minimum: 0. Maximum: 255.  Format: float. |
| SpeedUncertainty | number | Float value of speed uncertainty, expressed in kilometres per hour.  Minimum: 0. Maximum: 255.  Format: float. |
| BarometricPressure | integer | This IE specifies the measured uncompensated atmospheric pressure in units of Pascal (Pa).  Minimum: 30000. Maximum: 115000. |
| LcsServiceType | integer | The LCS service type as defined in 3GPP TS 22.071 [17] and clause 17.7.8 of 3GPP TS 29.002 [18].  Minimum: 0. Maximum: 127. |
| LdrReference | string | LDR Reference encoded as a string of hexadecimal characters. The LdrReference shall be of a minimum length of 2 characters and maximum length of 510 characters. |
| ReportingAmount | integer | Number of required periodic event reports.  Minimum: 1. Maximum: 8639999. |
| ReportingInterval | integer | Event reporting periodic interval in seconds.  Minimum: 1. Maximum: 8639999.  ReportingInterval x ReportingAmount shall not exceed 8639999. |
| MinimumInterval | integer | Minimum interval between event reports in seconds.  Minimum: 1. Maximum: 32767. |
| MaximumInterval | integer | Maximum interval between event reports in seconds.  Minimum: 1. Maximum: 86400. |
| SamplingInterval | integer | Maximum time interval between consecutive evaluations by a UE of a trigger event, in seconds.  Minimum: 1. Maximum: 3600 |
| ReportingDuration | integer | Maximum duration of event reporting, in seconds.  Minimum: 1. Maximum: 8640000. |
| LinearDistance | integer | The minimum straight line distance moved by a UE to trigger a motion event report, in meters.  Minimum: 1. Maximum: 10000. |
| LMFIdentification | string | The serving LMF identification as defined in 3GPP TS 23.273 [19], encoded as a string of hexadecimal characters. |
| EventReportCounter | integer | Number of event reports received from the target UE.  Minimum: 1. Maximum: 8640000.  Note: the current event report is included in the count. |
| EventReportDuration | integer | Duration of event reporting, in seconds.  Minimum: 0. Maximum: 8640000.  Note: the duration starts when event reporting is activated in the UE and extends to the current time. |

##### 6.1.6.3.3 Enumeration: ExternalClientType

The enumeration ExternalClientType represents the different types of clients of the location service.

Table 6.1.6.3.3-1: Enumeration ExternalClientType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "EMERGENCY\_SERVICES" | External client for emergency services |
| "VALUE\_ADDED\_SERVICES" | External client for value added services |
| "PLMN\_OPERATOR\_SERVICES" | External client for PLMN operator services |
| "LAWFUL\_INTERCEPT\_SERVICES" | External client for Lawful Intercept services |
| "PLMN\_OPERATOR\_BROADCAST\_SERVICES" | External client for PLMN Operator Broadcast services |
| "PLMN\_OPERATOR\_OM" | External client for PLMN Operator O&M |
| "PLMN\_OPERATOR\_ANONYMOUS\_STATISTICS" | External client for PLMN Operator anonymous statistics |
| "PLMN\_OPERATOR\_TARGET\_MS\_SERVICE\_SUPPORT" | External client for PLMN Operator target MS service support |

##### 6.1.6.3.4 Enumeration: SupportedGADShapes

The enumeration SupportedGADShapes represents the different types, or shapes, of geographic areas supported by the system.

Table 6.1.6.3.4-1: Enumeration SupportedGADShapes

|  |  |  |
| --- | --- | --- |
| Enumeration value | | Description |
| "POINT" | Ellipsoid Point | |
| "POINT\_UNCERTAINTY\_CIRCLE" | Ellipsoid point with uncertainty circle | |
| "POINT\_UNCERTAINTY\_ELLIPSE" | Ellipsoid point with uncertainty ellipse | |
| "POLYGON" | Polygon | |
| "POINT\_ALTITUDE" | Ellipsoid point with altitude | |
| "POINT\_ALTITUDE\_UNCERTAINTY" | Ellipsoid point with altitude and uncertainty ellipsoid | |
| "ELLIPSOID\_ARC" | Ellipsoid Arc | |

##### 6.1.6.3.5 Enumeration: ResponseTime

The enumeration ResponseTime represents the acceptable delay in the determination of the location of the UE.

Table 6.1.6.3.5-1: Enumeration ResponseTime

|  |  |
| --- | --- |
| Enumeration value | Description |
| "LOW\_DELAY" | Location request is expected with low delay level. |
| "DELAY\_TOLERANT" | Location request is delay tolerant. |
| "NO\_DELAY " | Location request is expected with no delay  (NOTE) |
| NOTE: The value is only used in the interface between GMLC and AF/LCS client via NEF, not further delivered to other NFs in the network. After receiving the enumeration value, the GMLC shall immediately return any location estimate or civic location that it currently has. The GMLC shall return either the Initial or Last Known Location of the Target UE. If no location estimate or Dispatchable Location is available, the GLMC shall return the failure indication and may optionally initiate procedures to obtain a location estimate or Dispatchable Location (e.g. to be available for a later request). | |

##### 6.1.6.3.6 Enumeration: PositioningMethod

The enumeration PositioningMethod represents the method used to determine the location of the UE.

Table 6.1.6.3.6-1: Enumeration PositioningMethod

|  |  |
| --- | --- |
| Enumeration value | Description |
| "CELLID" | Cell ID positioning method |
| "ECID" | Enhanced cell ID methods based on LTE signals |
| "OTDOA" | Observed time difference of arrival positioning based on LTE signals |
| "BAROMETRIC\_PRESSURE" | Positioning method based on barometric Pressure Sensor |
| "WLAN" | WLAN positioning |
| "BLUETOOTH" | Bluetooth positioning |
| "MBS" | Terrestrial Beacon System (TBS) positioning based on MBS signals |
| "MOTION\_SENSOR" | Positioning method based on motion Sensor |
| "DL\_TDOA" | Downlink Time Difference of Arrival (DL-TDOA) based on NR signals |
| "DL\_AOD" | Downlink Angle-of-Departure (DL-AoD) based on NR signals |
| "MULTI-RTT" | Multi-Round Trip Time Positioning (Multi-RTT based on NR signals). |
| "NR\_ECID" | NR enhanced cell ID methods (NR E-CID) based on NR signals. |
| "UL\_TDOA" | Uplink Time Difference of Arrival (UL-TDOA) based on NR signals |
| "UL\_AOA" | Uplink Angle of Arrival (UL-AoA), including the Azimuth of Arrival (A-AoA) and the Zenith of Arrival (Z-AoA) based on NR signals. |
| "NETWORK\_SPECIFIC" | Network specific position methods. |

##### 6.1.6.3.7 Enumeration: PositioningMode

The enumeration PositioningMode represents the mode used to determine the location of the UE when a certain positioning method is used.

Table 6.1.6.3.7-1: Enumeration PositioningMode

|  |  |
| --- | --- |
| Enumeration value | Description |
| "UE\_BASED" | UE-based mode |
| "UE\_ASSISTED" | UE-assisted mode |
| "CONVENTIONAL" | Conventional mode |

##### 6.1.6.3.8 Enumeration: GnssId

The enumeration GnssId represents the different GNSS systems.

Table 6.1.6.3.8-1: Enumeration GnssId

|  |  |
| --- | --- |
| Enumeration value | Description |
| "GPS" | GPS |
| "GALILEO" | Galileo |
| "SBAS" | Space Based Augmentation Systems |
| "MODERNIZED\_GPS" | Modernized GPS |
| "QZSS" | Quasi Zenith Satellite System |
| "GLONASS" | Global Navigation Satellite System |
| "BDS" | BeiDou Navigation Satellite System |
| "NAVIC" | Navigation with Indian Constellation |

##### 6.1.6.3.9 Enumeration: Usage

The enumeration Usage represents the type of usage made of the location measurement from the UE.

Table 6.1.6.3.9-1: Enumeration Usage

|  |  |
| --- | --- |
| Enumeration value | Description |
| "UNSUCCESS" | Not successful |
| "SUCCESS\_RESULTS\_NOT\_USED" | Successful result not used |
| "SUCCESS\_RESULTS\_USED\_TO\_VERIFY\_LOCATION" | Successful result used to verify the location estimate |
| "SUCCESS\_RESULTS\_USED\_TO\_GENERATE\_LOCATION" | Successful result used to generate the location estimate |
| "SUCCESS\_METHOD\_NOT\_DETERMINED" | Successful method not determined |

##### 6.1.6.3.10 Enumeration: LcsPriority

The enumeration LcsPriority represents the priority of the LCS client.

Table 6.1.6.3.10-1: Enumeration LcsPriority

|  |  |
| --- | --- |
| Enumeration value | Description |
| "HIGHEST\_PRIORITY" | LCS client with highest priority |
| "NORMAL\_PRIORITY" | LCS client with normal priority |

##### 6.1.6.3.11 Enumeration: VelocityRequested

The enumeration VelocityRequested represents the indication of velocity requirement.

Table 6.1.6.3.11-1: Enumeration VelocityRequested

|  |  |
| --- | --- |
| Enumeration value | Description |
| "VELOCITY\_IS\_NOT\_REQUESTED" | velocity estimate is required |
| "VELOCITY\_IS\_REQUESTED" | velocity estimate is not required |

##### 6.1.6.3.12 Enumeration: AccuracyFulfilmentIndicator

The enumeration AccuracyFulfilmentIndicator represents whether the requested accuracy was fulfilled or not.

