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Stage 3

(Release 15)

** 

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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.

# 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".

# 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].

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.

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

## 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.

### 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.

#### 5.2.2.2 DetermineLocation

##### 5.2.2.2.1 General

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

- Retrieve UE Location

##### 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).



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….) shall 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 (geodetic position, civic location, positioning methods…).

2b. On failure, 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 shall contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.2.2-2.

# 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 request URI used in HTTP request from the NF service consumer towards the NF service producer shall have the 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".

#### 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.

### 6.1.3 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

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

Table 6.1.3.1-1: Resources and methods overview

|  |  |  |  |
| --- | --- | --- | --- |
| Resource name | Resource URI | HTTP method or custom operation | Description |
| DetermineLocation  (Custom operation) | {apiRoot}/nlmf-loc/<apiVersion>/determine-location | determine-location (POST) |  |

### 6.1.4 Custom Operations without associated resources

#### 6.1.4.1 Overview

Table 6.1.4.1-1: Custom operations without associated resources

|  |  |  |
| --- | --- | --- |
| Custom operation URI | Mapped HTTP method | Description |
|  |  |  |
| {apiRoot}/nlmf-loc/<apiVersion>/determine-location | POST |  |

#### 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 "Deterrmine 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.  Upon success, a response body is returned containing the different parameters of the location data, such as:  - Geographic Area  - Civic Location  - Positioning methods |
| ProblemDetails | M | 1 | 403 Forbidden | The "cause" attribute shall be set to one of the following application errors:  - POSITIONING\_DENIED  - UNSPECIFIED  See table 6.1.7.3-1 for the description of these errors. |
| ProblemDetails | M | 1 | 500 Internal Server Error | The "cause" attribute shall be set to the following application error:  - POSITIONING\_FAILED  See table 6.1.7.3-1 for the description of these errors. |
| ProblemDetails | M | 1 | 504 Gateway Timeout | The "cause" attribute shall be set to the following application error:  - UNREACHABLE\_USER  See table 6.1.7.3-1 for the description of this error. |

### 6.1.5 Notifications

There are no notifications defined for the Nlmf\_Location service in this release of the specification.

### 6.1.6 Data Model

#### 6.1.6.1 General

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

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

Table 6.1.6.1-1: Nlmf specific Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Clause defined | Description |
| InputData | 6.1.6.2.2 |  |
| LocationData | 6.1.6.2.3 |  |
| GeographicalCoordinates | 6.1.6.2.4 |  |
| GeographicArea | 6.1.6.2.5 |  |
| Point | 6.1.6.2.6 |  |
| PointUncertaintyCircle | 6.1.6.2.7 |  |
| PointUncertaintyEllipse | 6.1.6.2.8 |  |
| Polygon | 6.1.6.2.9 |  |
| PointAltitude | 6.1.6.2.10 |  |
| PointAltitudeUncertainty | 6.1.6.2.11 |  |
| EllipsoidArc | 6.1.6.2.12 |  |
| LocationQoS | 6.1.6.2.13 |  |
| CivicAddress | 6.1.6.2.14 |  |
| PositioningMethodAndUsage | 6.1.6.2.15 |  |
| GnssPositioningMethodAndUsage | 6.1.6.2.16 |  |
| VelocityEstimate | 6.1.6.2.17 |  |
| HorizontalVelocity | 6.1.6.2.18 |  |
| HorizontalWithVerticalVelocity | 6.1.6.2.19 |  |
| HorizontalVelocityWithUncertainty | 6.1.6.2.20 |  |
| HorizontalWithVerticalVelocityAndUncertainty | 6.1.6.2.21 |  |
| UncertaintyEllipse | 6.1.6.2.22 |  |
| UeLcsCapability | 6.1.6.2.23 | Indicates the LCS capability supported by the UE. |
| Altitude | 6.1.6.3.2 |  |
| Angle | 6.1.6.3.2 |  |
| Uncertainty | 6.1.6.3.2 |  |
| Orientation | 6.1.6.3.2 |  |
| Confidence | 6.1.6.3.2 |  |
| Accuracy | 6.1.6.3.2 |  |
| InnerRadius | 6.1.6.3.2 |  |
| CorrelationID | 6.1.6.3.2 |  |
| AgeOfLocationEstimate | 6.1.6.3.2 |  |
| HorizontalSpeed | 6.1.6.3.2 |  |
| VerticalSpeed | 6.1.6.3.2 |  |
| SpeedUncertainty | 6.1.6.3.2 |  |
| BarometricPressure | 6.1.6.3.2 |  |
| ExternalClientType | 6.1.6.3.3 |  |
| SupportedGADShapes | 6.1.6.3.4 |  |
| ResponseTime | 6.1.6.3.5 |  |
| PositioningMethod | 6.1.6.3.6 |  |
| GnssMethod | 6.1.6.3.7 |  |
| GnssId | 6.1.6.3.8 |  |
| Usage | 6.1.6.3.9 |  |
| LcsPriority | 6.1.6.3.10 |  |
| VelocityRequested | 6.1.6.3.11 |  |
| AccuracyFulfilmentIndicator | 6.1.6.3.12 |  |
| VerticalDirection | 6.1.6.3.13 |  |