Table 6.1.6.3.12-1: Enumeration AccuracyFulfilmentIndicator

|  |  |
| --- | --- |
| Enumeration value | Description |
| "REQUESTED\_ACCURACY\_FULFILLED" | requested accuracy is fulfilled |
| "REQUESTED\_ACCURACY\_NOT\_FULFILLED" | requested accuracy is not fulfilled |

##### 6.1.6.3.13 Enumeration: VerticalDirection

The enumeration VerticalDirection represents the direction (upward/downward) of the vertical speed.

Table 6.1.6.3.13-1: Enumeration VerticalDirection

|  |  |
| --- | --- |
| Enumeration value | Description |
| "UPWARD" | Vertical speed is upward |
| "DOWNWARD" | Vertical speed is downward |

##### 6.1.6.3.14 Enumeration: LdrType

Table 6.1.6.3.14-1: Enumeration LdrType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "UE\_AVAILABLE" | UE available event |
| "PERIODIC" | Periodic event |
| "ENTERING\_INTO\_AREA" | Entering area event |
| "LEAVING\_FROM\_AREA" | Leaving area event |
| "BEING\_INSIDE\_AREA" | Being inside area event |
| "MOTION" | Motion event |

##### 6.1.6.3.15 Enumeration: ReportingAreaType

The enumeration ReportingAreaType indicates the type of a reporting area.

Table 6.1.6.3.15-1: Enumeration ReportingAreaType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "EPS\_TRACKING\_AREA\_IDENTITY" | EPS TAI |
| "E-UTRAN\_CELL\_GLOBAL\_IDENTIFICATION" | ECGI |
| "5GS\_TRACKING\_AREA\_IDENTITY" | 5GS TAI |
| "NR\_CELL\_GLOBAL\_IDENTITY" | NCGI |

##### 6.1.6.3.16 Enumeration: OccurrenceInfo

The enumeration OccurrenceInfo indicates whether event reporting is one time.

Table 6.1.6.3.16-1: Enumeration AreaType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "ONE\_TIME\_EVENT" | Event to be reported one-time only |
| "MULTIPLE\_TIME\_EVENT" | Event to be reported multiple times |

##### 6.1.6.3.17 Enumeration: ReportingAccessType

The enumeration ReportingAccessType indicates an allowed access type for event reporting.

Table 6.1.6.3.17-1: Enumeration ReportingAccessType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "NR" | NG Radio access |
| "EUTRA\_CONNECTED\_TO\_5GC" | E-URTAN access connected to 5GC |
| "NON\_3GPP\_CONNECTED\_TO\_5GC" | Non-3GPP access connected to 5GC |

##### 6.1.6.3.18 Enumeration: EventClass

Table 6.1.6.3.18-1: Enumeration EventClass

|  |  |
| --- | --- |
| Enumeration value | Description |
| "SUPPLEMENTARY\_SERVICES" | A supplementary services message containing an argument for an lcs-EventReport operation as defined in 3GPP TS 24.080 [20]. |

##### 6.1.6.3.19 Enumeration: ReportedEventType

Table 6.1.6.3.19-1: Enumeration ReportedEventType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "PERIODIC\_EVENT" | Periodic reporting event |
| "ENTERING\_AREA\_EVENT" | Entering area reporting event |
| "LEAVING\_AREA\_EVENT" | Leaving area reporting event |
| "BEING\_INSIDE\_AREA\_EVENT" | Being inside area reporting event |
| "MOTION\_EVENT" | Motion reporting event |
| "MAXIMUM\_INTERVAL\_EXPIRATION\_EVENT" | Expiration of maximum reporting interval event |
| "LOCATION\_CANCELLATION\_EVENT" | Cancellation of location reporting event |

##### 6.1.6.3.20 Enumeration: TerminationCause

Table 6.1.6.3.20-1: Enumeration TerminationCause

|  |  |
| --- | --- |
| Enumeration value | Description |
| "TERMINATION\_BY\_UE" | Event reporting terminated by UE |
| "TERMINATION\_BY\_NETWORK" | Event reporting terminated by Network |
| "NORMAL\_TERMINATION" | Normal Termination |

##### 6.1.6.3.21 Enumeration: LcsQosClass

Table 6.1.6.3.21-1: Enumeration LcsQosClass

|  |  |
| --- | --- |
| Enumeration value | Description |
| "BEST\_EFFORT" | Best Effort Class |
| "ASSURED" | Assured Class |

##### 6.1.6.3.22 Enumeration: UeLocationServiceInd

Table 6.1.6.3.22-1: Enumeration UeLocationServiceInd

|  |  |
| --- | --- |
| Enumeration value | Description |
| "LOCATION\_ESTIMATE" | Request location estimate |
| "LOCATION\_ASSISTANCE\_DATA" | Request location assistance data |

#### 6.1.6.4 Binary data

##### 6.1.6.4.1 Introduction

This clause defines the binary data that shall be supported in a binary body part in an HTTP multipart message (see clauses 6.1.2.2.2 and 6.1.2.4).

##### 6.1.6.4.2 LPP Message

LPP Message shall encode a LPP message as specified in 3GPP TS 36.355 [21], using the vnd.3gpp.lpp content-type.

### 6.1.7 Error Handling

#### 6.1.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

#### 6.1.7.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

#### 6.1.7.3 Application Errors

The application errors defined for the Nlmf\_Location service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| POSITIONING\_DENIED | 403 Forbidden | The positioning procedure was denied. |
| UNSPECIFIED | 403 Forbidden | The request is rejected due to unspecified reasons. |
| UNSUPPORTED\_BY\_UE | 403 Forbidden | A request for periodic or triggered location is not supported by the UE. |
| LOCATION\_SESSION\_UNKNOWN | 403 Forbidden | The location context was not found. |
| LOCATION\_TRANSFER\_NOT\_SUPPORTED | 403 Forbidden | Transfer of a location context is not supported |
| INSUFFICIENT\_RESOURCES | 403 Forbidden | Insufficient resources for location context transfer |
| EVENT\_REPORT\_UNRECOGNIZED | 403 Forbidden | The event report is unrecognized or cannot be parsed. |
| POSITIONING\_FAILED | 500 Internal Server Error | The positioning procedure failed. |
| UNREACHABLE\_USER | 504 Gateway Timeout | The user could not be reached in order to perform positioning procedure. |

### 6.1.8 Security

As indicated in 3GPP TS 33.501 [9], the access to the Nlmf\_Location API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [10]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [11]) plays the role of the authorization server.

If Oauth2 authorization is used, an NF Service Consumer, prior to consuming services offered by the Nlmf\_Location API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [11], 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 Nlmf\_Location service.

The Nlmf\_Location API defines scopes for OAuth2 authorization as specified in 3GPP TS 33.501 [9]; it defines a single scope consisting on the name of the service (i.e., "nlmf-loc"), and it does not define any additional scopes at resource or operation level.

### 6.1.9 Feature Negotiation

The optional features in table 6.1.9-1 are defined for the Nlmf\_Location API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.9-1: Supported Features

|  |  |  |  |
| --- | --- | --- | --- |
| Feature number | Feature Name | M/O | Description |
| 1 | ES3XX | M | Extended Support of HTTP 307/308 redirection  An NF Service Consumer (e.g. AMF) that supports this feature shall support handling of HTTP 307/308 redirection for any service operation of the Location service. An NF Service Consumer that does not support this feature does only support HTTP redirection as specified for 3GPP Release 15. |

### 6.1.10 HTTP redirection

An HTTP request may be redirected to a different LMF service instance, within the same LMF or a different LMF of an LMF set, e.g. when an LMF service instance is part of an LMF (service) set or when using indirect communications (see 3GPP TS 29.500 [4]). See also the ES3XX feature in clause 6.1.9.

An SCP that reselects a different LMF producer instance will return the NF Instance ID of the new LMF 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 LMF within an LMF set redirects a service request to a different LMF of the set using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new LMF 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].

## 6.2 Nlmf\_Broadcast Service API

### 6.2.1 API URI

The Nlmf\_Broadcast service shall use the Nlmf\_Broadcast API.

The API URI of the Nlmf\_Broadcast API shall be:

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

The request URI 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 "nlmf-broadcast".

- The <apiVersion> shall be "v1".

- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

### 6.2.2 Usage of HTTP

#### 6.2.2.1 General

HTTP/2, as defined in IETF RFC 7540 [12], 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].

HTTP messages and bodies for the Nlmf\_Location service shall comply with the OpenAPI [14] specification contained in Annex A.

#### 6.2.2.2 HTTP Standard Headers

##### 6.2.2.2.1 General

##### 6.2.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [13], shall be used as content type of the HTTP bodies specified in the present specification as indicated in clause 5.4 of 3GPP TS 29.500 [4].

- The Problem Details JSON Object (IETF RFC 7807 [15]). The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

#### 6.2.2.3 HTTP custom headers

##### 6.2.2.3.1 General

The following HTTP custom headers shall be supported:

- 3gpp-Sbi-Message-Priority: See 3GPP TS 29.500 [4], clause 5.2.3.2.2.

This API does not define any new HTTP custom headers.

### 6.2.3 Resources

#### 6.2.3.1 Overview

The structure of the Resource URIs of the Nlmf\_Broadcast service is shown in figure 6.2.3.1-1.



Figure 6.2.3.1-1: Resource URI structure of the Nlmf\_Broadcast API

### 6.2.4 Custom Operations without associated resources

#### 6.2.4.1 Overview

Table 6.2.4.1-1: Custom operations without associated resources

|  |  |  |  |
| --- | --- | --- | --- |
| Operation Name | Custom operation URI | Mapped HTTP method | Description |
| cipher-key-data | /cipher-key-data | POST | Ciphering Key Data |

#### 6.2.4.4 Operation: cipher-key-data

##### 6.2.4.4.1 Description

This clause describes the custom operation and what it is used for.

##### 6.2.4.4.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.2.4.4.2-1 and table 6.2.4.4.2-2.

Table 6.2.4.4.2-1: Data structures supported by the POST Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| CipherRequestData | M | 1 | Input parameters to the "Ciphering Key Data" operation |

Table 6.2.4.4.2-2: Data structures supported by the POST Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| CipherResponseData | M | 1 | 200 OK | This case represents a successful request for ciphering key data.  Upon success, a response body is returned indicating whether the LMF has ciphering key data. The ciphering key data is returned separately in a CipheringKeyData notification. |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be set to one of the following application errors:  - UNSPECIFIED  - BROADCAST\_CIPHERING\_KEYS\_NOT\_SUPPORTED  See table 6.2.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.4.4.2-3: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

Table 6.2.4.4.2-4: 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 service instance within the same LMF or LMF (service) set.  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 NF (service) instance ID towards which the request is redirected |

### 6.2.5 Notifications

#### 6.2.5.1 CipheringKeyData

##### 6.2.5.1.1 Description

The CipheringKeyData operation is used to notify the occurrence of new ciphering key information to a consumer NF (e.g. AMF).

##### 6.2.5.1.2 Notification Definition

Callback URI: {amfCallBackURI}

See clause 5.3.2.2.2 for the description of how the LMF obtains the Callback URI of the NF Service Consumer (i.e. AMF).

##### 6.2.5.1.3 Notification Standard Methods

6.2.5.1.3.1 POST

This method sends a ciphering key data notify to the NF Service Consumer.

This method shall support the request and response data structures and response codes specified in table 6.2.5.1.3.1-1 and table 6.2.5.1.3.1-2.

Table 6.2.5.1.3.1-1: Data structures supported by the POST Request Body

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| CipheringKeyInfo | M | 1 | Input parameters to the "Ciphering Key Data" operation |

Table 6.2.5.1.3.1-2: Data structures supported by the POST Response Body

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Response  codes | Description |
| CipheringKeyResponse | M | 1 | 200 OK | This case represents successful or partially successful storage of ciphering key information by the service consumer NF.  A response body is returned containing the following parameters:  - List of Ciphering Set IDs successfully stored  - List of Ciphering Set IDs not successfully stored |
| RedirectResponse | O | 0..1 | 307 Temporary Redirect | Temporary redirection. The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF service consumer to which the notification should be sent.  If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent. |
| RedirectResponse | O | 0..1 | 308 Permanent Redirect | Permanent redirection. The NF service consumer shall generate a Location header field containing a URI pointing to the endpoint of another NF service consumer to which the notification should be sent.  If an SCP redirects the message to another SCP then the location header field shall contain the same URI or a different URI pointing to the endpoint of the NF service consumer to which the notification should be sent. |
| ProblemDetails | O | 0..1 | 403 Forbidden | The "cause" attribute may be set to one of the following application errors:  - UNSPECIFIED  - UNABLE\_TO\_STORE\_CIPHERING\_KEY\_DATA  See table 6.2.7.3-1 for the description of this error. |
| NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). | | | | |

Table 6.2.5.1.3.1-3: Headers supported by the 307 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | A URI pointing to the endpoint of NF service consumer to which the notification should be sent |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the notification is redirected |

Table 6.2.5.1.3.1-4: Headers supported by the 308 Response Code on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description |
| Location | string | M | 1 | A URI pointing to the endpoint of NF service consumer to which the notification should be sent |
| 3gpp-Sbi-Target-Nf-Id | string | O | 0..1 | Identifier of the target NF (service) instance ID towards which the notification is redirected |

### 6.2.6 Data Model

#### 6.2.6.1 General

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

Table 6.2.6.1-1 specifies the data types defined for the Nlmf\_Broadcast service based interface protocol.

Table 6.2.6.1-1: Nlmf\_Broadcast specific Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Clause defined | Description |
| CipheringKeyInfo | 6.2.6.2.2 | Information within Ciphering Key Data Notification request |
| CipheringKeyResponse | 6.2.6.2.3 | Information within Ciphering Key Data Notification Response |
| CipheringDataSet | 6.2.6.2.4 | Represents a Ciphering Data Set |
| CipheringSetReport | 6.2.6.2.5 | Represents a report of Ciphering Data Set storage |
| CipherRequestData | 6.2.6.2.6 | Information within Ciphering Key Data request |
| CipherResponseData | 6.2.6.2.7 | Information within Ciphering Key Data Response |
| CipheringSetID | 6.2.6.3.2 | Ciphering Data Set ID |
| CipheringKey | 6.2.6.3.2 | Ciphering Key |
| C0 | 6.2.6.3.2 | First component of the initial ciphering counter |
| ValidityDuration | 6.2.6.3.2 | Validity Duration of the Ciphering Data Set |
| StorageOutcome | 6.2.6.3.3 | Indicates the result of Ciphering Data Set storage |
| DataAvailability | 6.2.6.3.4 | Indicates availability of ciphering key data at an LMF |

Table 6.2.6.1-2 specifies data types re-used by the Nlmf\_Broadcast 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 Nlmf service based interface.

Table 6.2.6.1-2: Nlmf\_Broadcast re-used Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Comments |
| Bytes | 3GPP TS 29.571 [8] | Binary data encoded as a base64 character string |
| DateTime | 3GPP TS 29.571 [8] | Date and Time |
| Uri | 3GPP TS 29.571 [8] | Uniform Resource Identifier |
| SupportedFeatures | 3GPP TS 29.571 [8] | Supported Features |
| RedirectResponse | 3GPP TS 29.571 [8] | Redirect Response |

#### 6.2.6.2 Structured data types

##### 6.2.6.2.1 Introduction

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

##### 6.2.6.2.2 Type: CipheringKeyInfo

Table 6.2.6.2.2-1: Definition of type CipheringKeyInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| cipheringData | array(CipheringDataSet) | M | 1..N | This IE contains one or more ciphering data sets, where each ciphering data set contains information for one ciphering key. |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.2.9 is supported. |

##### 6.2.6.2.3 Type: CipheringKeyResponse

Table 6.2.6.2.3-1: Definition of type CipheringKeyResponse

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| cipheringDataReport | Array(CipheringSetReport) | O | 1..N | This IE indicates the ciphering data sets which were successfully stored or not stored.  The absence of this IE indicates that all ciphering data sets were successfully stored. |