Table 6.1.6.1-2 specifies data types re-used by the Nlmf 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 re-used Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Comments |
| Supi | 3GPP TS 29.571 [8] |  |
| Pei | 3GPP TS 29.571 [8] |  |
| Gpsi | 3GPP TS 29.571 [8] |  |
| Ecgi | 3GPP TS 29.571 [8] |  |
| Ncgi | 3GPP TS 29.571 [8] |  |
| NfInstanceId | 3GPP TS 29.571 [8] |  |

#### 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 |  |
| correlationID | CorrelationID | O | 0..1 |  |
| 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 |  |
| supportedGADShapes | array(SupportedGADShapes) | O | 1..N |  |
| supi | Supi | O | 0..1 |  |
| pei | Pei | O | 0..1 |  |
| gpsi | Gpsi | O | 0..1 |  |
| ecgi | Ecgi | O | 0..1 | When present, this IE shall indicate the identifier of the E-UTRAN cell serving the UE. (NOTE 2) |
| ncgi | Ncgi | O | 0..1 | When present, this IE shall indicate the identifier of the NR cell serving the UE. (NOTE 2) |
| priority | LcsPriority | O | 0..1 |  |
| velocityRequested | VelocityRequested | O | 0..1 |  |
| ueLcsCap | UeLcsCapability | O | 0..1 | When present, this IE shall indicate the LCS capability supported by the UE. |
| 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. | | | | |

##### 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 |  |
| accuracyFulfilmentIndicator | AccuracyFulfilmentIndicator | O | 0..1 |  |
| ageOfLocationEstimate | AgeOfLocationEstimate | O | 0..1 |  |
| velocityEstimate | VelocityEstimate | O | 0..1 |  |
| civicAddress | CivicAddress | O | 0..1 |  |
| positioningDataList | array(PositioningMethodAndUsage) | O | 1..N |  |
| gnssPositioningDataList | array(GnssPositioningMethodAndUsage) | O | 1..N |  |
| ecgi | Ecgi | O | 0..1 |  |
| ncgi | Ncgi | O | 0..1 |  |
| 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. |

##### 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 (float value):  Minimum: -180  Maximum: 180 |
| lat | number | M | 1 | Latitude (float value):  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 | Description |
| Point | 1 | Geographical area consisting of a single point, represented by its longitude and latitude. |
| PointUncertaintyCircle | 1 | Geographical area consisting of a point and an uncertainty value. |
| PointUncertaintyEllipse | 1 | Geographical area consisting of a point, plus an uncertainty ellipse and a confidence value. |
| Polygon | 1 | Geographical area consisting of a list of points (between 3 to 15 points). |
| PointAltitude | 1 | Geographical area consisting of a point and an altitude value. |
| PointAltitudeUncertainty | 1 | Geographical area consisting of a point, an altitude value and an uncertainty value. |
| EllipsoidArc | 1 | Geographical are consisting of an ellipsoid arc. |

##### 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 |  |

##### 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 |  |
| uncertainty | Uncertainty | M | 1 |  |

##### 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 |  |
| uncertaintyEllipse | UncertaintyEllipse | M | 1 |  |
| confidence | Confidence | M | 1 |  |

##### 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 |  |
| altitude | Altitude | M | 1 |  |

##### 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 |  |
| altitude | Altitude | M | 1 |  |
| uncertaintyEllipse | UncertaintyEllipse | M | 1 |  |
| uncertaintyAltitude | Uncertainty | M | 1 |  |
| confidence | Confidence | M | 1 |  |

##### 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 |  |
| innerRadius | InnerRadius | M | 1 |  |
| uncertaintyRadius | Uncertainty | M | 1 |  |
| offsetAngle | Angle | M | 1 |  |
| includedAngle | Angle | M | 1 |  |
| confidence | Confidence | M | 1 |  |

##### 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 | Low delay vs. Delay tolerant |

##### 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] |

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 chapter 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 |  |
| mode | PositioningMode | M | 1 |  |
| usage | Usage | M | 1 |  |

##### 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 |  |
| gnss | GnssId | M | 1 |  |
| usage | Usage | M | 1 |  |

##### 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 |  |
| semiMinor | Uncertainty | M | 1 |  |
| orientationMajor | Orientation | M | 1 |  |