##### 6.2.6.2.4 Type: CipheringDataSet

Table 6.2.6.2.4-1: Definition of type CipheringDataSet

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| cipheringSetID | CipheringSetID | M | 1 | Identification of a ciphering data set |
| cipheringKey | CipheringKey | M | 1 | A ciphering key value |
| c0 | C0 | M | 1 | First component of the initial ciphering counter as defined in clause 7.4.2 of 3GPP TS 36.355 [21] |
| ltePosSibTypes | Bytes | O | 0..1 | This IE contains a bitmap indicating the LTE positioning SIB types for which the ciphering data set is applicable:  - a bit set to 0 indicates that the ciphering data set is not applicable to the corresponding LTE positioning SIB type  - a bit set to 1 indicates that the ciphering data set is applicable to the corresponding LTE positioning SIB type  The mapping of the bits to the LTE positioning SIB types is as follows:  -- bit 8 in the first octet maps to positioning SIB Type 1-1  -- bit 7 in the first octet maps to positioning SIB Type 1-2  -- bit 6 in the first octet maps to positioning SIB Type 1-3  -- bit 5 in the first octet maps to positioning SIB Type 1-4  -- bit 4 in the first octet maps to positioning SIB Type 1-5  -- bit 3 in the first octet maps to positioning SIB Type 1-6  -- bit 2 in the first octet maps to positioning SIB Type 1-7  -- bit 1 in the first octet maps to positioning SIB Type 1-8  -- bit 8 in the second octet maps to positioning SIB Type 2-1  -- bit 7 in the second octet maps to positioning SIB Type 2-2  -- bit 6 in the second octet maps to positioning SIB Type 2-3  -- bit 5 in the second octet maps to positioning SIB Type 2-4  -- bit 4 in the second octet maps to positioning SIB Type 2-5  -- bit 3 in the second octet maps to positioning SIB Type 2-6  -- bit 2 in the second octet maps to positioning SIB Type 2-7  -- bit 1 in the second octet maps to positioning SIB Type 2-8  -- bit 8 in the third octet maps to positioning SIB Type 2-9  -- bit 7 in the third octet maps to positioning SIB Type 2-10  -- bit 6 in the third octet maps to positioning SIB Type 2-11  -- bit 5 in the third octet maps to positioning SIB Type 2-12  -- bit 4 in the third octet maps to positioning SIB Type 2-13  -- bit 3 in the third octet maps to positioning SIB Type 2-14  -- bit 2 in the third octet maps to positioning SIB Type 2-15  -- bit 1 in the third octet maps to positioning SIB Type 2-16  -- bit 8 in the fourth octet maps to positioning SIB Type 2-17  -- bit 7 in the fourth octet maps to positioning SIB Type 2-18  -- bit 6 in the fourth octet maps to positioning SIB Type 2-19  -- bit 5 in the fourth octet maps to positioning SIB Type 2-20  -- bit 4 in the fourth octet maps to positioning SIB Type 2-21  -- bit 3 in the fourth octet maps to positioning SIB Type 2-22  -- bit 2 in the fourth octet maps to positioning SIB Type 2-23  -- bit 1 in the fourth octet maps to positioning SIB Type 2-24  -- bit 8 in the fifth octet maps to positioning SIB Type 2-25  -- bit 7 in the fifth octet maps to positioning SIB Type 3-1  -- bit 6 in the fifth octet maps to positioning SIB Type 4-1  -- bit 5 in the fifth octet maps to positioning SIB Type 5-1  Any unassigned bits are spare and shall be coded as zero. Non-included bits shall be treated as being coded as zero.  (NOTE 1) |
| nrPosSibTypes | Bytes | O | 0..1 | This IE contains a bitmap indicating the NR positioning SIB types for which the ciphering data set is applicable:  - a bit set to 0 indicates that the ciphering data set is not applicable to the corresponding NR positioning SIB type  - a bit set to 1 indicates that the ciphering data set is applicable to the corresponding NR positioning SIB type  The mapping of the bits to the NR positioning SIB types is as follows:  -- bit 8 in the first octet maps to positioning SIB Type 1-1  -- bit 7 in the first octet maps to positioning SIB Type 1-2  -- bit 6 in the first octet maps to positioning SIB Type 1-3  -- bit 5 in the first octet maps to positioning SIB Type 1-4  -- bit 4 in the first octet maps to positioning SIB Type 1-5  -- bit 3 in the first octet maps to positioning SIB Type 1-6  -- bit 2 in the first octet maps to positioning SIB Type 1-7  -- bit 1 in the first octet maps to positioning SIB Type 1-8  -- bit 8 in the second octet maps to positioning SIB Type 2-1  -- bit 7 in the second octet maps to positioning SIB Type 2-2  -- bit 6 in the second octet maps to positioning SIB Type 2-3  -- bit 5 in the second octet maps to positioning SIB Type 2-4  -- bit 4 in the second octet maps to positioning SIB Type 2-5  -- bit 3 in the second octet maps to positioning SIB Type 2-6  -- bit 2 in the second octet maps to positioning SIB Type 2-7  -- bit 1 in the second octet maps to positioning SIB Type 2-8  -- bit 8 in the third octet maps to positioning SIB Type 2-9  -- bit 7 in the third octet maps to positioning SIB Type 2-10  -- bit 6 in the third octet maps to positioning SIB Type 2-11  -- bit 5 in the third octet maps to positioning SIB Type 2-12  -- bit 4 in the third octet maps to positioning SIB Type 2-13  -- bit 3 in the third octet maps to positioning SIB Type 2-14  -- bit 2 in the third octet maps to positioning SIB Type 2-15  -- bit 1 in the third octet maps to positioning SIB Type 2-16  -- bit 8 in the fourth octet maps to positioning SIB Type 2-17  -- bit 7 in the fourth octet maps to positioning SIB Type 2-18  -- bit 6 in the fourth octet maps to positioning SIB Type 2-19  -- bit 5 in the fourth octet maps to positioning SIB Type 2-20  -- bit 4 in the fourth octet maps to positioning SIB Type 2-21  -- bit 3 in the fourth octet maps to positioning SIB Type 2-22  -- bit 2 in the fourth octet maps to positioning SIB Type 2-23  -- bit 1 in the fourth octet maps to positioning SIB Type 3-1  -- bit 8 in the fifth octet maps to positioning SIB Type 4-1  -- bit 7 in the fifth octet maps to positioning SIB Type 5-1  -- bit 6 in the fifth octet maps to positioning SIB Type 6-1  -- bit 5 in the fifth octet maps to positioning SIB Type 6-2  -- bit 4 in the fifth octet maps to positioning SIB Type 6-3  Any unassigned bits are spare and shall be coded as zero. Non-included bits shall be treated as being coded as zero.  (NOTE 1) |
| validityStartTime | DateTime | M | 1 | This IE contains the UTC time when the ciphering data set becomes valid. |
| validityDuration | ValidityDuration | M | 1 | The validity duration of the ciphering data set. |
| taiList | Bytes | O | 0..1 | This IE contains the TAIs of the tracking areas for which the ciphering data set is applicable. It is encoded as octets 2 to n of the 5GS tracking area identity list IE specified in clause 9.11.3.9 of 3GPP TS 24.501 [22].  If this IE is omitted, the ciphering data set is valid in the entire PLMN. |
| NOTE 1: At least one of ltesibTypes IE and nrsibTypes IE shall be included. | | | | |

##### 6.2.6.2.5 Type: CipheringSetReport

Table 6.2.6.2.5-1: Definition of CipheringSetReport

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| cipheringSetID | CipheringSetID | M | 1 | Identification of a ciphering data set |
| storageOutcome | StorageOutcome | M | 1 | Indication of whether the ciphering data set was successfully stored or was not stored. |

##### 6.2.6.2.6 Type: CipherRequestData

Table 6.2.6.2.6-1: Definition of CipherRequestData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| amfCallBackURI | Uri | M | 1 | Callback URI of the NF Service Consumer |
| supportedFeatures | SupportedFeatures | C | 0..1 | This IE shall be present if at least one optional feature defined in clause 6.2.9 is supported. |

##### 6.2.6.2.7 Type: CipherResponseData

Table 6.2.6.2.7-1: Definition of CipherResponseData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| dataAvailability | DataAvailability | M | 1 | An indication of whether the LMF currently has ciphering key data applicable to the NF Service Consumer |

#### 6.2.6.3 Simple data types and enumerations

##### 6.2.6.3.1 Introduction

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

##### 6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

|  |  |  |
| --- | --- | --- |
| Type Name | Type Definition | Description |
| CipheringSetID | integer | The ciphering set ID  Minimum = 0. Maximum = 65535 |
| CipheringKey | Bytes | A 128 bit ciphering key encoded as a base64 character string |
| C0 | Bytes | A 128 bit value for C0 encoded as a base64 character string |
| ValidityDuration | integer | The validity duration in minutes.  Minimum = 1. Maximum = 65535 |

##### 6.2.6.3.3 Enumeration: StorageOutcome

The enumeration StorageOutcome represents the outcome of cipher set data storage at the service consumer NF.

Table 6.2.6.3.3-1: Enumeration StorageOutcome

|  |  |
| --- | --- |
| Enumeration value | Description |
| "STORAGE\_SUCCESSFUL" | Indicates storage of Ciphering Data Set is successful |
| "STORAGE\_FAILED" | Indicates storage of Ciphering Data Set is not successful |

##### 6.2.6.3.4 Enumeration: DataAvailability

The enumeration DataAvailability represents the availability of ciphering key data at an LMF.

Table 6.2.6.3.4-1: Enumeration DataAvailability

|  |  |
| --- | --- |
| Enumeration value | Description |
| "CIPHERING\_KEY\_DATA\_AVAILABLE" | Indicates Ciphering Data Set is available in LMF |
| CIPHERING\_KEY\_DATA\_NOT\_AVAILABLE" | Indicates Ciphering Data Set is not available in LMF |

### 6.2.7 Error Handling

#### 6.2.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

#### 6.2.7.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

#### 6.2.7.3 Application Errors

The application errors defined for the Nlmf\_Broadcast service are listed in table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

|  |  |  |
| --- | --- | --- |
| Application Error | HTTP status code | Description |
| UNSPECIFIED | 403 Forbidden | The request is rejected due to unspecified reasons. |
| UNABLE\_TO\_STORE\_CIPHERING\_KEY\_DATA | 403 Forbidden | The service consumer NF was unable to store ciphering key data. |
| BROADCAST\_CIPHERING\_KEYS\_NOT\_SUPPORTED | 403 Forbidden | Ciphering keys for broadcast are not supported. |

### 6.2.8 Security

The Nlmf\_Broadcast API does not define service operations for which additional security is needed in this version of the specification.

### 6.2.9 Feature Negotiation

The optional features in table 6.2.9-1 are defined for the Nlmf\_Broadcast API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.2.9-1: Supported Features

|  |  |  |  |
| --- | --- | --- | --- |
| Feature number | Feature Name | M/O | Description |
| 1 | ES3XX | M | Extended Support of HTTP 307/308 redirection  An NF Service Consumer (e.g. AMF) that supports this feature shall support handling of HTTP 307/308 redirection for any service operation of the Broadcast service. An NF Service Consumer that does not support this feature does only support HTTP redirection as specified for 3GPP Release 15. |

### 6.2.10 HTTP redirection

An HTTP request may be redirected to a different LMF service instance, within the same LMF or a different LMF of an LMF set, e.g. when an LMF service instance is part of an LMF (service) set or when using indirect communications (see 3GPP TS 29.500 [4]). See also the ES3XX feature in clause 6.2.9.

An SCP that reselects a different LMF producer instance will return the NF Instance ID of the new LMF 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 LMF within an LMF set redirects a service request to a different LMF of the set using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new LMF 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 Nlmf Service APIs. It consists of an OpenAPI 3.0.0 specification, 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: 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 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

## A.2 Nlmf\_Location API

openapi: 3.0.0

info:

version: '1.1.5'

title: 'LMF Location'

description: |

LMF Location Service.

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externalDocs:

description: 3GPP TS 29.572 V16.9.0; 5G System; Location Management Services; Stage 3

url: 'http://www.3gpp.org/ftp/Specs/archive/29\_series/29.572/'

servers:

- url: '{apiRoot}/nlmf-loc/v1'

variables:

apiRoot:

default: https://example.com

description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:

- {}

- oAuth2ClientCredentials:

- nlmf-loc

paths:

/determine-location:

post:

summary: Determine Location of an UE

operationId: DetermineLocation

tags:

- Determine Location

requestBody:

content:

application/json:

schema:

$ref: '#/components/schemas/InputData'

multipart/related: # message with binary body part(s)

schema:

type: object

properties: # Request parts

jsonData:

$ref: '#/components/schemas/InputData'

binaryDataLppMessage:

type: string

format: binary

encoding:

jsonData:

contentType: application/json

binaryDataLppMessage:

contentType: application/vnd.3gpp.lpp

headers:

Content-Id:

schema:

type: string

required: true

responses:

'200':

description: Expected response to a valid request

content:

application/json:

schema:

$ref: '#/components/schemas/LocationData'

'204':

description: Expected response for MO-LR requesting location assistance data.

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

EventNotify:

'{$request.body#/hgmlcCallBackURI}':

post:

requestBody:

description: UE Event Notification

content:

application/json:

schema:

$ref: '#/components/schemas/EventNotifyData'

responses:

'204':

description: Expected response to a valid notification

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/cancel-location:

post:

summary: request cancellation of periodic or triggered location

operationId: CancelLocation

tags:

- Cancel Location

requestBody:

content:

application/json:

schema:

$ref: '#/components/schemas/CancelLocData'

required: true

responses:

'204':

description: Expected response to a successful cancellation

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

/location-context-transfer:

post:

summary: transfer context information for periodic or triggered location

operationId: LocationContextTransfer

tags:

- Location Context Transfer

requestBody:

content:

application/json:

schema:

$ref: '#/components/schemas/LocContextData'

required: true

responses:

'204':

description: Expected response to successful location context transfer

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

components:

securitySchemes:

oAuth2ClientCredentials:

type: oauth2

flows:

clientCredentials:

tokenUrl: '{nrfApiRoot}/oauth2/token'

scopes:

nlmf-loc: Access to the Nlmf\_Location API

schemas:

#

# COMPLEX TYPES

#

InputData:

type: object

not:

required: [ ecgi, ncgi ]

properties:

externalClientType:

$ref: '#/components/schemas/ExternalClientType'

correlationID:

$ref: '#/components/schemas/CorrelationID'

amfId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId'

locationQoS:

$ref: '#/components/schemas/LocationQoS'

supportedGADShapes:

type: array

items:

$ref: '#/components/schemas/SupportedGADShapes'

minItems: 1

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

pei:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Pei'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

ecgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ecgi'

ecgiOnSecondNode:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ecgi'

ncgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ncgi'

ncgiOnSecondNode:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ncgi'

priority:

$ref: '#/components/schemas/LcsPriority'

velocityRequested:

$ref: '#/components/schemas/VelocityRequested'

ueLcsCap:

$ref: '#/components/schemas/UeLcsCapability'

lcsServiceType:

$ref: '#/components/schemas/LcsServiceType'

ldrType:

$ref: '#/components/schemas/LdrType'

hgmlcCallBackURI:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

vgmlcAddress:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

ldrReference:

$ref: '#/components/schemas/LdrReference'

periodicEventInfo:

$ref: '#/components/schemas/PeriodicEventInfo'

areaEventInfo:

$ref: '#/components/schemas/AreaEventInfo'

motionEventInfo:

$ref: '#/components/schemas/MotionEventInfo'

reportingAccessTypes:

type: array

items:

$ref: '#/components/schemas/ReportingAccessType'

minItems: 1

ueConnectivityStates:

$ref: '#/components/schemas/UeConnectivityState'

ueLocationServiceInd:

$ref: '#/components/schemas/UeLocationServiceInd'

lppMessage:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/RefToBinaryData'

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

LocationData:

type: object

required:

- locationEstimate

properties:

locationEstimate:

$ref: '#/components/schemas/GeographicArea'

accuracyFulfilmentIndicator:

$ref: '#/components/schemas/AccuracyFulfilmentIndicator'

ageOfLocationEstimate:

$ref: '#/components/schemas/AgeOfLocationEstimate'

velocityEstimate:

$ref: '#/components/schemas/VelocityEstimate'

civicAddress:

$ref: '#/components/schemas/CivicAddress'

positioningDataList:

type: array

items:

$ref: '#/components/schemas/PositioningMethodAndUsage'

minItems: 1

gnssPositioningDataList:

type: array

items:

$ref: '#/components/schemas/GnssPositioningMethodAndUsage'

minItems: 1

ecgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ecgi'

ncgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ncgi'

altitude:

$ref: '#/components/schemas/Altitude'

barometricPressure:

$ref: '#/components/schemas/BarometricPressure'

servingLMFIdentification:

$ref: '#/components/schemas/LMFIdentification'

GeographicArea:

anyOf:

- $ref: '#/components/schemas/Point'

- $ref: '#/components/schemas/PointUncertaintyCircle'

- $ref: '#/components/schemas/PointUncertaintyEllipse'

- $ref: '#/components/schemas/Polygon'

- $ref: '#/components/schemas/PointAltitude'

- $ref: '#/components/schemas/PointAltitudeUncertainty'

- $ref: '#/components/schemas/EllipsoidArc'

GADShape:

type: object

required:

- shape

properties:

shape:

$ref: '#/components/schemas/SupportedGADShapes'

discriminator:

propertyName: shape

mapping:

POINT: '#/components/schemas/Point'

POINT\_UNCERTAINTY\_CIRCLE: '#/components/schemas/PointUncertaintyCircle'

POINT\_UNCERTAINTY\_ELLIPSE: '#/components/schemas/PointUncertaintyEllipse'

POLYGON: '#/components/schemas/Polygon'

POINT\_ALTITUDE: '#/components/schemas/PointAltitude'

POINT\_ALTITUDE\_UNCERTAINTY: '#/components/schemas/PointAltitudeUncertainty'

ELLIPSOID\_ARC: '#/components/schemas/EllipsoidArc'

Point:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

PointUncertaintyCircle:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

- uncertainty

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

uncertainty:

$ref: '#/components/schemas/Uncertainty'

PointUncertaintyEllipse:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

- uncertaintyEllipse

- confidence

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

uncertaintyEllipse:

$ref: '#/components/schemas/UncertaintyEllipse'

confidence:

$ref: '#/components/schemas/Confidence'

Polygon:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- pointList

properties:

pointList:

$ref: '#/components/schemas/PointList'

PointAltitude:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

- altitude

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

altitude:

$ref: '#/components/schemas/Altitude'

PointAltitudeUncertainty:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

- altitude

- uncertaintyEllipse

- uncertaintyAltitude

- confidence

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

altitude:

$ref: '#/components/schemas/Altitude'

uncertaintyEllipse:

$ref: '#/components/schemas/UncertaintyEllipse'

uncertaintyAltitude:

$ref: '#/components/schemas/Uncertainty'

confidence:

$ref: '#/components/schemas/Confidence'

EllipsoidArc:

allOf:

- $ref: '#/components/schemas/GADShape'

- type: object

required:

- point

- innerRadius

- uncertaintyRadius

- offsetAngle

- includedAngle

- confidence

properties:

point:

$ref: '#/components/schemas/GeographicalCoordinates'

innerRadius:

$ref: '#/components/schemas/InnerRadius'

uncertaintyRadius:

$ref: '#/components/schemas/Uncertainty'

offsetAngle:

$ref: '#/components/schemas/Angle'

includedAngle:

$ref: '#/components/schemas/Angle'

confidence:

$ref: '#/components/schemas/Confidence'

GeographicalCoordinates:

type: object

required:

- lon

- lat

properties:

lon:

type: number

format: double

minimum: -180

maximum: 180

lat:

type: number

format: double

minimum: -90

maximum: 90

UncertaintyEllipse:

type: object

required:

- semiMajor

- semiMinor

- orientationMajor

properties:

semiMajor:

$ref: '#/components/schemas/Uncertainty'

semiMinor:

$ref: '#/components/schemas/Uncertainty'

orientationMajor:

$ref: '#/components/schemas/Orientation'

PointList:

type: array

items:

$ref: '#/components/schemas/GeographicalCoordinates'

minItems: 3

maxItems: 15

LocationQoS:

type: object

properties:

hAccuracy:

$ref: '#/components/schemas/Accuracy'

vAccuracy:

$ref: '#/components/schemas/Accuracy'

verticalRequested:

type: boolean

responseTime:

$ref: '#/components/schemas/ResponseTime'

lcsQosClass:

$ref: '#/components/schemas/LcsQosClass'

PositioningMethodAndUsage:

type: object

required:

- method

- mode

- usage

properties:

method:

$ref: '#/components/schemas/PositioningMethod'

mode:

$ref: '#/components/schemas/PositioningMode'

usage:

$ref: '#/components/schemas/Usage'

methodCode:

type: integer

minimum: 16

maximum: 31

GnssPositioningMethodAndUsage:

type: object

required:

- mode

- gnss

- usage

properties:

mode:

$ref: '#/components/schemas/PositioningMode'

gnss:

$ref: '#/components/schemas/GnssId'

usage:

$ref: '#/components/schemas/Usage'