##### 6.1.6.2.23 Type: UeLcsCapability

Table 6.1.6.2.x-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 |

#### 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 | Float value of the altitude, expressed in meters.  Minimum = -32767. Maximum = 32767. |
| 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 |
| 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 |
| InnerRadius | integer | Integer value of the inner radius, expressed in meters.  Minimum = 0. Maximum = 327675. |
| 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. |
| VerticalSpeed | number | Float value of horizontal speed, expressed in kilometres per hour.  Minimum = 0. Maximum = 255. |
| SpeedUncertainty | number | Float value of speed uncertainty, expressed in kilometres per hour.  Minimum = 0. Maximum = 255. |
| BarometricPressure | integer | This IE specifies the measured uncompensated atmospheric pressure in units of Pascal (Pa).  Minimum = 30000. Maximum = 115000. |

##### 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" |  |
| "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" |  |

##### 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" |  |
| "POINT\_UNCERTAINTY\_CIRCLE" |  |
| "POINT\_UNCERTAINTY\_ELLIPSE" |  |
| "POLYGON" |  |
| "POINT\_ALTITUDE" |  |
| "POINT\_ALTITUDE\_UNCERTAINTY" |  |
| "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" |  |
| "DELAY\_TOLERANT" |  |

##### 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" |  |
| "ECID" |  |
| "OTDOA" |  |
| "BAROMETRIC\_PRESSURE" |  |
| "WLAN" |  |
| "BLUETOOTH" |  |
| "MBS" |  |
| "MOTION\_SENSOR" |  |

##### 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\_ASSISTED" |  |
| "CONVENTIONAL" |  |

##### 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" |  |
| "GALILEO" |  |
| "SBAS" |  |
| "MODERNIZED\_GPS" |  |
| "QZSS" |  |
| "GLONASS" |  |

##### 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" |  |
| "SUCCESS\_RESULTS\_NOT\_USED" |  |
| "SUCCESS\_RESULTS\_USED\_TO\_VERIFY\_LOCATION" |  |
| "SUCCESS\_RESULTS\_USED\_TO\_GENERATE\_LOCATION" |  |
| "SUCCESS\_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" |  |
| "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\_IS\_REQUESTED" |  |

##### 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\_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" |  |
| "DOWNWARD" |  |

### 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. |
| 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.

Annex A (normative): OpenAPI specification

## A.1 General

This Annex specifies the formal definition of the Nlmf Service API. 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 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on the public 3GPP file server in the following locations (see clause 5B of the 3GPP TR 21.900 [16] for further information):

- [https://www.3gpp.org/ftp/Specs/archive/OpenAPI/<Release>/](https://www.3gpp.org/ftp/Specs/archive/OpenAPI/%3cRelease%3e/), and

- [https://www.3gpp.org/ftp/Specs/<Plenary>/<Release>/OpenAPI/](https://www.3gpp.org/ftp/Specs/%3cPlenary%3e/%3cRelease%3e/OpenAPI/).

NOTE 2: To fetch the OpenAPI specification file after CT#83 plenary meeting for Release 15 in the above links <Plenary> must be replaced with the date the CT Plenary occurs, in the form of year-month (yyyy-mm), e.g. for CT#83 meeting <Plenary> must be replaced with value "2019-03" and <Release> must be replaced with value "Rel-15".

## A.2 Nlmf\_Location API

openapi: 3.0.0

info:

version: '1.0.4'

title: 'LMF Location'

description: |

LMF Location Service.

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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'

required: true

responses:

'200':

description: Expected response to a valid request

content:

application/json:

schema:

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

'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'

ncgi:

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

priority:

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

velocityRequested:

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

ueLcsCap:

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

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'

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: float

minimum: -180

maximum: 180

lat:

type: number

format: float

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'

PositioningMethodAndUsage:

type: object

required:

- method

- mode

- usage

properties:

method:

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

mode:

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

usage:

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

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

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

#

# SIMPLE TYPES

#

Altitude:

type: number

format: float

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

#

# 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

- type: string

PositioningMethod:

anyOf:

- type: string

enum:

- CELLID

- ECID

- OTDOA

- BAROMETRIC\_PRESSURE

- WLAN

- BLUETOOTH

- MBS

- MOTION\_SENSOR

- 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

- 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

externalDocs:

description: 3GPP TS 29.572 V15.6.0; 5G System; Location Management Services; Stage 3

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

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-192113 | 0028 | 1 | F | Major API version | 15.4.0 |
| 2019-06 | CT#84 | CP-192113 | 0030 | - | F | Open API Version | 15.4.0 |
| 2019-09 | CT#85 | CP-192119 | 0031 | 1 | F | Missing attribute FLR in Civic Address | 15.5.0 |
| 2019-09 | CT#85 | CP-192113 | 0037 | 1 | D | Correct type Polygon | 15.5.0 |
| 2019-09 | CT#85 | CP-192113 | 0038 | - | F | 3GPP TS 29.572 API version update | 15.5.0 |
| 2019-12 | CT#86 | CP-193033 | 0040 | 1 | F | Motion Sensor Position Method | 15.6.0 |
| 2019-12 | CT#86 | CP-193043 | 0047 | - | F | 3GPP TS 29.572 API version update | 15.6.0 |