CivicAddress:

type: object

properties:

country:

type: string

A1:

type: string

A2:

type: string

A3:

type: string

A4:

type: string

A5:

type: string

A6:

type: string

PRD:

type: string

POD:

type: string

STS:

type: string

HNO:

type: string

HNS:

type: string

LMK:

type: string

LOC:

type: string

NAM:

type: string

PC:

type: string

BLD:

type: string

UNIT:

type: string

FLR:

type: string

ROOM:

type: string

PLC:

type: string

PCN:

type: string

POBOX:

type: string

ADDCODE:

type: string

SEAT:

type: string

RD:

type: string

RDSEC:

type: string

RDBR:

type: string

RDSUBBR:

type: string

PRM:

type: string

POM:

type: string

usageRules:

type: string

method:

type: string

providedBy:

type: string

VelocityEstimate:

oneOf:

- $ref: '#/components/schemas/HorizontalVelocity'

- $ref: '#/components/schemas/HorizontalWithVerticalVelocity'

- $ref: '#/components/schemas/HorizontalVelocityWithUncertainty'

- $ref: '#/components/schemas/HorizontalWithVerticalVelocityAndUncertainty'

HorizontalVelocity:

type: object

required:

- hSpeed

- bearing

properties:

hSpeed:

$ref: '#/components/schemas/HorizontalSpeed'

bearing:

$ref: '#/components/schemas/Angle'

HorizontalWithVerticalVelocity:

type: object

required:

- hSpeed

- bearing

- vSpeed

- vDirection

properties:

hSpeed:

$ref: '#/components/schemas/HorizontalSpeed'

bearing:

$ref: '#/components/schemas/Angle'

vSpeed:

$ref: '#/components/schemas/VerticalSpeed'

vDirection:

$ref: '#/components/schemas/VerticalDirection'

HorizontalVelocityWithUncertainty:

type: object

required:

- hSpeed

- bearing

- hUncertainty

properties:

hSpeed:

$ref: '#/components/schemas/HorizontalSpeed'

bearing:

$ref: '#/components/schemas/Angle'

hUncertainty:

$ref: '#/components/schemas/SpeedUncertainty'

HorizontalWithVerticalVelocityAndUncertainty:

type: object

required:

- hSpeed

- bearing

- vSpeed

- vDirection

- hUncertainty

- vUncertainty

properties:

hSpeed:

$ref: '#/components/schemas/HorizontalSpeed'

bearing:

$ref: '#/components/schemas/Angle'

vSpeed:

$ref: '#/components/schemas/VerticalSpeed'

vDirection:

$ref: '#/components/schemas/VerticalDirection'

hUncertainty:

$ref: '#/components/schemas/SpeedUncertainty'

vUncertainty:

$ref: '#/components/schemas/SpeedUncertainty'

UeLcsCapability:

type: object

properties:

lppSupport:

type: boolean

default: true

ciotOptimisation:

type: boolean

default: false

PeriodicEventInfo:

type: object

required:

- reportingAmount

- reportingInterval

properties:

reportingAmount:

$ref: '#/components/schemas/ReportingAmount'

reportingInterval:

$ref: '#/components/schemas/ReportingInterval'

AreaEventInfo:

type: object

required:

- areaDefinition

properties:

areaDefinition:

type: array

items:

$ref: '#/components/schemas/ReportingArea'

minItems: 1

maxItems: 250

occurrenceInfo:

$ref: '#/components/schemas/OccurrenceInfo'

minimumInterval:

$ref: '#/components/schemas/MinimumInterval'

maximumInterval:

$ref: '#/components/schemas/MaximumInterval'

samplingInterval:

$ref: '#/components/schemas/SamplingInterval'

reportingDuration:

$ref: '#/components/schemas/ReportingDuration'

reportingLocationReq:

type: boolean

default: true

ReportingArea:

type: object

required:

- areaType

properties:

areaType:

$ref: '#/components/schemas/ReportingAreaType'

tai:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Tai'

ecgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ecgi'

ncgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ncgi'

MotionEventInfo:

type: object

required:

- linearDistance

properties:

linearDistance:

$ref: '#/components/schemas/LinearDistance'

occurrenceInfo:

$ref: '#/components/schemas/OccurrenceInfo'

minimumInterval:

$ref: '#/components/schemas/MinimumInterval'

maximumInterval:

$ref: '#/components/schemas/MaximumInterval'

samplingInterval:

$ref: '#/components/schemas/SamplingInterval'

reportingDuration:

$ref: '#/components/schemas/ReportingDuration'

reportingLocationReq:

type: boolean

default: true

CancelLocData:

type: object

required:

- hgmlcCallBackURI

- ldrReference

properties:

hgmlcCallBackURI:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

ldrReference:

$ref: '#/components/schemas/LdrReference'

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

LocContextData:

type: object

required:

- amfId

- ldrType

- hgmlcCallBackURI

- ldrReference

- eventReportMessage

properties:

amfId:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId'

locationQoS:

$ref: '#/components/schemas/LocationQoS'

supportedGADShapes:

type: array

items:

$ref: '#/components/schemas/SupportedGADShapes'

minItems: 1

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

ldrType:

$ref: '#/components/schemas/LdrType'

hgmlcCallBackURI:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

ldrReference:

$ref: '#/components/schemas/LdrReference'

periodicEventInfo:

$ref: '#/components/schemas/PeriodicEventInfo'

areaEventInfo:

$ref: '#/components/schemas/AreaEventInfo'

motionEventInfo:

$ref: '#/components/schemas/MotionEventInfo'

eventReportMessage:

$ref: '#/components/schemas/EventReportMessage'

eventReportingStatus:

$ref: '#/components/schemas/EventReportingStatus'

ueLocationInfo:

$ref: '#/components/schemas/UELocationInfo'

cIoT5GSOptimisation:

type: boolean

default: false

ecgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ecgi'

ncgi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Ncgi'

guami:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Guami'

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

EventReportMessage:

type: object

required:

- eventClass

- eventContent

properties:

eventClass:

$ref: '#/components/schemas/EventClass'

eventContent:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/RefToBinaryData'

EventReportingStatus:

type: object

properties:

eventReportCounter:

$ref: '#/components/schemas/EventReportCounter'

eventReportDuration:

$ref: '#/components/schemas/EventReportDuration'

UELocationInfo:

type: object

properties:

locationEstimate:

$ref: '#/components/schemas/GeographicArea'

ageOfLocationEstimate:

$ref: '#/components/schemas/AgeOfLocationEstimate'

velocityEstimate:

$ref: '#/components/schemas/VelocityEstimate'

ageOfVelocityEstimate:

$ref: '#/components/schemas/AgeOfLocationEstimate'

EventNotifyData:

type: object

required:

- reportedEventType

- ldrReference

properties:

reportedEventType:

$ref: '#/components/schemas/ReportedEventType'

supi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

gpsi:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

hgmlcCallBackURI:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

ldrReference:

$ref: '#/components/schemas/LdrReference'

locationEstimate:

$ref: '#/components/schemas/GeographicArea'

ageOfLocationEstimate:

$ref: '#/components/schemas/AgeOfLocationEstimate'

civicAddress:

$ref: '#/components/schemas/CivicAddress'

positioningDataList:

type: array

items:

$ref: '#/components/schemas/PositioningMethodAndUsage'

minItems: 1

gnssPositioningDataList:

type: array

items:

$ref: '#/components/schemas/GnssPositioningMethodAndUsage'

minItems: 1

servingLMFidentification:

$ref: '#/components/schemas/LMFIdentification'

terminationCause:

$ref: '#/components/schemas/TerminationCause'

velocityEstimate:

$ref: '#/components/schemas/VelocityEstimate'

altitude:

$ref: '#/components/schemas/Altitude'

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

UeConnectivityState:

type: object

required:

- accessType

properties:

accessType:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/AccessType'

connectivitystate:

$ref: 'TS29518\_Namf\_EventExposure.yaml#/components/schemas/CmState'

#

#

# SIMPLE TYPES

#

Altitude:

type: number

format: double

minimum: -32767

maximum: 32767

Angle:

type: integer

minimum: 0

maximum: 360

Uncertainty:

type: number

format: float

minimum: 0

Orientation:

type: integer

minimum: 0

maximum: 180

Confidence:

type: integer

minimum: 0

maximum: 100

Accuracy:

type: number

format: float

minimum: 0

InnerRadius:

type: integer

format: int32

minimum: 0

maximum: 327675

CorrelationID:

type: string

minLength: 1

maxLength: 255

AgeOfLocationEstimate:

type: integer

minimum: 0

maximum: 32767

HorizontalSpeed:

type: number

format: float

minimum: 0

maximum: 2047

VerticalSpeed:

type: number

format: float

minimum: 0

maximum: 255

SpeedUncertainty:

type: number

format: float

minimum: 0

maximum: 255

BarometricPressure:

type: integer

minimum: 30000

maximum: 115000

LcsServiceType:

type: integer

minimum: 0

maximum: 127

LdrReference:

type: string

minLength: 2

maxLength: 510

ReportingAmount:

type: integer

minimum: 1

maximum: 8639999

ReportingInterval:

type: integer

minimum: 1

maximum: 8639999

MinimumInterval:

type: integer

minimum: 1

maximum: 32767

MaximumInterval:

type: integer

minimum: 1

maximum: 86400

SamplingInterval:

type: integer

minimum: 1

maximum: 3600

ReportingDuration:

type: integer

minimum: 1

maximum: 8640000

LinearDistance:

type: integer

minimum: 1

maximum: 10000

LMFIdentification:

type: string

EventReportCounter:

type: integer

minimum: 1

maximum: 8640000

EventReportDuration:

type: integer

minimum: 1

maximum: 8640000

#

# ENUMS

#

ExternalClientType:

anyOf:

- type: string

enum:

- EMERGENCY\_SERVICES

- VALUE\_ADDED\_SERVICES

- PLMN\_OPERATOR\_SERVICES

- LAWFUL\_INTERCEPT\_SERVICES

- PLMN\_OPERATOR\_BROADCAST\_SERVICES

- PLMN\_OPERATOR\_OM

- PLMN\_OPERATOR\_ANONYMOUS\_STATISTICS

- PLMN\_OPERATOR\_TARGET\_MS\_SERVICE\_SUPPORT

- type: string

SupportedGADShapes:

anyOf:

- type: string

enum:

- POINT

- POINT\_UNCERTAINTY\_CIRCLE

- POINT\_UNCERTAINTY\_ELLIPSE

- POLYGON

- POINT\_ALTITUDE

- POINT\_ALTITUDE\_UNCERTAINTY

- ELLIPSOID\_ARC

- type: string

ResponseTime:

anyOf:

- type: string

enum:

- LOW\_DELAY

- DELAY\_TOLERANT

- NO\_DELAY

- type: string

PositioningMethod:

anyOf:

- type: string

enum:

- CELLID

- ECID

- OTDOA

- BAROMETRIC\_PRESSURE

- WLAN

- BLUETOOTH

- MBS

- MOTION\_SENSOR

- DL\_TDOA

- DL\_AOD

- MULTI-RTT

- NR\_ECID

- UL\_TDOA

- UL\_AOA

- NETWORK\_SPECIFIC

- type: string

PositioningMode:

anyOf:

- type: string

enum:

- UE\_BASED

- UE\_ASSISTED

- CONVENTIONAL

- type: string

GnssId:

anyOf:

- type: string

enum:

- GPS

- GALILEO

- SBAS

- MODERNIZED\_GPS

- QZSS

- GLONASS

- BDS

- NAVIC

- type: string

Usage:

anyOf:

- type: string

enum:

- UNSUCCESS

- SUCCESS\_RESULTS\_NOT\_USED

- SUCCESS\_RESULTS\_USED\_TO\_VERIFY\_LOCATION

- SUCCESS\_RESULTS\_USED\_TO\_GENERATE\_LOCATION

- SUCCESS\_METHOD\_NOT\_DETERMINED

- type: string

LcsPriority:

anyOf:

- type: string

enum:

- HIGHEST\_PRIORITY

- NORMAL\_PRIORITY

- type: string

VelocityRequested:

anyOf:

- type: string

enum:

- VELOCITY\_IS\_NOT\_REQUESTED

- VELOCITY\_IS\_REQUESTED

- type: string

AccuracyFulfilmentIndicator:

anyOf:

- type: string

enum:

- REQUESTED\_ACCURACY\_FULFILLED

- REQUESTED\_ACCURACY\_NOT\_FULFILLED

- type: string

VerticalDirection:

type: string

enum:

- UPWARD

- DOWNWARD

LdrType:

anyOf:

- type: string

enum:

- UE\_AVAILABLE

- PERIODIC

- ENTERING\_INTO\_AREA

- LEAVING\_FROM\_AREA

- BEING\_INSIDE\_AREA

- MOTION

- type: string

ReportingAreaType:

anyOf:

- type: string

enum:

- EPS\_TRACKING\_AREA\_IDENTITY

- E-UTRAN\_CELL\_GLOBAL\_IDENTIFICATION

- 5GS\_TRACKING\_AREA\_IDENTITY

- NR\_CELL\_GLOBAL\_IDENTITY

- type: string

OccurrenceInfo:

anyOf:

- type: string

enum:

- ONE\_TIME\_EVENT

- MULTIPLE\_TIME\_EVENT

- type: string

ReportingAccessType:

anyOf:

- type: string

enum:

- NR

- EUTRA\_CONNECTED\_TO\_5GC

- NON\_3GPP\_CONNECTED\_TO\_5GC

- type: string

EventClass:

anyOf:

- type: string

enum:

- SUPPLEMENTARY\_SERVICES

- type: string

ReportedEventType:

anyOf:

- type: string

enum:

- PERIODIC\_EVENT

- ENTERING\_AREA\_EVENT

- LEAVING\_AREA\_EVENT

- BEING\_INSIDE\_AREA\_EVENT

- MOTION\_EVENT

- MAXIMUM\_INTERVAL\_EXPIRATION\_EVENT

- LOCATION\_CANCELLATION\_EVENT

- type: string

TerminationCause:

anyOf:

- type: string

enum:

- TERMINATION\_BY\_UE

- TERMINATION\_BY\_NETWORK

- NORMAL\_TERMINATION

- type: string

LcsQosClass:

anyOf:

- type: string

enum:

- BEST\_EFFORT

- ASSURED

- type: string

UeLocationServiceInd:

anyOf:

- type: string

enum:

- LOCATION\_ESTIMATE

- LOCATION\_ASSISTANCE\_DATA

- type: string

## A.3 Nlmf\_Broadcast API

openapi: 3.0.0

info:

version: '1.0.3'

title: 'LMF Broadcast'

description: |

LMF Broadcast Service.

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externalDocs:

description: 3GPP TS 29.572 V16.8.0; 5G System; Location Management Services; Stage 3

url: 'http://www.3gpp.org/ftp/Specs/archive/29\_series/29.572/'

servers:

- url: '{apiRoot}/nlmf-broadcast/v1'

variables:

apiRoot:

default: https://example.com

description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

paths:

/cipher-key-data:

post:

summary: Request ciphering key data

operationId: CipheringKeyData

tags:

- Request Ciphering Key Data

requestBody:

content:

application/json:

schema:

$ref: '#/components/schemas/CipherRequestData'

required: true

responses:

'200':

description: Expected response to a valid request

content:

application/json:

schema:

$ref: '#/components/schemas/CipherResponseData'

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

callbacks:

CipheringKeyData:

'{$request.body#/amfCallBackURI}':

post:

requestBody:

description: Ciphering Key Data Notification

content:

application/json:

schema:

$ref: '#/components/schemas/CipheringKeyInfo'

responses:

'200':

description: Expected response to a valid request

content:

application/json:

schema:

$ref: '#/components/schemas/CipheringKeyResponse'

'307':

$ref: 'TS29571\_CommonData.yaml#/components/responses/307'

'308':

$ref: 'TS29571\_CommonData.yaml#/components/responses/308'

'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'

'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'

'504':

$ref: 'TS29571\_CommonData.yaml#/components/responses/504'

default:

$ref: 'TS29571\_CommonData.yaml#/components/responses/default'

components:

schemas:

#

# COMPLEX TYPES

#

CipheringKeyInfo:

type: object

required:

- cipheringData

properties:

cipheringData:

type: array

items:

$ref: '#/components/schemas/CipheringDataSet'

minItems: 1

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

CipheringKeyResponse:

type: object

properties:

cipheringDataReport:

type: array

items:

$ref: '#/components/schemas/CipheringSetReport'

minItems: 1

CipheringDataSet:

type: object

required:

- cipheringSetID

- cipheringKey

- c0

- validityStartTime

- validityDuration

properties:

cipheringSetID:

$ref: '#/components/schemas/CipheringSetID'

cipheringKey:

$ref: '#/components/schemas/CipheringKey'

c0:

$ref: '#/components/schemas/C0'

ltePosSibTypes:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Bytes'

nrPosSibTypes:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Bytes'

validityStartTime:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/DateTime'

validityDuration:

$ref: '#/components/schemas/ValidityDuration'

taiList:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Bytes'

CipheringSetReport:

type: object

required:

- cipheringSetID

- storageOutcome

properties:

cipheringSetID:

$ref: '#/components/schemas/CipheringSetID'

storageOutcome:

$ref: '#/components/schemas/StorageOutcome'

CipherRequestData:

type: object

required:

- amfCallBackURI

properties:

amfCallBackURI:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

supportedFeatures:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

CipherResponseData:

type: object

required:

- dataAvailability

properties:

dataAvailability:

$ref: '#/components/schemas/DataAvailability'

#

#

# SIMPLE TYPES

#

CipheringSetID:

type: integer

minimum: 0

maximum: 65535

CipheringKey:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Bytes'

C0:

$ref: 'TS29571\_CommonData.yaml#/components/schemas/Bytes'

ValidityDuration:

type: integer

minimum: 1

maximum: 65535

#

# ENUMS

#

StorageOutcome:

anyOf:

- type: string

enum:

- STORAGE\_SUCCESSFUL

- STORAGE\_FAILED

DataAvailability:

anyOf:

- type: string

enum:

- CIPHERING\_KEY\_DATA\_AVAILABLE

- CIPHERING\_KEY\_DATA\_NOT\_AVAILABLE

Annex B (informative): Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2018-01 | CT4#82 |  |  |  |  | TS Skeleton agreed in CT4#82 | 0.0.0 |
| 2018-01 | CT4#82 | C4-181398 |  |  |  | Initial draft (C4-181119)  Incorporation of agreed pCRs from CT4#82: C4-181121, C4-181233, C4-181234 | 0.1.0 |
| 2018-03 | CT4#83 | C4-182444 |  |  |  | Incorporation of agreed pCRs from CT4#83: C4-182181, C4-182427 | 0.2.0 |
| 2018-03 | CT#79 | CP-180034 |  |  |  | Presented for information | 1.0.0 |
| 2018-04 | CT4#84 | C4-183524 |  |  |  | Incorporation of agreed pCRs from CT4#84: C4-183184, C4-183363, C4-183510 | 1.1.0 |
| 2018-05 | CT4#85 | C4-184640 |  |  |  | Incorporation of agreed pCRs from CT4#85: C4-184195, C4-184197, C4-184198, C4-184199, C4-184202, C4-184443, C4-184446, C4-184547 | 1.2.0 |
| 2018-06 | CT#80 | CP-181111 |  |  |  | Presented for approval | 2.0.0 |
| 2018-06 | CT#80 |  |  |  |  | Approved in CT#80 | 15.0.0 |
| 2018-09 | CT#81 | CP-182066 | 0002 | 2 |  | Error Cases | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0003 | - |  | Custom Headers | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0004 | - |  | Overall Clean-up | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0005 | - |  | Description of Structured data types | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0006 | 1 |  | Resource structure presentation | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0007 | 1 |  | LMF servers clause in OpenAPI | 15.1.0 |
| 2018-09 | CT#81 | CP-182066 | 0008 | - |  | API Version Update | 15.1.0 |
| 2018-12 | CT#82 | CP-183025 | 0010 | 1 | F | Cardinality | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0011 | - | F | APIRoot Clarification | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0012 | - | F | AMF Id | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0013 | - | F | Barometric Pressure in Location Data | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0014 | 1 | F | Clarify Serving Cell in Input Data | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0015 | 1 | F | Oauth2 Corrections | 15.2.0 |
| 2018-12 | CT#82 | CP-183025 | 0016 | - | F | API Version | 15.2.0 |
| 2018-12 | CT#82 | CP-183179 | 0017 | - | F | ExternalDocs Update | 15.2.0 |
| 2019-03 | CT#83 | CP-190030 | 0018 | 1 | F | OpenAPI Corrections | 15.3.0 |
| 2019-03 | CT#83 | CP-190030 | 0019 | 1 | F | Application Errors | 15.3.0 |
| 2019-03 | CT#83 | CP-190030 | 0020 | 1 | F | Essential Correction to InnerRadius | 15.3.0 |
| 2019-03 | CT#83 | CP-190030 | 0021 | 1 | F | Mandatory Response Codes | 15.3.0 |
| 2019-03 | CT#83 | CP-190030 | 0022 | 1 | F | Essential correction to OpenAPI definition of GeographicArea | 15.3.0 |
| 2019-03 | CT#83 | CP-190030 | 0023 | - | F | API version update | 15.3.0 |
| 2019-06 | CT#84 | CP-191042 | 0024 | 2 | F | UE Capabilities | 15.4.0 |
| 2019-06 | CT#84 | CP-191042 | 0025 | 2 | F | Storage of OpenAPI specification files | 15.4.0 |
| 2019-06 | CT#84 | CP-191042 | 0027 | 1 | F | Copyright Note in OpenAPI Spec | 15.4.0 |
| 2019-06 | CT#84 | CP-191042 | 0028 | 1 | F | Major API version | 15.4.0 |
| 2019-06 | CT#84 | CP-191042 | 0030 | - | F | Open API Version | 15.4.0 |
| 2019-09 | CT#85 | CP-192113 | 0031 | 1 | F | Missing attribute FLR in Civic Address | 16.0.0 |
| 2019-09 | CT#85 | CP-192192 | 0033 | 2 | B | LMF service operations for a deferred 5GC-MT-LR | 16.0.0 |
| 2019-09 | CT#85 | CP-192192 | 0034 | 1 | B | LMF service operations for a commercial 5GC-MT-LR | 16.0.0 |
| 2019-09 | CT#85 | CP-192192 | 0035 | - | F | High Accuracy Support | 16.0.0 |
| 2019-09 | CT#85 | CP-192113 | 0037 | 1 | D | Correct type Polygon | 16.0.0 |
| 2019-09 | CT#85 | CP-192120 | 0039 | - | F | 3GPP TS 29.572 API version update | 16.0.0 |
| 2019-12 | CT#86 | CP-193033 | 0041 | 1 | A | Motion Sensor Position Method | 16.1.0 |
| 2019-12 | CT#86 | CP-193165 | 0042 | 3 | B | Addition of the LMF Broadcast Service Operations | 16.1.0 |
| 2019-12 | CT#86 | CP-193055 | 0043 | 1 | B | LCS QoS Class | 16.1.0 |
| 2019-12 | CT#86 | CP-193036 | 0045 | 1 | F | ExternalDoc Clause | 16.1.0 |
| 2019-12 | CT#86 | CP-193036 | 0046 | 1 | F | ProblemDetails Optional in Error Response | 16.1.0 |
| 2019-12 | CT#86 | CP-193044 | 0048 | - | F | 3GPP TS 29.572 API version update | 16.1.0 |
| 2020-03 | CT#87 | CP-200039 | 0049 | 2 | F | Add Corresponding API descriptions in clause 5.1 | 16.2.0 |
| 2020-03 | CT#87 | CP-200039 | 0050 | 2 | D | Editorial corrections | 16.2.0 |
| 2020-03 | CT#87 | CP-200039 | 0051 | 1 | F | Correction - formatting consistency | 16.2.0 |
| 2020-03 | CT#87 | CP-200018 | 0052 |  | B | Connectivity state per access type | 16.2.0 |
| 2020-03 | CT#87 | CP-200018 | 0053 |  | B | Primary Cell in the Secondary RAN node | 16.2.0 |
| 2020-03 | CT#87 | CP-200052 | 0055 |  | F | 3GPP TS 29.572 Rel16 API External doc update | 16.2.0 |
| 2020-03 | CT#87 | CP-200180 | 0054 | 4 | B | Request Type and embedded LPP message | 16.2.0 |
| 2020-06 | CT#88e | CP-201060 | 0056 | 1 | F | Add a new Notifications Overview Table | 16.3.0 |
| 2020-06 | CT#88e | CP-201060 | 0057 | 1 | F | Add custom operation Name | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0058 |  | F | Location Context Transfer | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0059 | 1 | B | Network Specific Positioning Methods | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0060 |  | B | Positioning Methods Support | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0061 | 2 | F | Storage of YAML files in ETSI Forge | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0062 | 1 | F | Resolve Editor Notes | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0063 | 1 | F | LDRreference | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0065 | 1 | F | Resolution of EN on NR positioning SIBs | 16.3.0 |
| 2020-06 | CT#88e | CP-201032 | 0068 | 1 | F | Adding ResponseTime enumaration value | 16.3.0 |
| 2020-06 | CT#88e | CP-201060 | 0069 |  | F | Missing Descriptions | 16.3.0 |
| 2020-06 | CT#88e | CP-201073 | 0070 |  | F | 29.572 Rel-16 API version and External doc update | 16.3.0 |
| 2020-09 | CT#89e | CP-202112 | 0071 | 1 | F | Optionality of ProblemDetails in TS29.572 cleanup | 16.4.0 |
| 2020-09 | CT#89e | CP-202112 | 0073 | 1 | F | Adding missing navigation satellite systems for positioning | 16.4.0 |
| 2020-09 | CT#89e | CP-202112 | 0074 | 1 | F | Including VGMLC address towards LMF when requesting LMF's Location service | 16.4.0 |
| 2020-09 | CT#89e | CP-202112 | 0075 | 1 | F | Corrections on EventNotify service operation | 16.4.0 |
| 2020-09 | CT#89e | CP-202043 | 0077 | 1 | F | Correct mismatch on GeographicArea between table and yaml | 16.4.0 |
| 2020-09 | CT#89e | CP-202096 | 0078 | - | F | 29.572 Rel-16 API version and External doc update | 16.4.0 |
| 2020-12 | CT#90e | CP-203050 | 0080 | 1 | F | Essential corrections in clause 5.2.2.4 CancelLocation | 16.5.0 |
| 2020-12 | CT#90e | CP-203050 | 0081 | 1 | F | Indication of control plane CIoT 5GS optimization in LocationContextTransfer | 16.5.0 |
| 2020-12 | CT#90e | CP-203035 | 0082 | 1 | F | YAML files in 3GPP Forge | 16.5.0 |
| 2020-12 | CT#90e | CP-203036 | 0085 | 1 | F | 29.572 Rel-16 API version and External doc update | 16.5.0 |
| 2021-03 | CT#91e | CP-210041 | 0087 | - | F | Missing PIDL-LO elements in Location Information | 16.6.0 |
| 2021-03 | CT#91e | CP-210037 | 0088 | 1 | F | HTTP 3xx redirection | 16.6.0 |
| 2021-03 | CT#91e | CP-210054 | 0091 | - | F | 29.572 Rel-16 API version and External doc update | 16.6.0 |
| 2021-06 | CT#92e | CP-210059 | 0097 |  | F | 3xx description correction for SCP | 16.7.0 |
| 2021-06 | CT#92e | CP-210059 | 0101 | 1 | F | Redirect Response | 16.7.0 |
| 2021-06 | CT#92e | CP-210073 | 0104 |  | F | 29.572 Rel-16 API version and External doc update | 16.7.0 |
| 2021-09 | CT#93e | CP-212064 | 0110 |  | F | Encoding of binary attributes in JSON objects | 16.8.0 |
| 2021-09 | CT#93e | CP-212080 | 0116 |  | F | 29.572 Rel-16 API version and External doc update | 16.8.0 |
| 2022-03 | CT#95e | CP-220226 | 0129 | 1 | F | Corrections on attributes | 16.9.0 |
| 2022-03 | CT#95e | CP-220216 | 0132 |  | F | 29.572 Rel-16 API version and External doc update | 16.9.0 |